The Integration of CL resources in CALL for Irish in the Primary School Context

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Abstract
It is difficult to integrate Computational Linguistics (CL) techniques in Computer-Assisted Language Learning (CALL) artefacts. The **C**omputational **L**inguistics **I**ntegrated in **C**ALL for **I**rish (CLICI) research[1] presented in this dissertation aims to re-use existing CL resources and where suitable ones do not exist, to build its own modular, re-usable resources. The research question addressed was: can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium primary schools in Ireland? Irish is a compulsory subject in Irish primary schools but there are complex socio-cultural issues surrounding the teaching and learning of the language and in general CALL resources are not available for this group of learners.

CL techniques and resources generally do not have CALL as a primary focus. There are often technical and pedagogical problems when CL and CALL researchers aim to integrate them in CALL artefacts. The CLICI project aimed to learn from previous CL/CALL projects and determine the pedagogical needs in the deployment context first, and then to consider how CL techniques and resources can be used in CALL artefacts to address these needs. The project followed a structured approach to CALL design and development, using the Analysis Design Development Implementation Evaluation (ADDIE) courseware lifecycle. The CLICI project consists of three components: a Lesson Generation Component (LGC), a Verb Conjugation Component (VCC) and a Writing Checker Component (WCC). The LGC is a tool that facilitates the development of CALL lessons. The VCC enables automatic creation of animated verb conjugation lessons. The WCC enables students to enter free-form texts in Irish and provides feedback.

The CLICI project demonstrated that it was possible to integrate existing CL resources in useful CALL artefacts for Irish in English-medium primary schools. However, the main determiner of success lies in the hands of the teachers and students.

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Abbreviations

ADDIE	Analysis Design Development Implementation Evaluation
C1	Class 1
C2	Class 2
C3	Class 3
C4	Class 4
C5	Class 5
C6	Class 6
C7	Class 7
C8	Class 8
C9	Class 9
CALL	Computer Assisted Language Learning
CD	Compact Disk
CL	Computational Linguistics
CLC	Computer Learner Corpus
CLT	Communicative Language Teaching
CLICI	Computational Linguistics Integrated in CALL for Irish
DCG	Definite Clause Grammar
FST	Finite State Transducer
GC	Grammar Checker
GCC	Generic and Comprehensive Construct
GLDT	Global Local Differential Targeted
ICALL	Intelligent Computer Assisted Language Learning
ICT4LT	Information and Communications Technology For Language Teachers
L1	A persons' first language
L2	A language other than a persons' first language
LC	Learner Corpora
LGC	Lessons Generator Component
MS	Microsoft
NLP	Natural Language Processing
NNS	Non-Native Speaker
NS	Native Speaker
PC	Personal Computer
POS	Part Of Speech
QL	Qualitative
QT	Quantitative
S1	School 1

S2	School 2
SLA	Second Language Acquisition
T1	Teacher 1
T2	Teacher 2
T3	Teacher 3
T4	Teacher 4
T5	Teacher 5
T6	Teacher 6
UI	User Interface
VCC	Verb Conjugation Component
WCC	Writing Checker Component
XML	eXtensible Markup Language

Typographical Conventions

All non-English language examples in the text are in *italic* typeface followed by the translation in brackets e.g. *bris* (to break).

When a particular segment of a word is being discussed it is highlighted in bold typeface e.g. ***fuin****neog* (window).

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Chapter 1

1.1 Introduction

This thesis presents the research and findings on the integration of Computational Linguistics (CL) technologies in Computer Assisted Language Learning (CALL) artefacts for Irish in the primary school context. It explains the motivation for undertaking the research as well as the methodology and principles adopted. It explains the research questions posed and provides answers to these questions. To chart the background, the dissertation reviews the use of CL in CALL and presents a Strengths Weaknesses Opportunities Threats (SWOT) analysis of the area. It reviews Irish, its role in the education system in the Republic of Ireland and CALL artefacts for Irish. It describes the process of developing CL/CALL resources using Colpaert's (2004) Analysis Design Development Implementation (ADDIE) model. It concludes with the overall findings, the difficulties encountered during the project, the project's limitations, the contribution to knowledge as well as suggestions for future improvements.

This chapter provides an introduction to the topic. Section 1.2 provides background information about the project while Section 1.3 gives an outline of the use of CL technologies in CALL. Section 1.4 defines the research question: *can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium Primary Schools in Ireland?* The objectives, requirements and constraints of the project are discussed in Section 1.5. Section 1.6 outlines the research methodology, including the basic principles used to guide the design and development of the project. Section 1.7 discusses the ethical issues involved in a project of this nature, while Section 1.8 clarifies some of the main terms used throughout this thesis. The project chronology is given in Section 1.9. Section 1.10 provides an overview of the organisation of the thesis, while Section 1.11 summarises this chapter.

1.2 Background to the Project

The project reported in this thesis was part of a larger project funded by the Irish Research Council for Science, Engineering and Technology (IRCSET) (project code SC/02/298). The overall project title was "The Integration of Computational Linguistics (CL) Techniques in Computer Assisted Language Learning (CALL)". This project focused on integrating CL techniques and resources in CALL. The project comprised three sub-projects: the Development of Plurilingual CALL resources for French/Spanish and Italian (ESPRIT – Koller, 2006); Probabilistic Detection of Ungrammatical Sentences for CALL (Wagner et al., 2007); and the CLICI – **C**omputational **L**inguistics **I**ntegrated in **C**ALL for **I**rish research project reported in this thesis. Some research projects in this area (i.e. the integration of CL and CALL) start with a particular piece of Computational Linguistics (CL) technology and attempt to use it in a CALL application. This is often not successful and for this reason, CLICI started by

ascertaining what needs existed in the target deployment scenario and, following on from this, determining whether CL resources could meet these needs.

The motivation behind the CLICI project was to determine whether Computational Linguistics (CL) resources can be integrated in useful CALL artefacts for Irish in the primary school context. Irish has been a compulsory subject in primary schools in Ireland for many years (see Chapter 4). However, the levels of attainment are low and the attitude to the language is not always positive (Harris and Murtagh, 1999). This project investigates whether CALL resources, especially with the use of CL technology, can contribute to a more positive learning environment for the students. Currently there are very few CALL artefacts for adults and even less for young learners of Irish. Very few of these artefacts use CL resources and, to date, no CL/CALL resources exist for primary school learners. There is a general need to improve the teaching of Irish and it is important that new approaches are investigated to see if they are useful.

1.3 Background to CL and CALL

The use of CL resources in CALL has generally been driven by CL specialists and has had limited success (see Chapter 3 for details). Some of the issues to be dealt with include the lack of fit between what CL can do and what is required in CALL artefacts, the lack of suitable existing CL resources for CALL and the need for complex CL technology and/or a large CL/CALL team. CL tools and techniques are mainly designed to work with correct input (Vandeventer Faltin, 2003). Sometimes, they are only usable by CL-knowledgeable researchers (Holland, 1995). However, language learners produce incorrect input and are not usually CL-knowledgeable. Thus, it is often difficult to use CL resources for CALL. Many CL resources have been developed to test a particular linguistic theory and are not suitable for CALL (Jager, 2001). The gap between the theoretical orientation of CL resources and the practical needs of language learners means that it is often impractical for these CL resources to be used in CALL (Holland, 1995). Integrating CL technologies in CALL is difficult and usually requires a large multi-disciplinary team to do it successfully. Previous CL/CALL projects had their origins in CL researchers investigating whether their software could be used in language learning (e.g. Weischedel and Black , 1980), and as a result, have been technology-led rather than pedagogically driven. This has often been to the detriment of the resulting CALL software. A further problem is that there are socio-cultural factors that contribute to the difficulties in developing useful CL/CALL resources (Chapter 3, Section 3.5). Attitudes from Computer Science questioning the value of working with CALL (Schulze, 2003a), to the perception in some pedagogical quarters that 'high-end' technology does not sit well with language teaching and learning (Oxford, 1995) can discourage multidisciplinary work in the intersection of the two fields. All these factors militate against the use of CL technologies in CALL.

This project aims to address and overcome these problems by working closely with the teacher in the classroom and to carry out comprehensive analysis to determine actual learner (and teacher) needs. In order for a CL/CALL project to have any chance of success, it is essential that the research team have an understanding of the pedagogical needs of the learners (and teachers) and realise that these needs are what drives the project. An understanding of the technical possibilities is required, as well as a vision as to how these can address the needs. Rather than seeing what CL technologies are available and trying to map them to pedagogical needs, this project first identified the learner needs and then investigated what CL resources and techniques were available to address these needs. One of the oft-cited problems with CL/CALL (e.g. Salaberry, 1996) is that CL techniques cannot provide complete coverage of any human language and thus they are not suitable for CALL. Although some researchers have come close to covering specific sub-languages (see Chapter 3), in general this is still an issue for CL/CALL systems. However, this project aimed to avail of the fact that the target group of learners are still learning their L1 (English) and have limited L2 ability and so the level of linguistic sophistication is less than that of adult learners (who are typically the target audience for CL/CALL artefacts).

1.4 Research Question

Blin and Levy (2003) provided guidelines to CALL researchers on how to formulate their research questions. These guidelines include the need to state the research question clearly, to avoid being over ambitious in terms of breadth and to focus on a particular context. With this in mind, the research question that this project investigates can be formulated as: *can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium Primary Schools in Ireland?* The core terms used in this formulation of the research question are explained below.

"Existing" means that the resource has already been developed or is available for use (e.g. a data resource). "Computational Linguistics" (CL) refers to the use of the computer in the analysis and production of language (a more detailed definition of CL and related terms is given in Chapter 3, Section 3.2). "Resource" refers to any item that could be useful in the context of this project. Resources include software tools and electronic data sources. "Integrated" implies incorporating the CL resources in a seamless manner. "Successful" in this context implies evaluating the resulting system from CALL, software engineering and CL/CALL perspectives. Chapter 10 covers this aspect of the project in detail. "Useful" refers to usability, usage, user satisfaction and didactic efficiency as defined by Colpaert (2004). In the literature, researchers use many different terms to refer to CALL resources. Levy uses the word "artefact" to cover these CALL resources including systems, programs, tools, tutors and software. "Irish" refers to the native language of Ireland. It is sometimes called Gaelic in the literature. "English-

medium" refers to the language of classroom instruction. The vast majority of education in Ireland is through the medium of English. There are some Irish-medium schools in Ireland – some of them are based in the Gaeltacht (a traditional Irish-speaking region) and others are based in urban areas and of recent origin (see Chapter 4 for details). "Ireland" refers to the Republic of Ireland (rather than the island of Ireland, as the role of Irish language education is different in Northern Ireland).

This research question can be further broken down into several sub-questions:

- Can CL and CALL be integrated to develop useful CL/CALL artefacts for a language poorly-served by CL resources with limited developer resources?
- How hard is it to integrate CL resources in CALL?
- How language-independent are the resulting CL/CALL artefacts?
- How automatic is the process of developing the CL/CALL artefacts?
- Is it worthwhile using the external resources?
- Is it worth the effort?

Chapters 10 and 11 provide answers to the main research question and these sub-questions.

1.5 Objectives, Requirements and Constraints

Objectives

The research question outlined above (Section 1.4) states the overall objective of the project. This section breaks this question down into component objectives. The major aim is to investigate if CL resources can be successfully integrated into CALL. Success depends on CALL suitability, software quality and whether or not the time, effort and resources used to design and develop the system were efficiently and effectively deployed. Another objective was to reuse, where possible, existing CL resources and to avoid re-inventing the wheel. Often CL/CALL developers like to develop their own resources from scratch, even if there are already tools in existence that could be used to produce, or at least contribute to the development of, the required software. The aim of the research reported here was to avoid duplication of effort where possible. Another aim was to find out what conditions are necessary for the successful deployment of CL/CALL artefacts. This involved reviewing the relevant literature and also researching the conditions in the intended deployment context. Another objective was to determine if CL resources can be used in CALL for Minority Languages. Many of the CL/CALL systems in existence cater for the Most Commonly Taught Languages (MCTLs), that are well-served by main-stream CL techniques and resources. Would it be possible to use CL resources of languages less-served by these techniques and resources? It is often easier to develop a system for a particular language, rather than developing one that is (at least to some extent) language independent. One of the objectives of this project was to develop a CL/CALL integration template that would not only work for Irish, but that could also be used to develop

resources for other (Minority and Endangered) languages. A final objective would be to determine if the CL/CALL development template can actually be of use to these other languages.

The main objectives of the project have been identified in the previous paragraph. However, it is equally important to state what is not covered by the project. This project does not aim to modify the pedagogical approach used to teach Irish. It takes its cue from the pedagogical perspective of the teachers involved. The philosophy here was that the teachers have much more experience of actually teaching the language and are pedagogically trained and it does not make sense for a (in some respects) pedagogical novice to impose upon them. The project did not aim to test the effectiveness of CL/CALL application per se (e.g. in terms of measuring language proficiency of test and control groups with and without CL/CALL exposure). Certainly, specific aspects of the project were investigated for effectiveness (see Chapter 10), but CALL research has moved on from the black-and-white question of whether or not CALL is better than non-CALL, and thus, this type of comparison was not a focus of the CLICI project. It is important to note that providing wide-coverage CL/CALL artefacts for Irish was not an aim of this project. Finally, although the objective was not to produce commercial-quality resources, the aim was to produce high quality CL/CALL resources.

Requirements

Several basic requirements were established for this project, including the availability of CL resources, curriculum tie-in, efficient use of teacher resources and the need to develop child-friendly, robust materials suitable for learners with different abilities. Ideally, suitable CL resources should be available for use outside the original project in which they were developed. Unfortunately, many CL resources are developed only for internal use by the developers and it is difficult for others to use them. Often the resources are not fully documented or sufficiently robust for outside use. The knowledge that the resources exist and are available must be in the public domain. For example, a research report in a relevant journal can allow other researchers to be aware of the existence and capabilities of particular resources. Sometimes there may be intellectual property rights or confidentiality issues to be overcome before a particular CL resource can be used outside its original context and the effort required to facilitate external usage is not merited.

CALL is an "extra" in today's Irish primary schools, on top of and not integrated into core school hours. Although not a strict requirement, it would be useful if the resources developed were linked to a target curriculum or at least tie-in with the curriculum. Otherwise, their use could be severely limited as there is very limited discretionary time available to primary school students and they are unlikely to use the software outside of school hours. As the deployment

context was the primary school, it was important that, outside of pedagogical direction, minimum teacher input would be required to produce and use the resources. In Ireland, primary school teachers teach all subjects and are not only concerned with the teaching of Irish. They have a lot of competing pressures on their time and it is essential that any time they devote to working on CALL is of value.

CL/CALL resources must be child-friendly and consider the specific needs of younger learners. General User Interface (UI) guidelines should be followed to ensure that the software is usable by the target audience, but extra thought must be given to what differences or modifications are required for children. Consideration must also be given to ergonomic and classroom layout issues such as the location of the computer display, the keyboard and the mouse. The resources must be robust, as there is very limited technical support available in primary schools in Ireland (Mulkeen, 2001). Where limited technical support is available, it is often not available immediately during the school day, and, therefore, any CALL resources developed for primary school target groups should be sufficiently robust so that immediate external technical support is not required.

Finally, CL/CALL software must be suitable for students of different levels of ability. Primary school classes in Ireland tend to be heterogeneous with regard to student ability and it is important that the software is usable by, and suitable for, all the students in a given class. However, the CALL materials should not obviously distinguish between good, medium and weak students in such a way that the students know that they are being classified as such, as this can create feelings of inferiority among the weaker students and may lead to teasing from their peers.

Constraints

There are a number of important limiting constrains in this environment including limited CL resources for Irish, lack of CALL knowledge amongst primary school teachers in Ireland and PC availability.

There are very few CL resources available for Irish, at least in the public domain. This means that the project has to be imaginative in the use of existing resources or develop new resources from scratch. Given the limited resources available to the project, careful consideration has been given to whether or not to reuse an existing resource or develop a new one (if a suitable one does not exist) to ensure limited resources are used effectively (and not based purely on developer desires or personal interest). Furthermore, primary school teachers are not knowledgeable about CALL, let alone CL/CALL. This has implications for their understanding of the potential of any CL/CALL system for Irish, as well as possible limitations. This means

that care must be taken to ensure that the teachers understand what CALL entails, what it can and cannot do and what they can expect to do with CALL artefacts.

Although computing power continues to improve, primary schools in Ireland may not have very modern hardware available to them. There is no point developing CL/CALL resources that require high-performance machines, as they are unlikely to exist in the intended deployment context. Therefore, any CL/CALL resources that are developed must be usable on fairly standard machines that are likely to be available in primary schools. Related to this is the issue of internet connectivity. Although there is continued improvement in the availability of internet connections in primary schools in Ireland, it cannot be assumed that all schools have high-speed broadband connections available in each classroom. Technology should not dictate what resources are developed, but CL/CALL resources must take into consideration what technology is (or may be) available to the target users.

1.6 Research Methodology

The project is guided by a number of important principles. These are summarised in Table 1.1 and an explanation is given here.

Basic Principles

It is important to state clearly the deployment context and the goals of the project, as sometimes CALL projects are vague or unclear in this regard (Levy, 1999). The research question was clearly stated in Section 1.4. It is important to incorporate principles or guidelines for developers so that they understand the context and philosophy of the project (Davies et al., 1994; Hémard, 1997). Previous CALL research should be studied and the lessons learnt should be applied, if appropriate. Unfortunately, it is not always the case that relevant prior research is investigated before undertaking new research. However, it makes sense to do so, as otherwise, a project may run the risk of reinventing the wheel or repeating the same mistakes. General CALL research findings (Davies, 1997) and findings from a specific context are relevant in this regard. Davies summarises lessons learnt in the past 20 years (initially published in 1997 and updated in 2002). He notes the importance of training and warns against regarding technology as the panacea. This is especially pertinent in the CLICI context as the teachers and students were CALL novices and there was the possibility that they might regard CALL as the answer to all their problems with teaching Irish. For this project, the literature on previous CL/CALL projects was reviewed (Chapter 3), as well as the socio-cultural and pedagogical context of Irish (Chapter 4). The findings from this research fed into the analysis and subsequent phases of the project.

A key tenet of the project has been to consider deployment from the start. There is no point in developing wonderful resources if they cannot be used in the intended deployment context. Therefore, the computing resources available and the profile of the target user group should inform, but not limit, the design process. Chapters 5 and 6 address this issue. It is also important to consider evaluation from the start. Rather than developing the CALL resources and then deciding what to evaluate, evaluation should be taken into account during design. What is the aim of the project? How will success be measured? Levy (1999) argues that it is important to state the theory behind the project so it will be clear what the motivation for undertaking the research is and how it should be evaluated. Chapter 7 discusses the theory behind the resources developed as part of this project. Qualitative and quantitative evaluation techniques can be used in CALL evaluation – both provide useful information for reviewing a project. The difficulties that surround evaluation, and how to overcome at least some of them, are discussed in Chapter 10.

Another key feature of successful CALL is to involve the user early on in the process. User involvement is important in any software engineering project, not just CALL. Sometimes designers and developers are reluctant to work with users until the product is 'presentable'. They fear that the users will not understand the software or that they will get a false impression of what it can do if they see an incomplete version of the system. However, it is much easier to make adjustments to a system at an early stage of design, rather than later, when change is generally much more costly. A designer cannot presume to know the users so well that their advice and feedback is not required. Also, if the aim of the system is to develop CALL resources for real users, what is the point of delivering a system that does not meet their needs? There are several ways of involving users. In the context of this project, teachers were consulted on learner needs, while the target users provided input on aspects of the user interface.

Specifically with regard to the primary school context, it was important to see if the resources could fit in or be linked with the curriculum (as this might increase the chances of producing software that would really be used). Also, given that the primary school teachers are responsible for teaching all subjects, not just Irish, and that they have to manage their time efficiently, it was important to minimise, where possible, the teacher effort required to produce CALL resources. One other issue that had to be borne in mind was the question of using a computer in the classroom versus using a computer laboratory and this would have to be investigated during the course of the project.

Principle	Application
CALL	
State context and goals	Deployment context (primary school) and research question clearly stated
Incorporate guidelines for developers	Concept and design specified for developers
Learn from previous research	Reviewed relevant literature
Consider real-world issues from the start	Deployment context considered and investigated from the beginning
Consider evaluation from the start	What to measure and how to measure were considered from the beginning
Involve target users early on	Teacher shown mock screen and students provided feedback during prototype stage
Work with the teacher	Met with the teachers and discussed needs and ideas
Primary School	
Fit with curriculum	Curriculum, syllabi and textbooks reviewed
Minimise teacher effort	Prepare for teacher meetings, easier input options considered
Logistics for computer usage	Investigated computer-in-class vs computer lab usage
Computational Linguistics	
Review prior research	Relevant literature reviewed
Review resources available	Irish Morphology Engine and *Gramadóir* investigated
Consider pedagogical value	Verb information and writing checker could be useful
Consider deployment effort	Verb information possibly not too difficult; writing checker would have to be adapted
Other	
User Interface must be suitable	UI guidelines followed and considered for young learners
SLA: motivation is important	Consideration given to developing enjoyable resources
Pedagogy: most important aspect	Teacher-driven rather than developer-driven
Software engineering techniques useful	Good software engineering techniques employed

Table 1.1 Basic CLICI Principles and their Application

Looking at the field of Computational Linguistics (CL), it was important to investigate previous research. In this regard, the relevant literature was reviewed (e.g. Holland et al., 1995; Jager et al., 1998; Nerbonne, 2003 – see Chapter 3) and a meeting with Nerbonne took place to learn about the area and discuss ideas. A review of what resources were available was carried out and

consideration was given to their potential pedagogical value. Uí Dhonnchadha's (2002) Morphology Engine for Irish and *Gramadóir* (Scannell, 2005 – an Irish grammar checker) were investigated. For example, the Irish Morphology Engine can provide verb conjugation information and this could be useful from a pedagogical point of view. Consideration was also given to how easy or hard the CL resources would be to use in developing CALL materials and to whether or not their deployment would be worth the effort.

One of the problems with previous CL/CALL projects is that the developers are usually not particularly interested in the User Interface (UI) (Holland, 1995) and so the resulting software is not very suitable for the target (non-expert) user. It was therefore important to learn from this and to ensure that the UI was appropriate for primary school students. This involved applying general UI guidelines, web design guidelines (e.g. Nielsen, 1996; 1999), giving consideration to colours that would be suitable for younger learners and potentially useful additions such as the use of animation to make it more interesting (e.g. Doolittle et al., 2004). The field of Second Language Acquisition (SLA) has identified motivation as one of the key factors in successful language learning (e.g. Dörnyei, 1994). Bearing this in mind, the CLICI project aimed to provide CALL resources that were pedagogically sound and yet appealing to the students. Something as simple as calling the language learning exercises 'games' makes them sound more enjoyable and fun, compared to using the work 'exercise'. The importance of pedagogy has been stated previously. The CLICI project did not aim to impose a particular pedagogical philosophy on the teachers, but rather, it aimed to fit in with their pedagogical practices. These were an eclectic mix, combining aspects of the communicative approach along with the use of grammar teaching for some aspects of language learning. A lot of effort is required to ensure that CALL projects develop pedagogically appropriate material, especially given the limited resources available to them. The software engineering techniques used in a project are often under-reported in the literature. The CLICI project aimed to adhere to good software engineering practices, as these tend to lead to better developed and more maintainable software.

General Methodology

The CLICI project surveyed primary school students in two schools about their attitudes to Irish. It carried out a pilot study on how CALL could be used in this context, what the students thought of the CALL resources and what practical problems existed. Note that several experts (e.g. MacWhinney, 1995; Felix, 2005; Hubbard, 2005) warn of the dangers of basing findings on students with very limited exposure to CALL materials – what MacWhinney (1995) refers to as the 'smile coefficient' - see Chapter 10, Section 10.4). The pilot study (see Chapter 6) was undertaken to determine needs and to learn about the intended CALL deployment context. It did not aim to provide more concrete information – as that was the aim of the rest of the project. One of the schools involved in the project was a mainstream school; a fairly large primary

school located in an urban setting in Dublin, Ireland. The other school is also in an urban area in Dublin, but located in a disadvantaged (i.e. economically deprived) area. This meant that there were differing needs and deployment contexts between the two schools. Chapter 9 provides more details on the schools. Background research analysis as well as meetings with the teachers and Irish pedagogical specialists formed part of the needs analysis. Findings from the pilot study and the background analysis were combined to determine what resources would be developed during the CLICI project. Standard principles (e.g. Colpaert, 2004; Sommerville, 2004) were used to design, develop and test the required software. Evaluation was considered at the design stage. Once developed and tested, evaluation criteria suggested by CALL researchers (Chapelle, 2001; ICT4LT, 2005; Colpaert, 2004) were used to evaluate the CLICI resources, from both objective and subjective viewpoints.

1.7 Ethics

It is often assumed that CALL research has an ethical dimension. In North America, university-based researchers who wish to undertake investigations on human subjects usually have to submit their research plans to their Ethics Committee (EC). In recent years, this is becoming more common in Europe also. Previously, the EC may have dealt with physical experiments, but any research involving humans (including CALL research) should get approval from the relevant EC. In Dublin City University (DCU), the EC has only been established recently. In many areas of research, although there are guidelines, there are no international standards available for researchers to follow. Various regions of the world have similar yet differing guidelines. One of the key aspects to consider is the effects of any proposed research on its participants. This involves not only physical effects but also emotional and psychological effects. In the CALL context for example, this would involve considering not only whether or not the software being tested is physically suitable for the user, but also whether or not it leaves learners feeling demoralised after using the resources.

The DCU Ethics Committee (DCUEC, 2006) reviews research projects that deal with physical experiments and other experiments involving humans. CALL research falls into the second category. Within this category, there are two ways of seeking ethical approval. If the research involves adults and meets certain guidelines, it can go through a fast-track approval system. If the research involves children under the age of 16, it must be discussed at a meeting of the EC. The researcher must submit a completed application form, along with a plain language statement and the proposed consent form to the committee. As this research project was one of the first of its kind for the DCUEC (CALL for young learners), there were a few iterations before the EC approved the research. Note that this project started before the EC was established and the EC approval applies for the period from September 2005 onwards. The Plain Language Statement and Consent Form are included in Appendix A. As the participants

in this project were all under 16 years of age, their parents or guardians also had to sign the Consent Form.

1.8 Terminology

Computational Linguistics (CL) is informed by linguistics (including grammars and language theories), whereas "Natural Language Processing" (NLP) uses many different methods including linguistics-based, but also signal-processing, statistical and (usually electronic-) engineering-based methods to process human language (speech, text) by computer. Although the term "CL/CALL" is perhaps more suitable to the use of CL techniques and resources in CALL, the term "NLP/CALL" is more common in the field of CALL and both terms are used in this thesis. Further discussion of the differences between these two terms is given in Chapter 3, Section 3.2. Unless otherwise stated, the term "Computer Assisted Language Learning" (CALL) is used in its broadest sense. It is used to cover all aspects of language learning, where a computer or software is used, including "Web-Enabled Language Learning" (WELL) and "Technology-Enabled Language Learning" (TELL). For editorial reasons, the terms "artefact", "program", "system", "software", "resource", "materials" and "courseware" are used interchangeably throughout this document, although specific terms are used where appropriate for reasons of clarity. Likewise, "student", "learner" and "user" are used to refer to the language learner.

In the CALL literature, the term "implementation" refers to the actual deployment of CALL materials. However, in some contexts, the word "implementation" can refer to software development i.e. the implementation of the design plans. Therefore, to avoid possible confusion, the term "deployment" is used to refer to the usage of the CALL materials by learners.

In this thesis, the term "games" refers to language learning exercises. This is the term that is commonly used by the teachers and students in the primary school context in Ireland. Examples of games include multiple-choice exercises, matching exercises and gap-fill exercises. The term is not used in the computer game sense of the word (i.e. it does not imply the use of interactive multimedia software where the user has to carry out certain actions to win points or rewards).

1.9 Project Chronology

This project followed a typical CALL or software engineering schedule. An investigation into the relevant areas was carried out and followed by an Analysis-Design-Development-Implementation-Evaluation (ADDIE) approach to resource development (see Colpaert (2004) and Chapter 5 for an overview). A literature review of the relevant research areas was carried out. This included research on the field of Computational Linguistics, the use of CL

technologies in CALL, Irish and its pedagogical and socio-cultural context, language learning in the primary school in general and Irish CL resources. An Analysis Phase was then carried out to ascertain the needs of the learners and other interested parties. In the context of the CLICI project, these other interested parties include teachers, parents and Irish language organisations. As there was no specific literature available on the use of CALL for Irish in primary schools (leaving aside the use of CL technologies), it was necessary to carry out a pilot project to test the feasibility of developing CALL materials for Irish and, even more importantly, to see if they were really usable in the primary school context. Would the teachers consider them to be pedagogically useful? Would the students enjoy using them? What logistical problems exist? Based on the findings of the Analysis Phase and the pilot study, a Design Phase was carried out in which the concepts behind the required resources and the specification of these resources were defined. This involved looking at previous research on the specific resources to be developed and integrating and adapting the relevant findings to this particular context. The Design phase output fed into the Development phase in which the required software was actually coded and tested. The CALL materials were then installed in two primary schools in Dublin, Ireland and were evaluated by the teachers, the students and the developer.

Figure 1.1 shows a simplified chronology for the CLICI project. Note that although there appears to be overlap between the Design, Development and Implementation phases for the project as a whole, the design for each separate component of the project was completed before the development commenced. Obviously, the implementation (or deployment) of the CALL materials did not occur before the development of a particular component.

1.10 Thesis Organisation

Chapter 2 provides an overview of the CLICI system. Chapter 3 reviews the area of CL and CALL. It looks at previous NLP/CALL projects, the integration difficulties that exist and carries out a Strengths/Weaknesses/Opportunities/Threats (SWOT) analysis of the field. Chapter 4 provides an overview of Irish, its history and current socio-cultural position. A brief outline of the language is provided along with a review of CALL and Irish in general and in the primary school in particular. Chapter 4 also introduces some of the CL resources that are available for Irish. Chapter 5 presents the ADDIE model (Colpaert, 2004) and why it was chosen for the CLICI project. It also focuses on the Analysis Phase of the project, and discusses the General Local Differential Targeted (GLDT) analysis grid for Learners, Teachers, Pedagogy, Technology, Content and Other Actors (e.g. parents and content developers). It summaries the requirements of each of these components and outlines what is required for the Design Phase. Chapter 6 discusses the pilot study that was undertaken to determine the feasibility of developing and using CALL resources for Irish. It also outlines the logistical issues that arose during the study and the resources to be developed by the CLICI project.

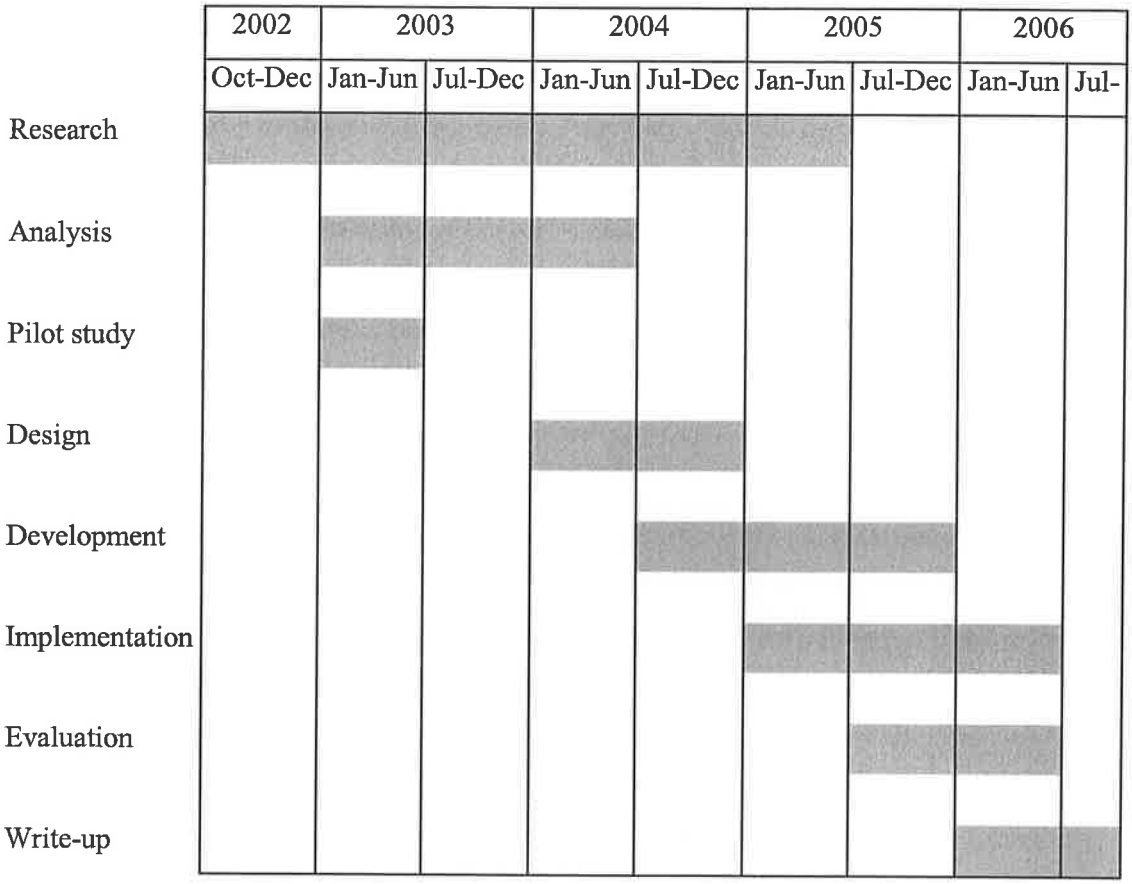

Figure 1.1 Project Chronology

Chapter 7 addresses the Design Phase of the project. It looks at the link between analysis and design and the application of Colpaert's design sub-phases (conceptualisation, specification and prototyping) to the CLICI project. Chapter 8 reviews the Development and Testing of the CLICI software. It looks at the development principles adopted during the project and highlights the importance of testing. Chapter 9 reviews how the CLICI resources were actually used in the target environment. It provides an overview, an implementation history and findings of the two schools and classes involved in the Implementation (deployment) Phase. Chapter 10 provides an evaluation of the CLICI project. It reviews the project from a CALL point of view using Chapelle's evaluation criteria (Chapelle, 2001), ICT4LT evaluation criteria (ICT4LT, 2005) and Colpaert's usefulness criteria (Colpaert, 2004). It evaluates the project from a software engineering perspective and also from a CL/CALL viewpoint. It also discusses the pitfalls of CALL evaluation research and the actions taken to try to avoid them. Chapter 10 also outlines the limitations of the research findings. Chapter 11 provides a summary of the project, along with the benefits, difficulties, improvements, limitations and findings. It gives the necessary and desirable conditions for the successful deployment of CL/CALL resources in the Irish primary school context. It also discusses the contribution to knowledge and suggestions for future work.

1.11 Summary

This chapter gives an introduction to the CLICI research project on the integration of Computational Linguistics (CL) technologies in Computer Assisted Language Learning (CALL) artefacts for Irish in English-medium primary schools in Ireland. Section 1.2 provides some overall background information about the project while Section 1.3 gives an outline of the use of CL technologies in CALL. The research question addressed by this project - *Can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium Primary Schools in Ireland?* – is explained in Section 1.4. The objectives, requirements and constraints of the project are discussed in Section 1.5. The section also outlines what was not part of the research agenda of the CLICI project. Section 1.6 provides an overview of the research methodology, including the basic principles used to guide the design and development of the project. Section 1.7 discusses the ethical issues involved in a project of this nature and specifically the ethical approval for this research. Section 1.8 clarifies some of the main terms used throughout this thesis, including CL/NLP, CALL, and implementation/deployment. A simplified project chronology is shown in Section 1.9. Section 1.10 provides an overview of the organisation of the thesis, from the background research on CL and Irish, through the ADDIE model stages and the final summary in Chapter 11.

Chapter 2 Overview of CLICI

2.1 Introduction

This chapter provides an overview of the CLICI system. Section 2.2 explains the motivation behind this chapter and the need to provide the reader with a brief outline of the CLICI system before documenting the development process of the system itself in detail in the remainder of the dissertation. Section 2.3 provides a brief overview of the CLICI system. Section 2.4 introduces the Lesson Generator Component (LGC), which provides an improved interface to the CALL Template (Ward, 2001) to facilitate the creation of language lessons and related exercises. Section 2.5 outlines the Verb Conjugation Component (VCC) which provides static and animated verb conjugation web pages. The VCC reuses two existing resources: an Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002) and an animation tool (Koller, 2004) described in this section. Section 2.6 presents the Writing Checker Component (WCC) which provides a writing checker targeted at primary school students of Irish. The WCC uses *Gramadóir* (Scannell, 2005) as its underlying engine, and the section provides a brief outline of *Gramadóir*. Section 2.7 summarises the chapter.

2.2 Purpose of this Chapter

This remaining chapters in this thesis describe the conception, development and evaluation of the CLICI system using the Analysis Design Development Implementation Evaluation (ADDIE) model (Colpaert, 2004), as a way to tackle the question "can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium Primary Schools in Ireland". As these chapters describe an evolving process, it would be difficult for the reader to gain an overall understanding of the complete system, until the end of the process, as the capabilities, components and architecture of the CLICI system are introduced step by step in the relevant chapters. Therefore, in order to improve the readability of the thesis and to help orient the reader, this chapter provides an overview of the CLICI system. The motivation for the three CLICI components and the justification of the design decisions made during the project are detailed in the remaining chapters of the thesis.

2.3 CLICI System Overview

The CLICI system consists of three components: a Lesson Generator Component (LGC), a Verb Conjugation Component (VGC) and a Writing Checker Component (WCC). The CLICI system provides a wrapper around these three components to present a unified interface to learners and teachers. Figure 2.1 shows a diagram of the CLICI wrapper around the three components, while Figure 2.2 shows how learners and teachers view the CLICI system.

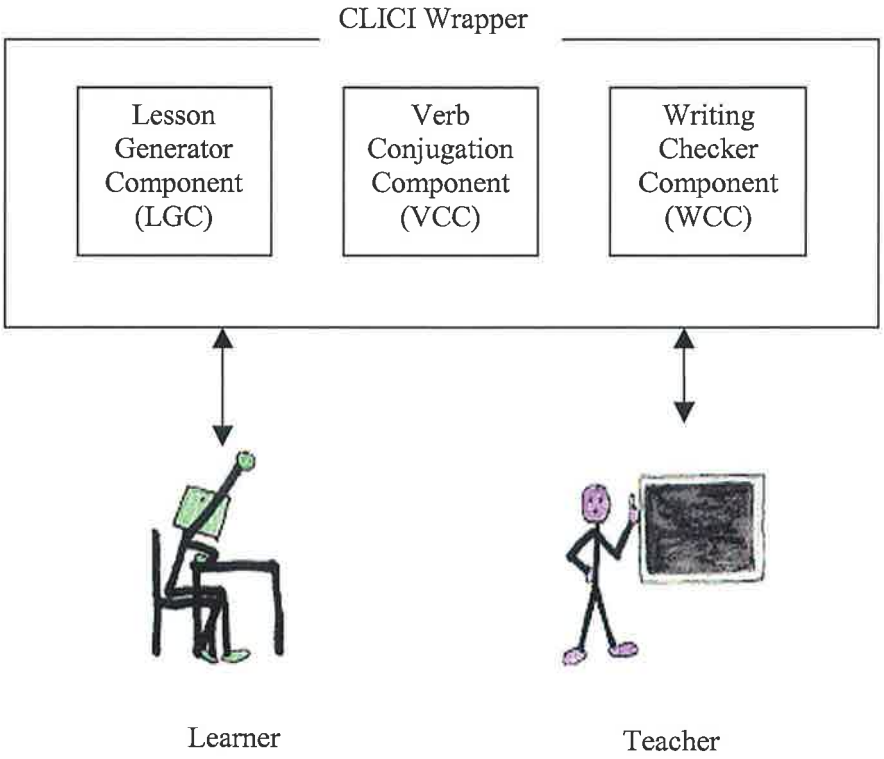

Figure 2.1 Overview of CLICI System and CLICI Wrapper

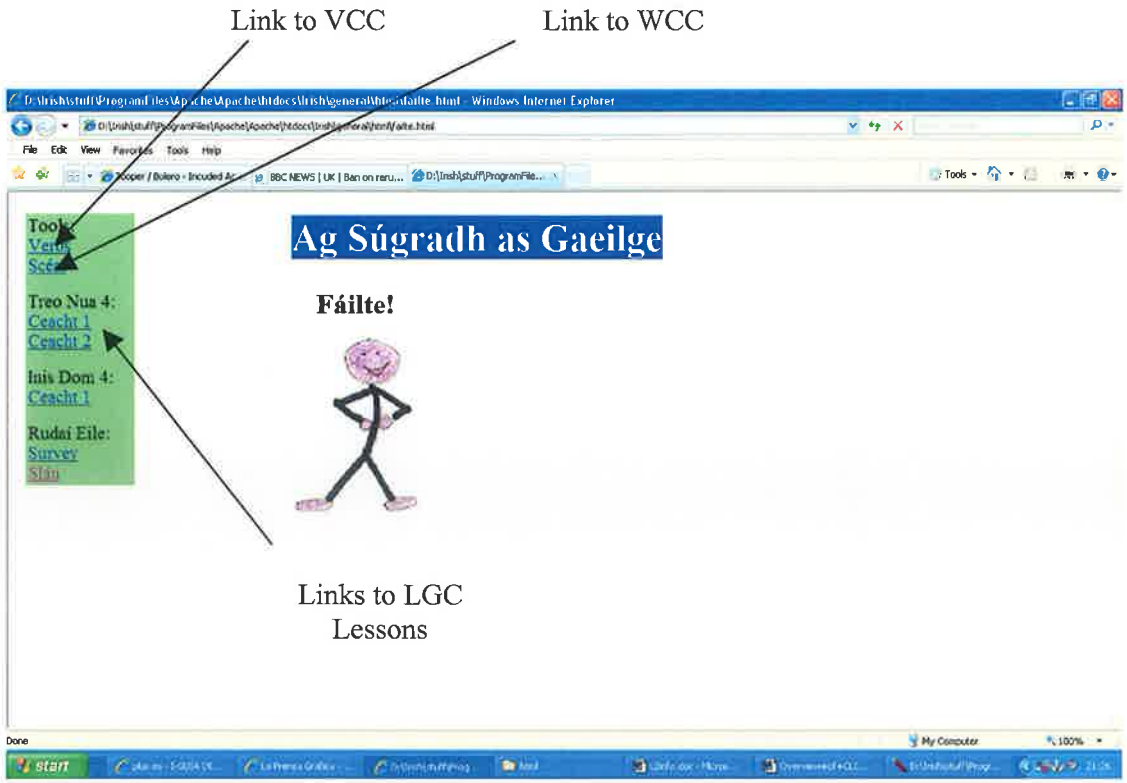

Figure 2.2 Main CLICI Screen

The Lesson Generator Component (LGC) provides a tool to create lessons and exercises. Its primary focus is obviously to provide CALL materials for lessons. However, the lessons also

provide an environment in which to present the other CLICI components (i.e. the VCC and the WCC) to the user, rather than provide them in isolation. The LGC is discussed in Section 2.3. The Verb Conjugation Component (VCC) displays verb conjugation information to the learner in either static or animated mode. In static mode, the data is displayed as normal text, while in animated mode, the changes required to conjugate a verb in a particular tense are shown dynamically on the screen. The VCC is presented in Section 2.5. The Writing Checker Component (WCC) is a tool that allows learners to input unrestricted text in Irish and to receive feedback and is described in Section 2.6. Sections 2.4 – 2.6 give a brief introduction to the relevant component, as well as an overview of the existing external resources used to develop the component. They also provide a summary of the resources produced by the component.

2.4 Lesson Generator Component

The purpose of the Lesson Generator Component (LGC) is to facilitate the creation of language lessons and exercises ("games"). It does this by providing a wrapper around an existing CALL Template (Ward, 2001) (see below for more information) and, with the addition of local code, offers an improved interface to the courseware developer. Figure 2.3 shows a system diagram for the LGC and LGC wrapper. Figure 2.4 shows the flow of information for the LGC. The courseware developer provides the required information (e.g. lesson content) in a plain text file. The LGC then converts this file into the format required by the CALL Template. The CALL Template subsequently generates the web pages for the learner.

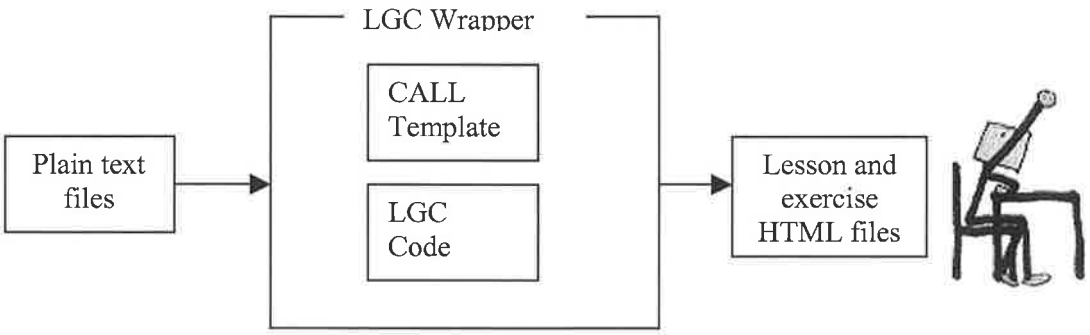

Figure 2.3 Overview of Lesson Generator Component

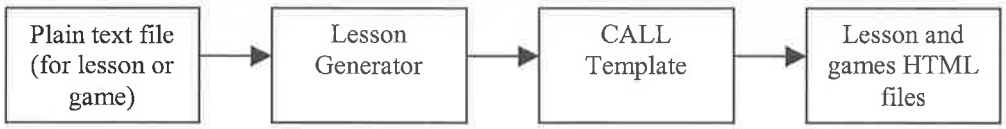

Figure 2.4 Information Flow for the Lesson Generator Component

Figure 2.5 provides an example input lesson file (note that the text is not shown in italics, as the text in the source file is not written in italics). Figure 2.6 shows the web page produced by the LGC (note that the image and audio recordings are specified separately). Figures 2.7, 2.8, 2.9

and 2.10 show an example of a multiple-choice exercise, a matching exercise, a mixed-up sentence exercise and a gap-fill exercise, respectively, generated by the LGC.

Portion of Plain Text File for a Lesson	Translation
Bhí Ciarán ag siúl lá amháin. Bhí lochán uisce ar an mbóthar. Ní fhaca Ciarán an lochán.	Ciaran was walking one day. There was a puddle on the road. Ciaran didn't see the puddle. .....

Figure 2.5 Portion of Plain Text File for a Lesson

CALL Template

The CALL Template (Ward, 2001) provides a tool to enable courseware developers with limited computer skills to develop CALL resources for Minority and Endangered Languages. It facilitates the development of language lessons, with multiple-choice, matching and gap-fill exercises. It uses XML technologies (XML, 2000) and the exercises are built using Hot Potatoes software (Holmes and Arneil, 1998). The source files are XML-tagged files which are then converted into html files using XSL files (XSL, 2001). Although targeted at courseware developers with basic computer skills, some understanding of the concepts of XML tagging is desirable.

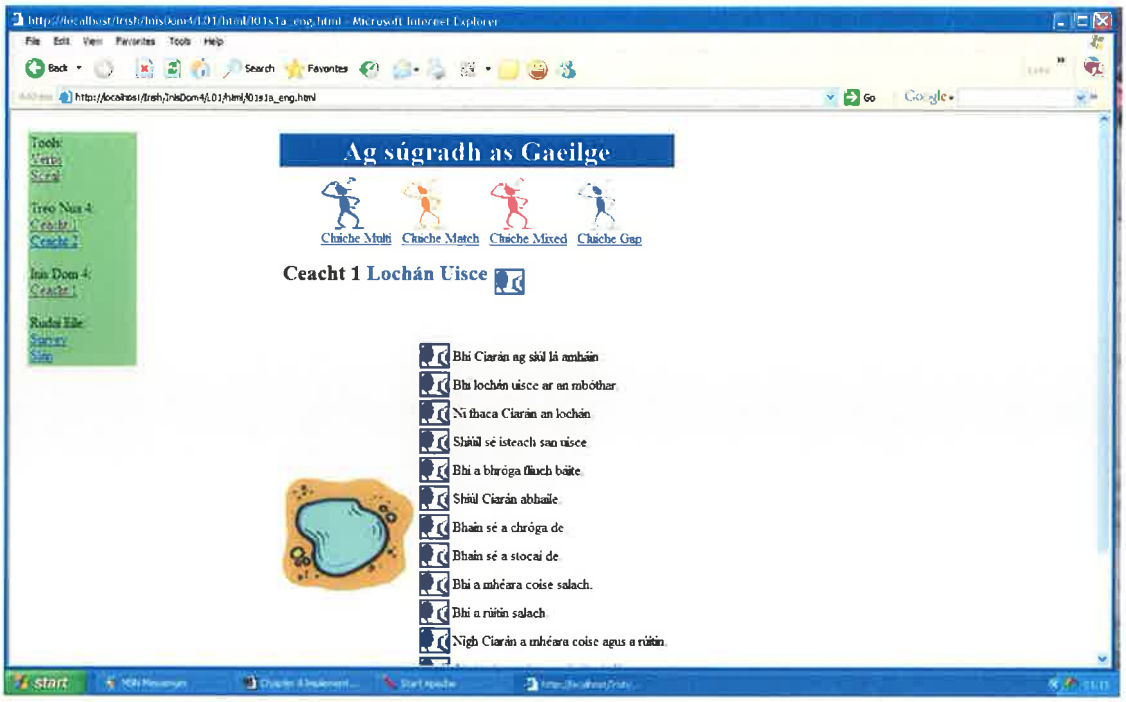

Figure 2.6 Lesson Page Produced using the LGC

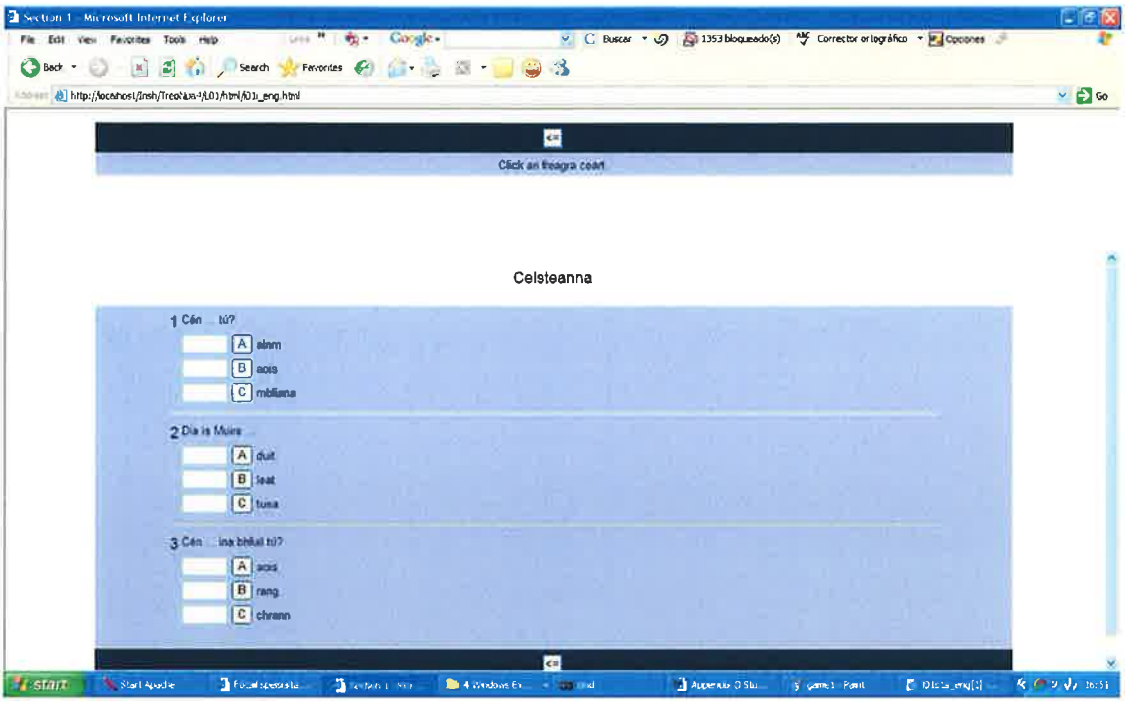

Figure 2.7 Multiple-choice Exercise Example

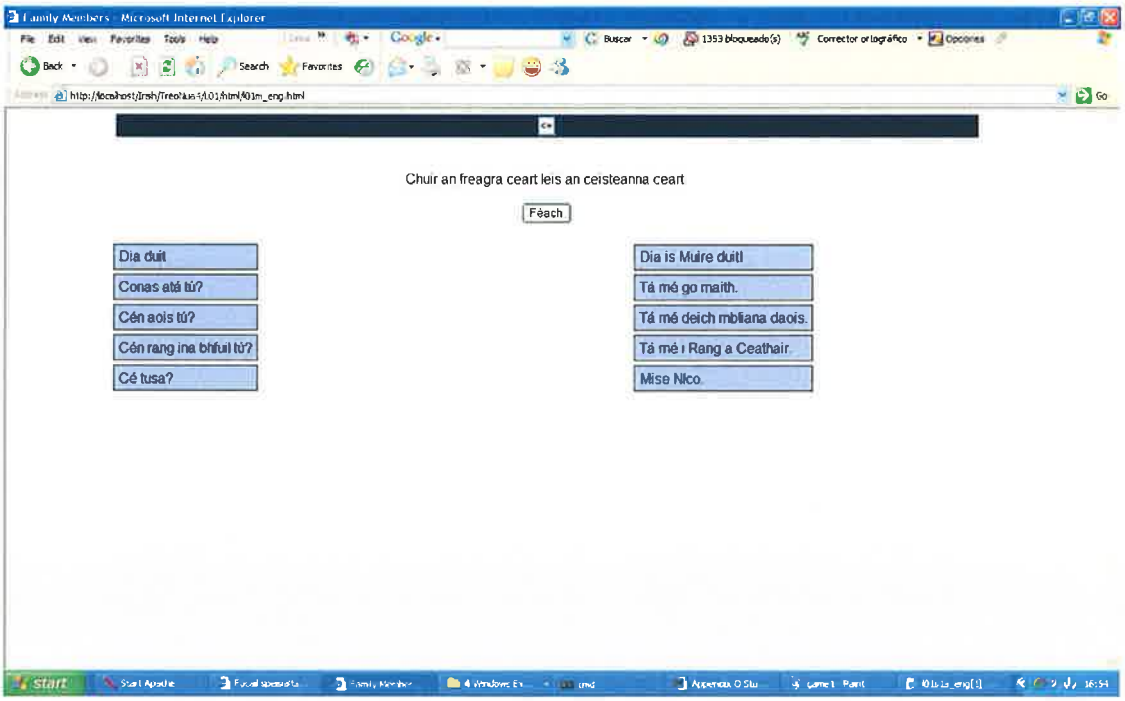

Figure 2. 8 Matching Exercise Example

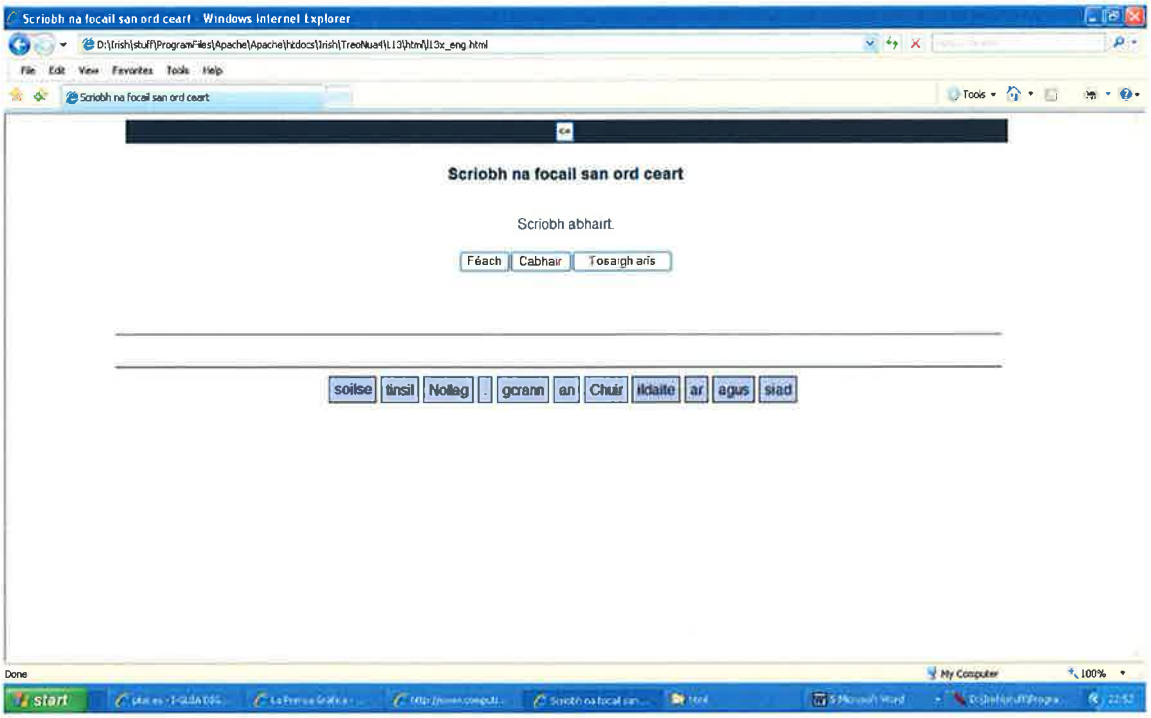

Figure 2.9 Mixed-up Exercise Example

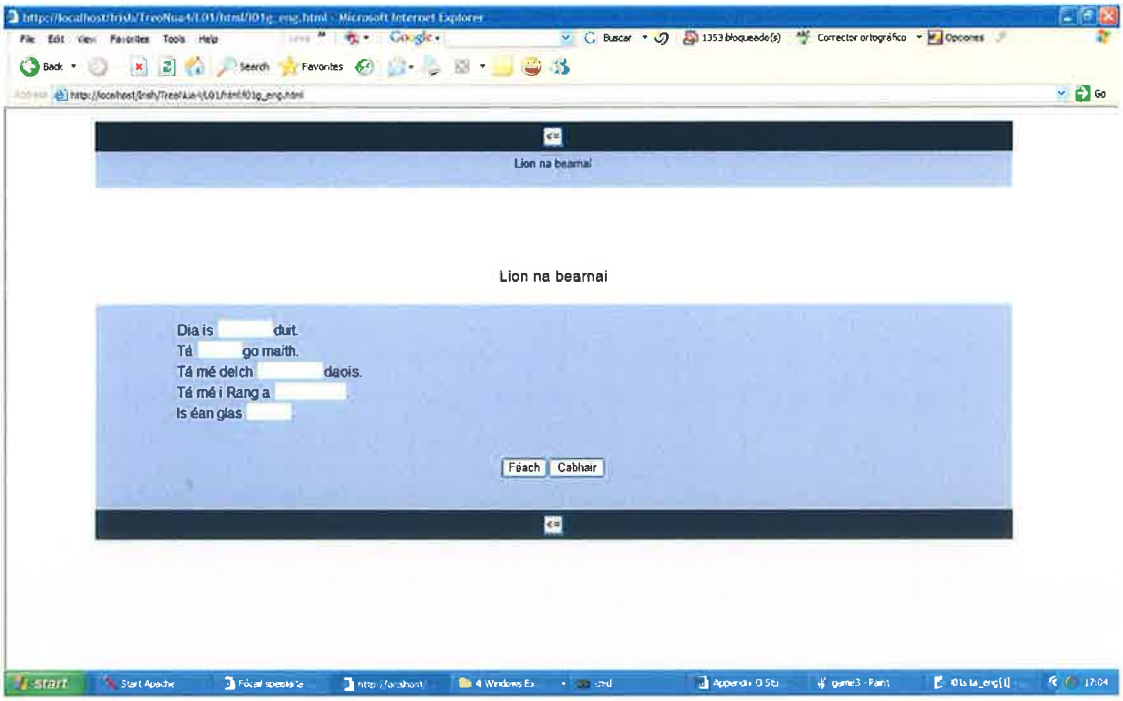

Figure 2.10 Gap-fill Exercise Example

The minimal functionality and rudimentary interface of the LGC mean that the LGC can only be considered a very limited Authoring Tool (AT), especially compared to CALL-specific ATs such as MALTED (Malted, 2000). However, in the context of this project, it provides a useful tool that reuses an existing resource i.e. the CALL Template, Ward (2001) – this is in keeping with the general philosophy of the project. An extra exercise type, a mixed-up sentence exercise was added to the CALL Template system, as this was deemed desirable by one of the

teachers involved in the project. Overall, 12 lessons and their related exercises were developed and used during the CLICI project. Table 2.1 shows a summary of the LGC.

Feature	Information
Purpose	To provide a very simple lesson and exercise ("game") authoring tool
External resources used	CALL Template (Ward, 2001)
Functionality	Enables the courseware author to write a lesson or exercise using a plain text file, rather than have to edit an XML-tagged file. The Lesson Generator then converts this file into the required format for the CALL Template. This in turn produces the lessons and games in HTML format.
Resources created	12 lessons and 48 exercises (1 multiple-choice, 1 matching, 1 mix-up and 1 gap-fill exercise per lesson)

Table 2.1 Summary of the Lesson Generator Component

2.5 Verb Conjugation Component

The Verb Conjugation Component (VCC) is a tool that creates static and animated web pages that display verb conjugation information. It also creates exercises ("games") related to the verb conjugation automatically based on pedagogical options selected by the teacher (similar to those produced by the LGC). The VCC provides a wrapper around three existing resources: an Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002), an animation tool (Koller, 2004) (see below for more information on these resources) and the CALL Template (Ward, 2001) outlined above. It integrates these resources using local code and uses teacher-supplied pedagogical information to provide the CALL resources to the user. Figure 2.11 shows an overview of the VCC. Figure 2.12 shows the flow of information for the VCC.

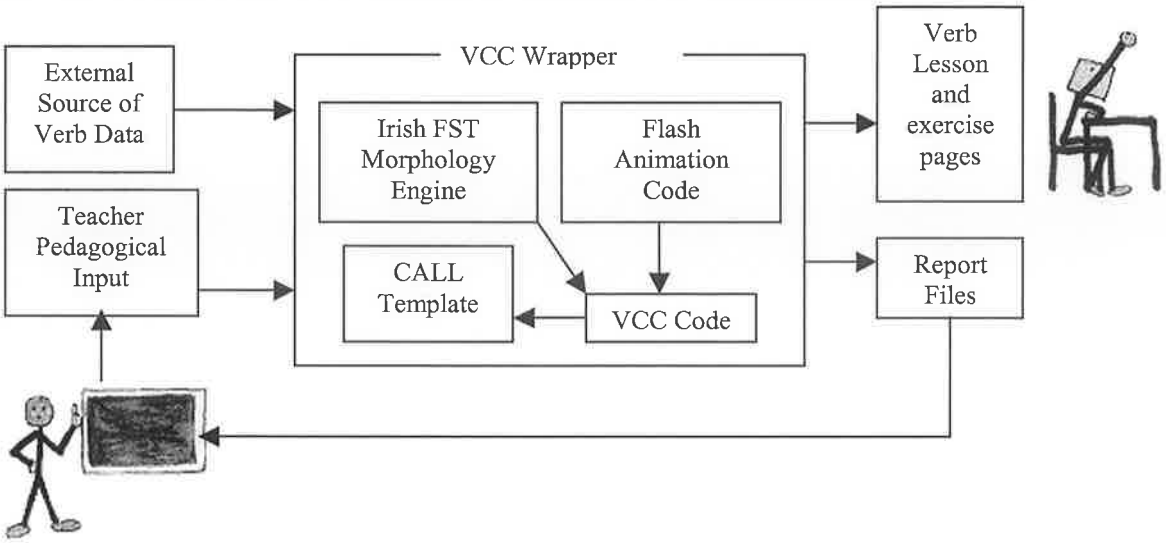

Figure 2.11 Overview of the Verb Conjugation Component

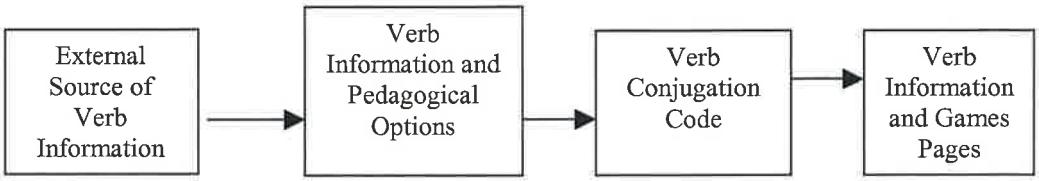

Figure 2. 12 Information Flow for the Verb Conjugation Component

The Irish Finite State Morphology Engine provides both analysis and generation of morphological information for Irish words, phrases and sentences. In the context of this research project, the Irish Finite State Morphology Engine was used to provide (generate) verb conjugation information for Irish verbs. For practical reasons, the VCC focused on a subset of verbs that was specified by one of the teachers who participated in the project. Information extraction and conversion utilities were written to put the verb conjugation data into a suitable tagged internal format. This tagged data is then combined with Koller's (2004) animation tool to produce the required animated web pages. The animation tool is very useful as the VCC just needs to provide a template version that can be populated systematically using the tagged verb conjugation files. In the absence of the animation tool, the creation of the dynamic web pages would have required fairly considerable software research and development and would have detracted from the main research goals of the project.

The main verb page is shown in Figure 2.13. It provides a list of the verbs that are available to the learner.

Figure 2.13 Main Verb Page of the Verb Conjugation Component

In static mode, the changes required to conjugate a given verb in a particular tense are shown highlighted in red. In animated mode, these changes are shown to the learner by visually displaying the process of the necessary modifications in a film-like sequence of movements, insertions and replacements of character sequences. For example, the verb *bris* (to break) is a regular verb (i.e. a verb that follows the normal conjugation rules in Irish) that requires the insertion of the letter '*h*' between the first and second letters of the verb (i.e. '*b*' and '*r*', respectively) to form the correct conjugation of the verb in the past tense (for all persons except the first person plural). Figure 2.14 shows the relevant web page for *bris* in static mode, while Figure 2.15 shows the equivalent page in animated mode. It is difficult to capture a dynamic display in printed format however Figure 2.15 Part 1 should convey the essence of the process.

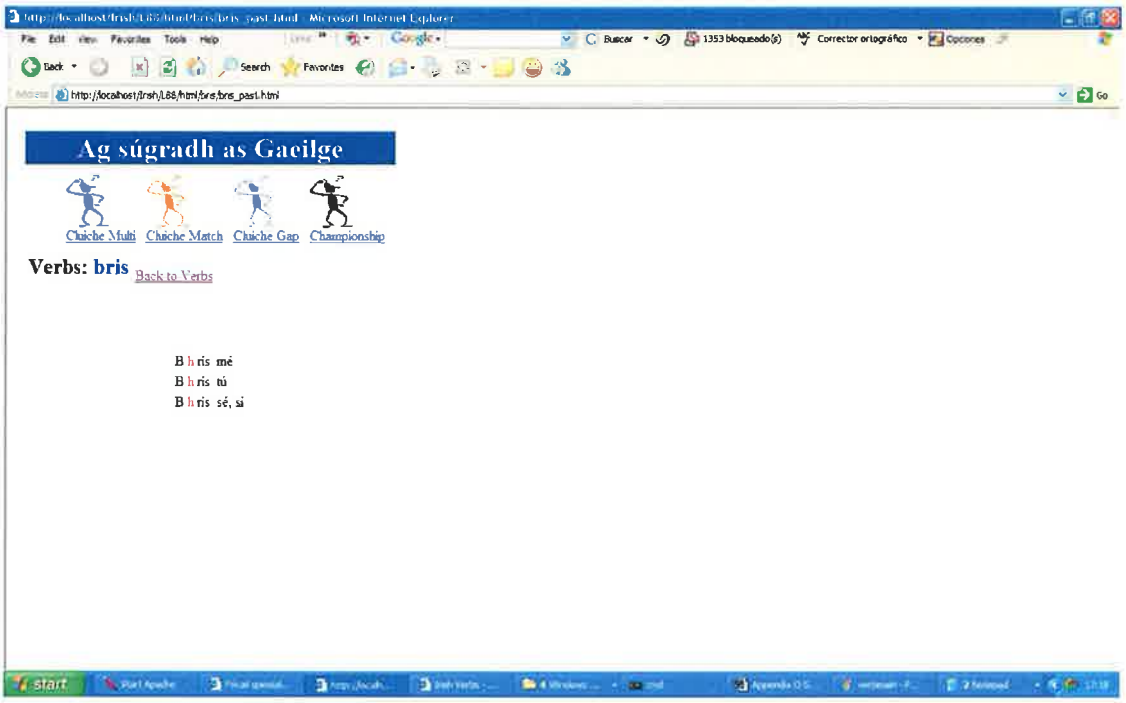

Figure 2.14 Static Verb Page for *bris* (to break)

Apart from the existing exercise types (multiple-choice, matching, mixed-up and gap-fill), a new exercise type, called the "Championship", was created in the VCC. The Championship contains a mix of multiple-choice and gap-fill questions and is used to monitor students' scores. An example is shown in Figure 2.16.

Figure 2.15 – Animated Verb Page for bris (to break) – Part 1

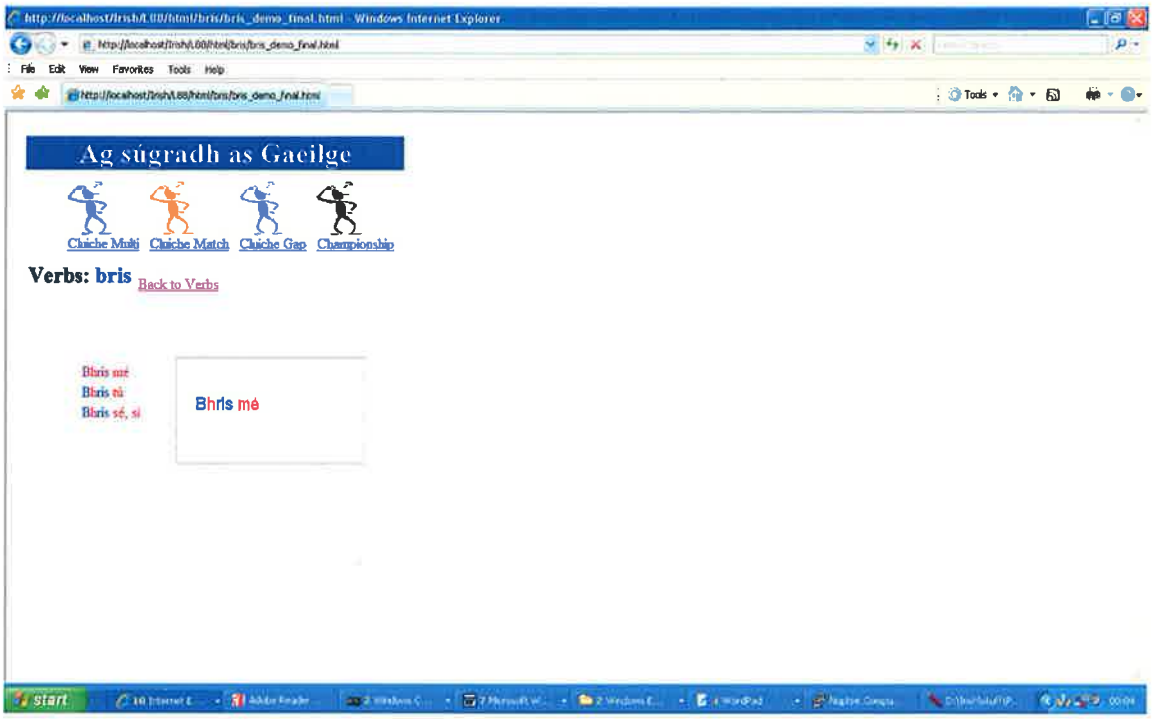

Figure 2.15 Animated Verb Page for *bris* – Part 2

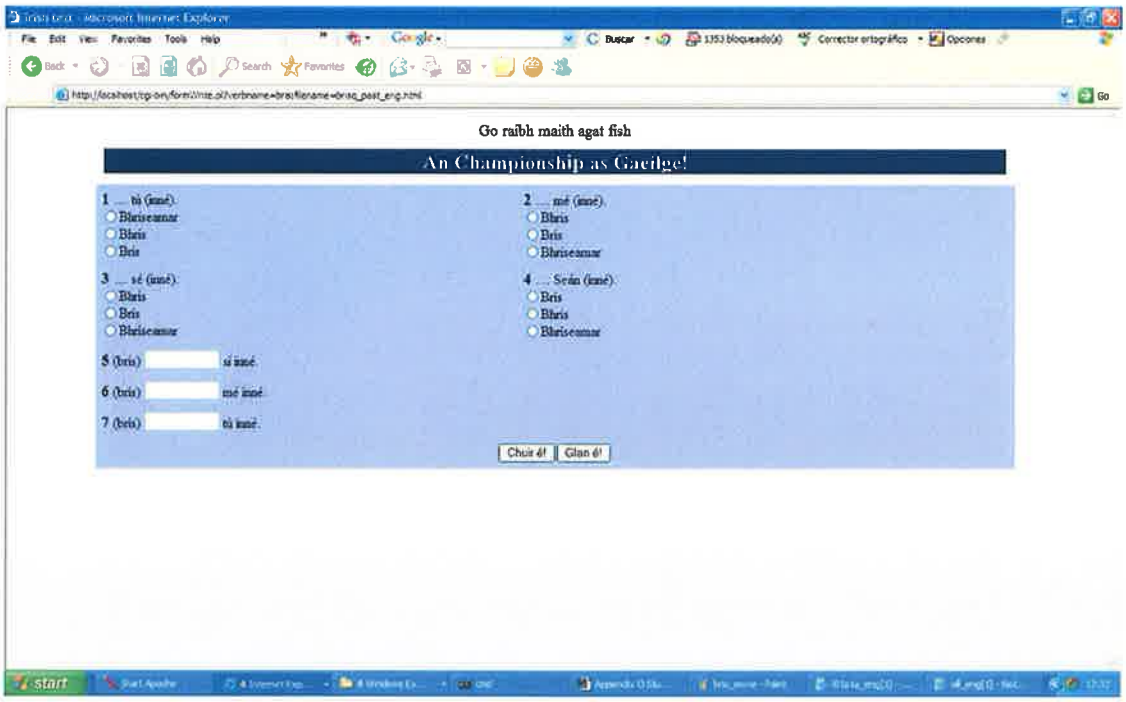

Figure 2.16 Championship Exercise Example

Irish Finite State Morphology Engine

Uí Dhonnchadha's (2002) Irish Finite State Transducer Morphology Engine uses the Xerox Finite-State Tools (Beesley and Karttunen, 2003) to provide an analyser and generator for Irish inflectional morphology for nouns, adjectives and verbs. Replace rule triggers (for stems and affixes) and replace rules written as regular expressions (for word mutations) are combined to produce a two-level morphological transducer for Irish. The system is designed for broad

coverage and covers most of the commonly used nouns, adjectives and verbs in Irish. The morphological information provided by the system is more reliable than the equivalent manually created data would be (due to the possibility of typing errors) and is very comprehensive. For example, the Irish Finite State Morphology Engine provides 52 conjugation forms for each verb (e.g. there are 5 forms provided for the past indicative – see Figure 2.17). The VCC only uses a very small subset of these forms, but with minor modifications, it could use many more forms, if required.

bris+Verb+PastInd	b^FHhris
bris+Verb+PastInd+1P+Pl	b^FHhris^FSear
bris+Verb+PastInd+Auto	bris^FSeadh
bris+Verb+PastInd+Auto+Neg	bris^FSeadh
bris+Verb+PastInd+Auto+NegQ	bris^FSeadh
bris+Verb+PastInd+Auto+Q	bris^FSeadh

Figure 2.17 Past Indicative Information for bris (to break) supplied by the Irish Finite State Morphology Engine (Ui Dhonnchadha, 2002)

Animation Tool

Koller's (2004) animation tool is a flexible resource that provides Flash (2006) animation for data provided at runtime. The Flash-based interface dynamically displays XML data read in at runtime and generates the required animation (either insert, deletion or replacement of letters or words). The animation tool is language-independent. The transformation of the linguistically tagged data supplied to the animation tool into the XML data format required for animation is carried out by Perl scripts that can be tailored to individual language needs. The animation tool has been used for the development of plurilingual language resources for three Romance languages (French, Spanish and Italian) (see Koller (2006) for details).

Table 2.2 provides a summary of the VCC.

Feature	Information
Purpose	To provide a tool to produce static and animated verb conjugation web pages based on externally supplied verb data.
External resources used	Irish Finite State Transducer Engine (Uí Dhonnchadha, 2002); Animation Tool (Koller, 2004)
Functionality	Produces static and dynamic web pages that highlight the changes required to conjugate a verb in a given tense. It also automatically creates related exercises for the learner.
Resources created	Static and animated web pages for 20 verbs, along with related exercises

Table 2.2 Summary of the Verb Conjugation Component

2.6 Writing Checker Component

The Writing Checker Component (WCC) provides a resource that checks the learner's (unrestricted) text input and provides feedback on spelling and grammar errors. The WCC provides a wrapper around an existing grammar checker (*Gramadóir*, Scannell (2005) – see below) and combines it with locally defined (additional) rules. The WCC adapts the messages supplied by *Gramadóir* for the target learner group. Figure 2.18 shows an overview of the WCC. Figure 2.19 shows the flow of information for the WCC.

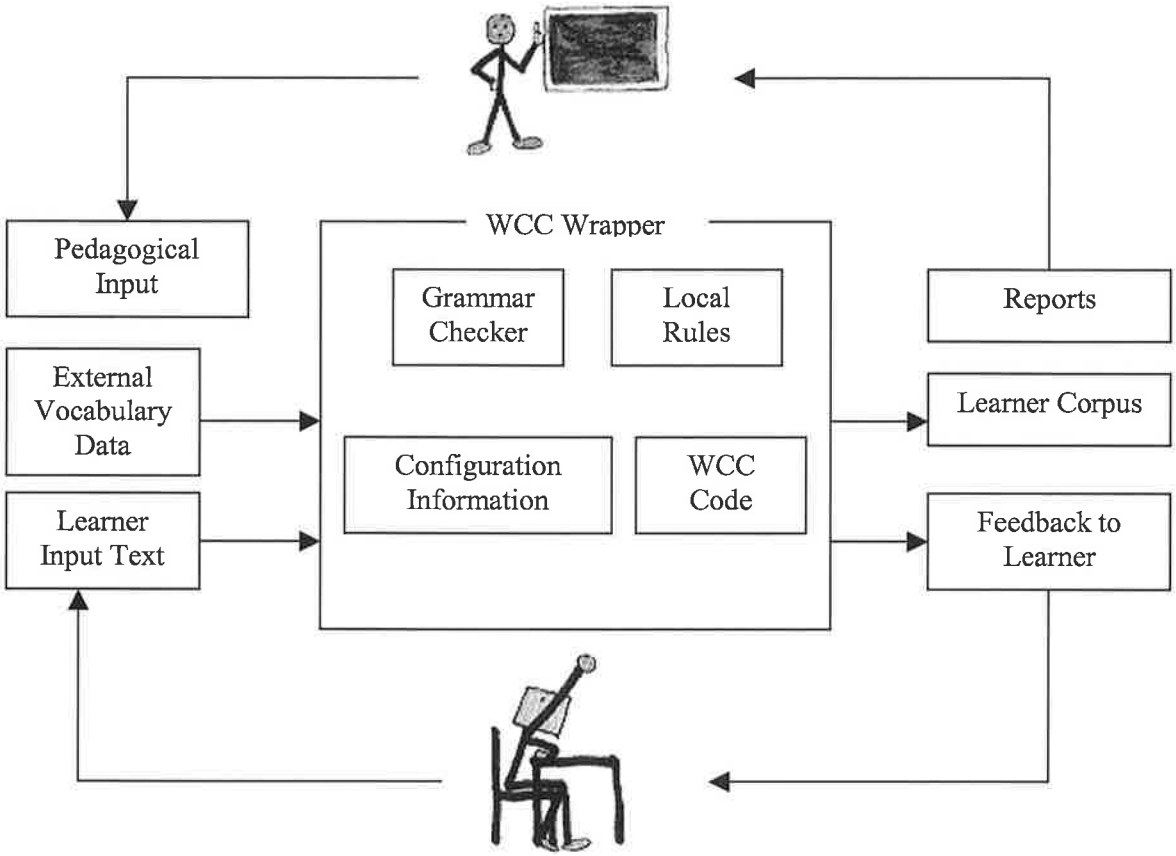

Figure 2.18 Overview of the Writing Checker Component

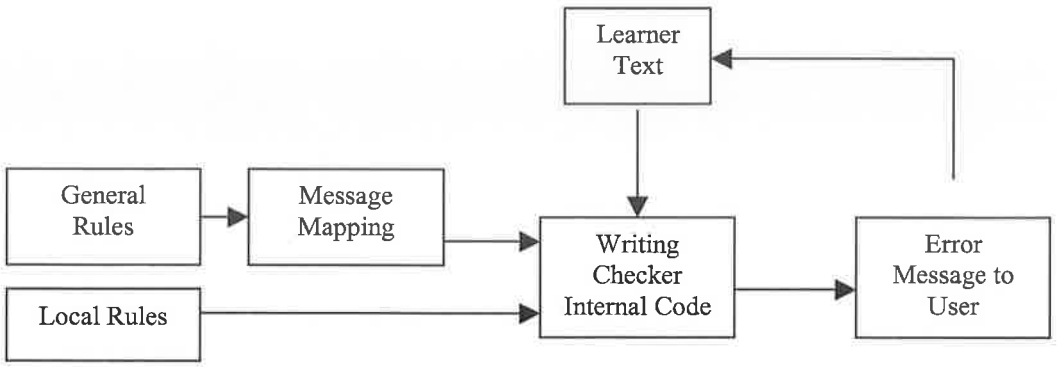

Figure 2.19 Information Flow for the Writing Checker Component

Gramadóir is an open-source grammar checking engine that has been implemented for Irish (see below for more details). While *Gramadóir* is a very useful resource for checking Irish texts, it had to be adapted to suit primary school students. For example, the command line version *Gramadóir* does not distinguish between spelling and grammar errors, so the WCC had to separate these different error types[1]. The decision to separate these errors was based on a pedagogical requirement specified by one of the teachers involved in the project and the general recommendation for a Grammar Checker to focus on grammar rather than orthographical errors (Tschichold, 1999). The WCC also had to identify and manage false-positive (i.e. when the system reports an error when there is no error) and false-negative (i.e. when the system does not report an error when there is one) responses from *Gramadóir* relative to the primary school context (e.g. it is very unlikely that a primary school student would intend to use the subjunctive tense in Irish, and therefore error messages from *Gramadóir* relating to subjunctive errors had to be filtered). *Gramadóir*'s error messages also had to be rephrased to make them more understandable by young learners. For example, *Gramadóir*'s error message "`Unnecessary eclipsis`" (i.e. nasalization) was changed to "You do not need a letter before the word here" by the WCC. WCC also facilitates the addition of local rules and the deactivation of certain general rules.

The learner can make changes to the text, resubmit it and receive updated feedback if desired. Spelling and grammar errors are displayed separately to make the feedback easier to understand. Figure 2.20 shows an example of a learner's text with one spelling error and one grammar error. The spelling error is shown on the right-hand side of the screen, while the grammar error is displayed below the text.

Gramadóir

Table 2.3 shows a summary of the main features of *Gramadóir*. *Gramadóir* (Scannell, 2005) is an open-source grammar checking engine that is intended as a platform for the development of sophisticated natural language processing tools for languages with limited computation resources. *Gramadóir* is portable and runs on a variety of platforms including Linux, Sun Solaris, Macs and MS Windows. It is modular, providing separate interfaces for segmentation and part-of-speech tagging for example. It has an easy to use command line interface and there is also a web interface. It is a corpus-based engine that can be bootstrapped from corpora harvested by Irish web crawling software *An Crúbadán* (Scannell, 2004). Scanell (2005) claims that it is easy to develop a specific grammar checker as the language developers' pack is designed so that no programming experience is required. *Gramadóir* is also scalable, language independent and freely available. Table 2.4 provides a summary of the WCC.

[1] The underlying *Gramadóir* engine does facilitate the separation of spelling and grammar errors, but the command line version, which the WCC uses, does not report these errors separately.

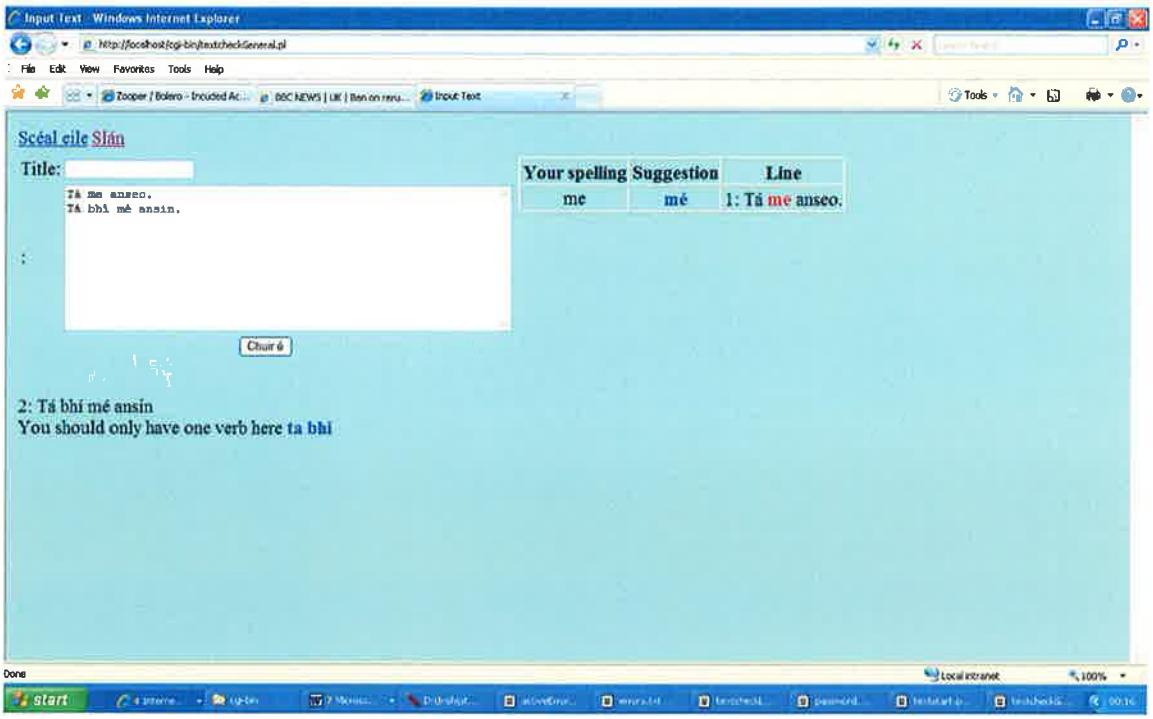

Figure 2.20 Example Learner Text with WCC Feedback

Feature	Comment
Portable	Can be used on a variety of operating systems, include Linux, Mac and MS Windows
Modular	Provides separate components for sentence segmentation, spell checking, part-of-speech tagging and grammar checking.
Easy to use	There is a simple command line interface and a web interface to the software.
Corpus-based	Bootstrapped from web-based corpora.
Easy to develop	The language developers' pack designed so that no programming experience is required.
Scalable	Spell checking packages can be developed in a few hours while the engine also facilitates the development of a full-scale grammar checker.
Language independent	Unicode support and support for rich morphological phenomena found in many non-European languages.
Free Software	Released under the Gnu General Public License that permits copying, modification and selling as long as the redistributed versions retain the same freedoms.

Table 2.3 Summary of the Main Features of *Gramadóir*

Feature	Information
Purpose	To provide a writing checker that adapts an externally supplied grammar checker to the needs of the target learner group.
External resources used	*Gramadóir* (Scannell, 2005)
Functionality	The WCC allows the learner to input unrestricted text and provides feedback on spelling and grammar errors.
Resources created	A writing checker for Irish that adapts (rephrases or filters out) 31 grammar errors and 9 spelling errors (from *Gramadóir*) and adds 6 local error rules and one punctuation rule (see Chapter 7, Section 7.8 for details on the WCC; Appendices D, E and F show the mapped error messages, the grammar errors detected and the spelling errors messages of the WCC respectively).

Table 2.4 Summary of the Writing Checker Component

2.7 Summary

This chapter provides an overview of the CLICI system. Section 2.2 outlines the motivation behind the chapter. Section 2.3 gives a brief high-level overview of the CLICI system. Section 2.4 introduces the Lesson Generator Component (LGC), which uses the CALL Template (Ward, 2001) to produce lessons and related exercises. The Verb Conjugation Component (VCC) is described in Section 2.5, along with the two external resources it uses, namely the Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002) and the animation tool (Koller, 2004). Section 2.6 outlines the Writing Checker Component (WCC) and gives an overview of *Gramadóir* (Scannell, 2005), the underlying engine of the WCC.

Chapter 2 Overview of CLICI

2.1 Introduction

This chapter provides an overview of the CLICI system. Section 2.2 explains the motivation behind this chapter and the need to provide the reader with a brief outline of the CLICI system before documenting the development process of the system itself in detail in the remainder of the dissertation. Section 2.3 provides a brief overview of the CLICI system. Section 2.4 introduces the Lesson Generator Component (LGC), which provides an improved interface to the CALL Template (Ward, 2001) to facilitate the creation of language lessons and related exercises. Section 2.5 outlines the Verb Conjugation Component (VCC) which provides static and animated verb conjugation web pages. The VCC reuses two existing resources: an Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002) and an animation tool (Koller, 2004) described in this section. Section 2.6 presents the Writing Checker Component (WCC) which provides a writing checker targeted at primary school students of Irish. The WCC uses *Gramadóir* (Scannell, 2005) as its underlying engine, and the section provides a brief outline of *Gramadóir*. Section 2.7 summarises the chapter.

2.2 Purpose of this Chapter

This remaining chapters in this thesis describe the conception, development and evaluation of the CLICI system using the Analysis Design Development Implementation Evaluation (ADDIE) model (Colpaert, 2004), as a way to tackle the question "can existing CL resources be integrated successfully in useful CALL artefacts for Irish for English-medium Primary Schools in Ireland". As these chapters describe an evolving process, it would be difficult for the reader to gain an overall understanding of the complete system, until the end of the process, as the capabilities, components and architecture of the CLICI system are introduced step by step in the relevant chapters. Therefore, in order to improve the readability of the thesis and to help orient the reader, this chapter provides an overview of the CLICI system. The motivation for the three CLICI components and the justification of the design decisions made during the project are detailed in the remaining chapters of the thesis.

2.3 CLICI System Overview

The CLICI system consists of three components: a Lesson Generator Component (LGC), a Verb Conjugation Component (VGC) and a Writing Checker Component (WCC). The CLICI system provides a wrapper around these three components to present a unified interface to learners and teachers. Figure 2.1 shows a diagram of the CLICI wrapper around the three components, while Figure 2.2 shows how learners and teachers view the CLICI system.

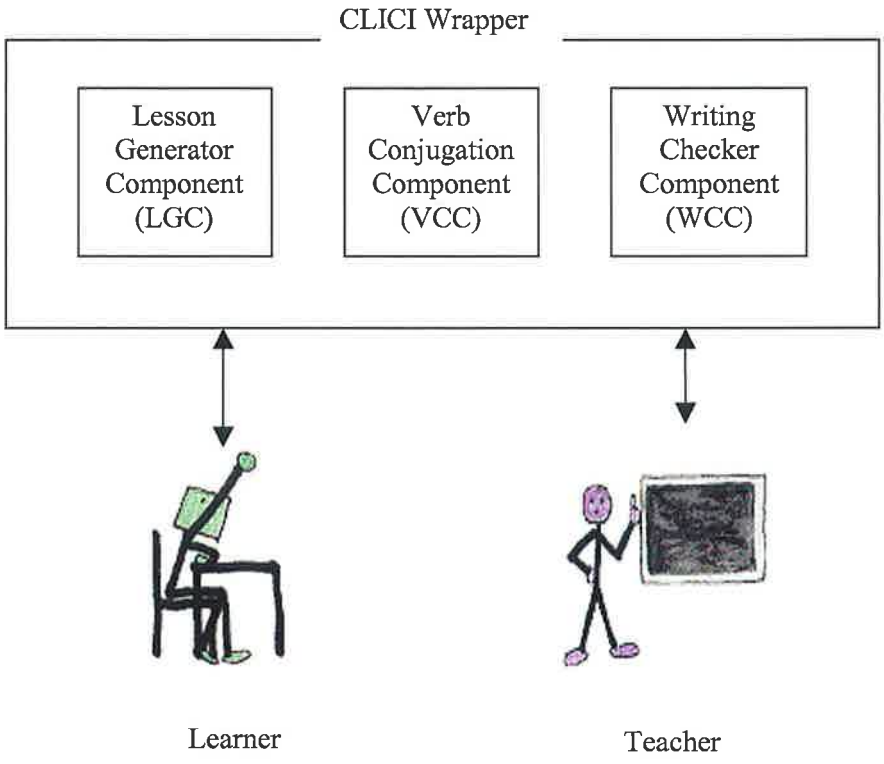

Figure 2.1 Overview of CLICI System and CLICI Wrapper

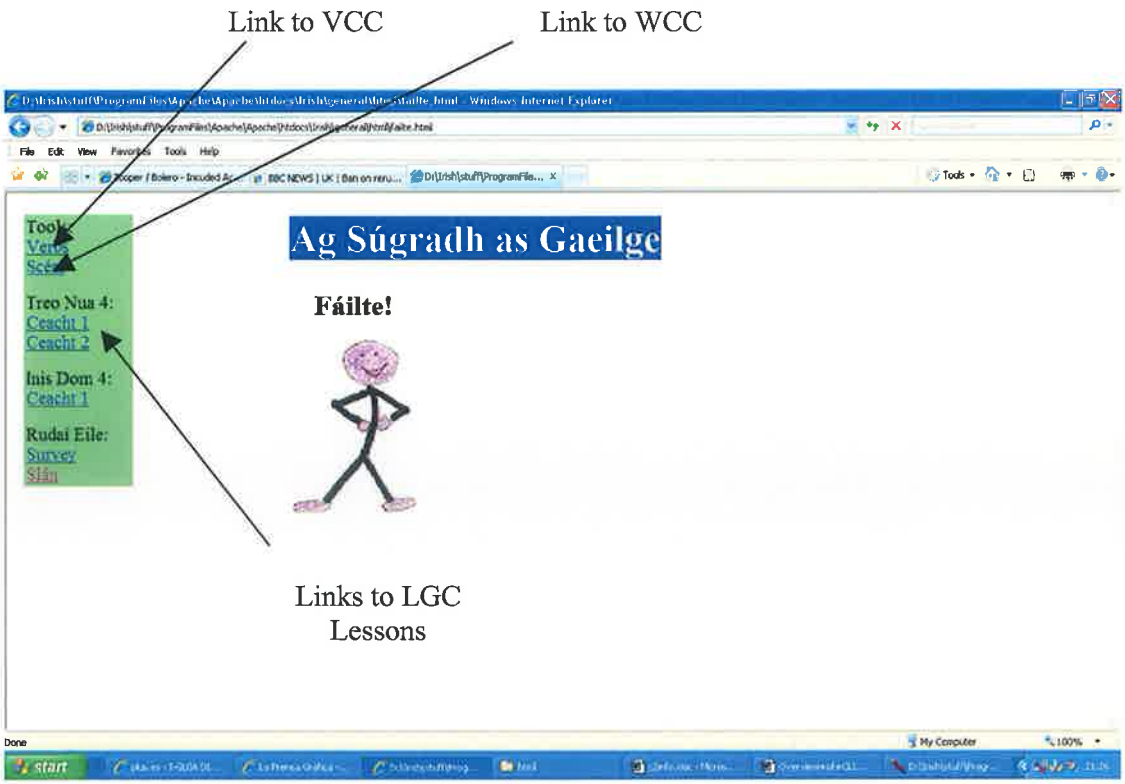

Figure 2.2 Main CLICI Screen

The Lesson Generator Component (LGC) provides a tool to create lessons and exercises. Its primary focus is obviously to provide CALL materials for lessons. However, the lessons also

provide an environment in which to present the other CLICI components (i.e. the VCC and the WCC) to the user, rather than provide them in isolation. The LGC is discussed in Section 2.3. The Verb Conjugation Component (VCC) displays verb conjugation information to the learner in either static or animated mode. In static mode, the data is displayed as normal text, while in animated mode, the changes required to conjugate a verb in a particular tense are shown dynamically on the screen. The VCC is presented in Section 2.5. The Writing Checker Component (WCC) is a tool that allows learners to input unrestricted text in Irish and to receive feedback and is described in Section 2.6. Sections 2.4 – 2.6 give a brief introduction to the relevant component, as well as an overview of the existing external resources used to develop the component. They also provide a summary of the resources produced by the component.

2.4 Lesson Generator Component

The purpose of the Lesson Generator Component (LGC) is to facilitate the creation of language lessons and exercises ("games"). It does this by providing a wrapper around an existing CALL Template (Ward, 2001) (see below for more information) and, with the addition of local code, offers an improved interface to the courseware developer. Figure 2.3 shows a system diagram for the LGC and LGC wrapper. Figure 2.4 shows the flow of information for the LGC. The courseware developer provides the required information (e.g. lesson content) in a plain text file. The LGC then converts this file into the format required by the CALL Template. The CALL Template subsequently generates the web pages for the learner.

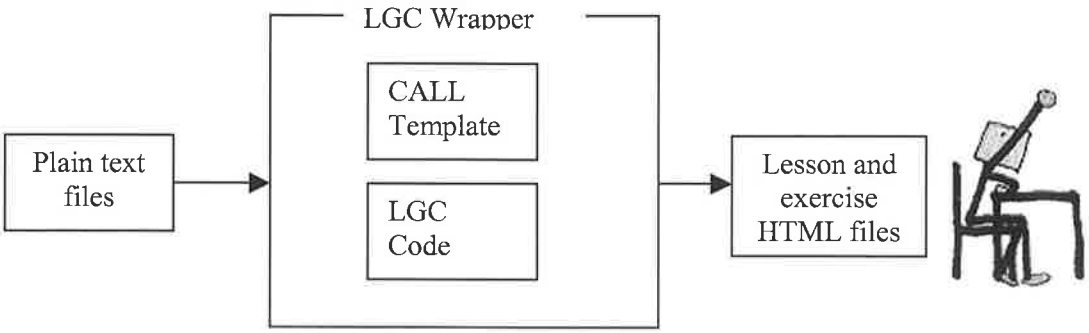

Figure 2.3 Overview of Lesson Generator Component

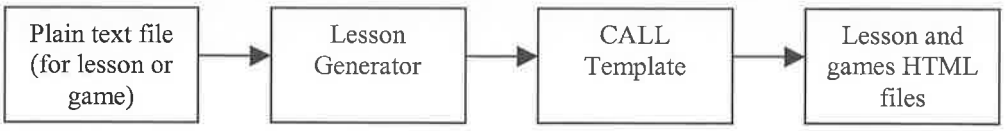

Figure 2.4 Information Flow for the Lesson Generator Component

Figure 2.5 provides an example input lesson file (note that the text is not shown in italics, as the text in the source file is not written in italics). Figure 2.6 shows the web page produced by the LGC (note that the image and audio recordings are specified separately). Figures 2.7, 2.8, 2.9

and 2.10 show an example of a multiple-choice exercise, a matching exercise, a mixed-up sentence exercise and a gap-fill exercise, respectively, generated by the LGC.

Portion of Plain Text File for a Lesson	Translation
Bhí Ciarán ag siúl lá amháin. Bhí lochán uisce ar an mbóthar. Ní fhaca Ciarán an lochán.	Ciaran was walking one day. There was a puddle on the road. Ciaran didn't see the puddle. .....

Figure 2.5 Portion of Plain Text File for a Lesson

CALL Template

The CALL Template (Ward, 2001) provides a tool to enable courseware developers with limited computer skills to develop CALL resources for Minority and Endangered Languages. It facilitates the development of language lessons, with multiple-choice, matching and gap-fill exercises. It uses XML technologies (XML, 2000) and the exercises are built using Hot Potatoes software (Holmes and Arneil, 1998). The source files are XML-tagged files which are then converted into html files using XSL files (XSL, 2001). Although targeted at courseware developers with basic computer skills, some understanding of the concepts of XML tagging is desirable.

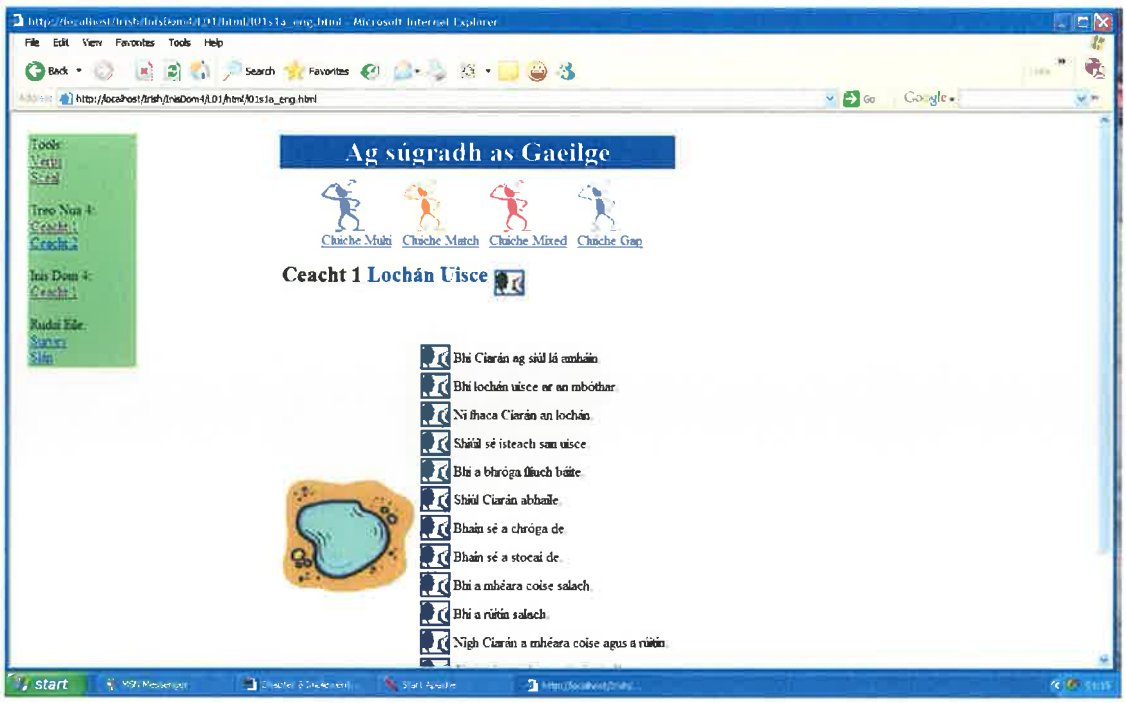

Figure 2.6 Lesson Page Produced using the LGC

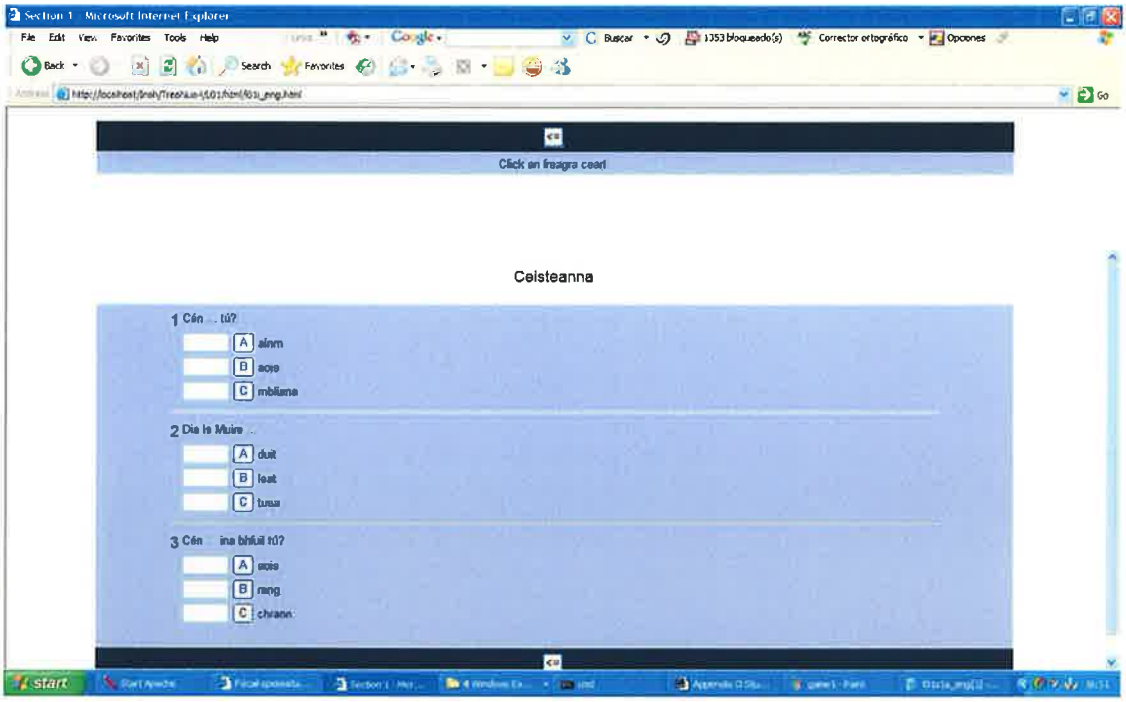

Figure 2.7 Multiple-choice Exercise Example

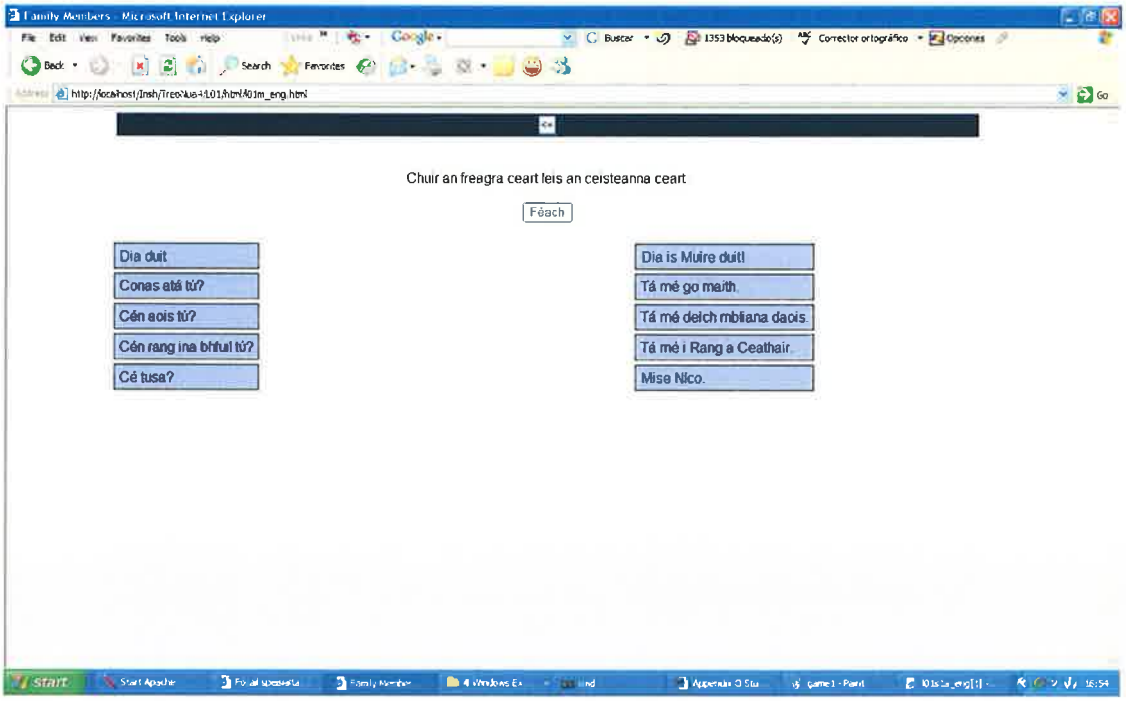

Figure 2. 8 Matching Exercise Example

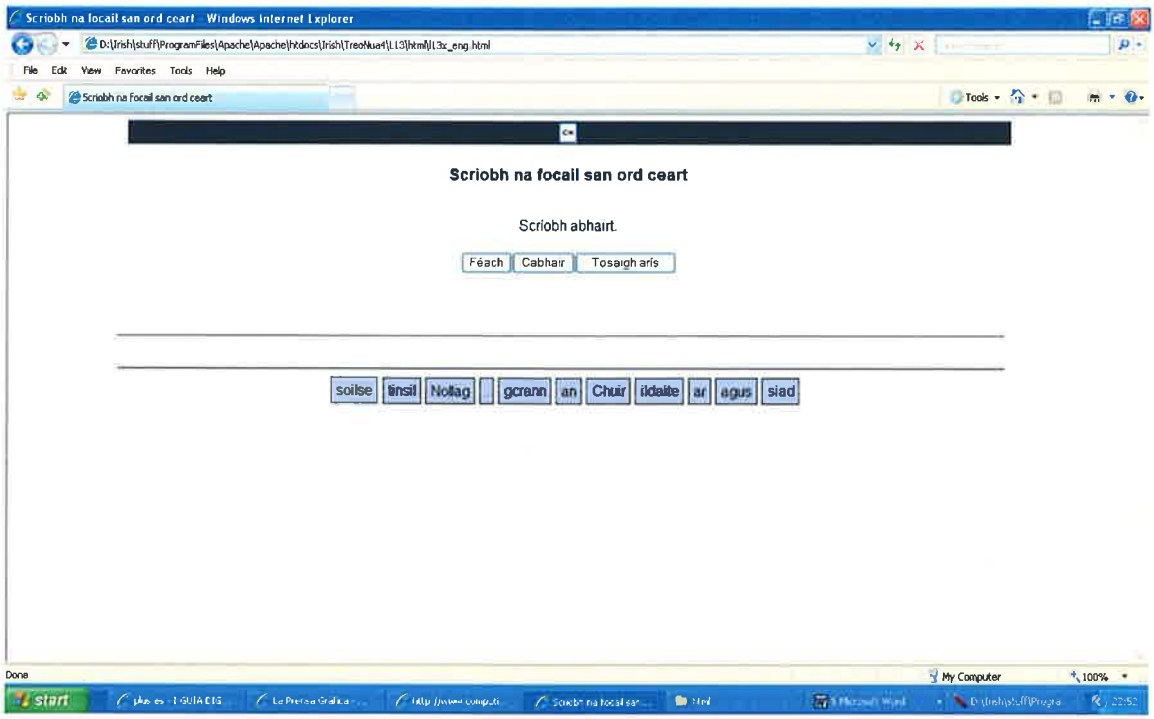

Figure 2.9 Mixed-up Exercise Example

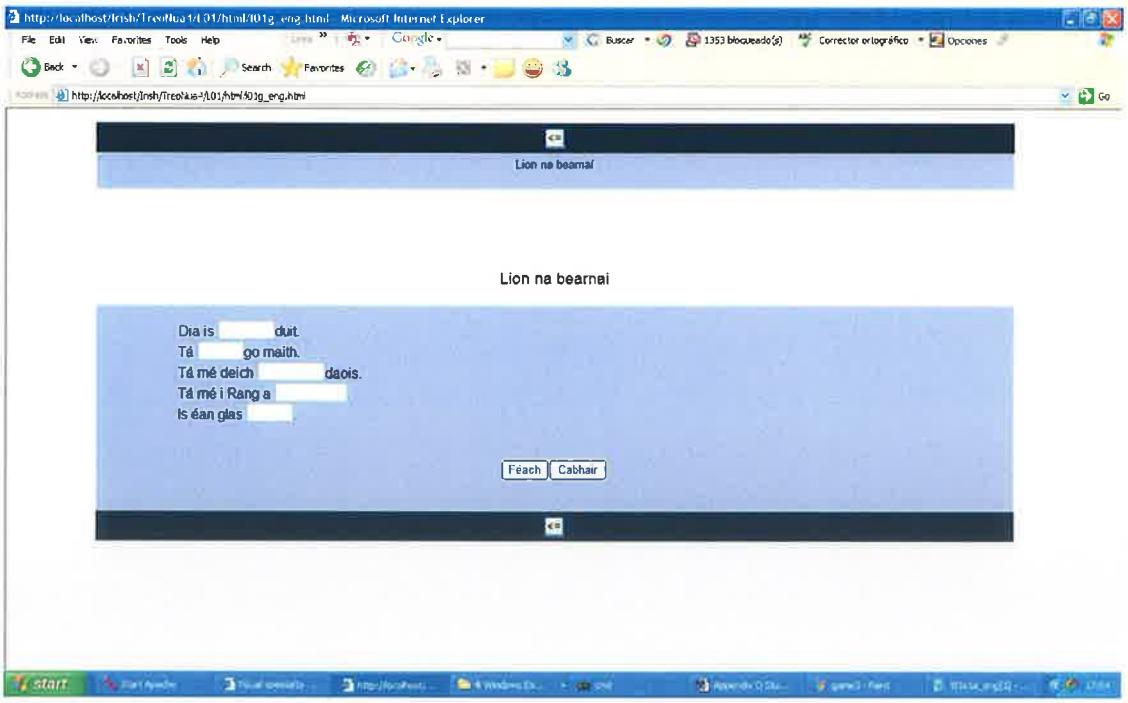

Figure 2.10 Gap-fill Exercise Example

The minimal functionality and rudimentary interface of the LGC mean that the LGC can only be considered a very limited Authoring Tool (AT), especially compared to CALL-specific ATs such as MALTED (Malted, 2000). However, in the context of this project, it provides a useful tool that reuses an existing resource i.e. the CALL Template, Ward (2001) – this is in keeping with the general philosophy of the project. An extra exercise type, a mixed-up sentence exercise was added to the CALL Template system, as this was deemed desirable by one of the

teachers involved in the project. Overall, 12 lessons and their related exercises were developed and used during the CLICI project. Table 2.1 shows a summary of the LGC.

Feature	Information
Purpose	To provide a very simple lesson and exercise ("game") authoring tool
External resources used	CALL Template (Ward, 2001)
Functionality	Enables the courseware author to write a lesson or exercise using a plain text file, rather than have to edit an XML-tagged file. The Lesson Generator then converts this file into the required format for the CALL Template. This in turn produces the lessons and games in HTML format.
Resources created	12 lessons and 48 exercises (1 multiple-choice, 1 matching, 1 mix-up and 1 gap-fill exercise per lesson)

Table 2.1 Summary of the Lesson Generator Component

2.5 Verb Conjugation Component

The Verb Conjugation Component (VCC) is a tool that creates static and animated web pages that display verb conjugation information. It also creates exercises ("games") related to the verb conjugation automatically based on pedagogical options selected by the teacher (similar to those produced by the LGC). The VCC provides a wrapper around three existing resources: an Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002), an animation tool (Koller, 2004) (see below for more information on these resources) and the CALL Template (Ward, 2001) outlined above. It integrates these resources using local code and uses teacher-supplied pedagogical information to provide the CALL resources to the user. Figure 2.11 shows an overview of the VCC. Figure 2.12 shows the flow of information for the VCC.

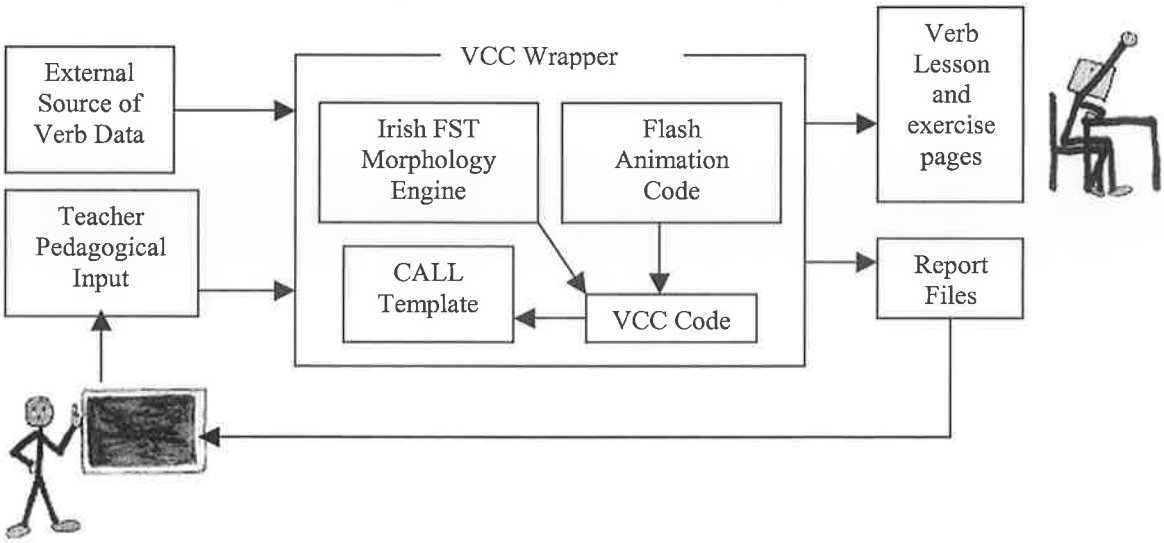

Figure 2.11 Overview of the Verb Conjugation Component

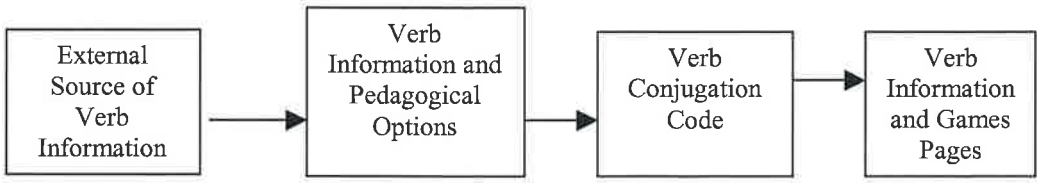

Figure 2. 12 Information Flow for the Verb Conjugation Component

The Irish Finite State Morphology Engine provides both analysis and generation of morphological information for Irish words, phrases and sentences. In the context of this research project, the Irish Finite State Morphology Engine was used to provide (generate) verb conjugation information for Irish verbs. For practical reasons, the VCC focused on a subset of verbs that was specified by one of the teachers who participated in the project. Information extraction and conversion utilities were written to put the verb conjugation data into a suitable tagged internal format. This tagged data is then combined with Koller's (2004) animation tool to produce the required animated web pages. The animation tool is very useful as the VCC just needs to provide a template version that can be populated systematically using the tagged verb conjugation files. In the absence of the animation tool, the creation of the dynamic web pages would have required fairly considerable software research and development and would have detracted from the main research goals of the project.

The main verb page is shown in Figure 2.13. It provides a list of the verbs that are available to the learner.

Figure 2.13 Main Verb Page of the Verb Conjugation Component

In static mode, the changes required to conjugate a given verb in a particular tense are shown highlighted in red. In animated mode, these changes are shown to the learner by visually displaying the process of the necessary modifications in a film-like sequence of movements, insertions and replacements of character sequences. For example, the verb *bris* (to break) is a regular verb (i.e. a verb that follows the normal conjugation rules in Irish) that requires the insertion of the letter '*h*' between the first and second letters of the verb (i.e. '*b*' and '*r*', respectively) to form the correct conjugation of the verb in the past tense (for all persons except the first person plural). Figure 2.14 shows the relevant web page for *bris* in static mode, while Figure 2.15 shows the equivalent page in animated mode. It is difficult to capture a dynamic display in printed format however Figure 2.15 Part 1 should convey the essence of the process.

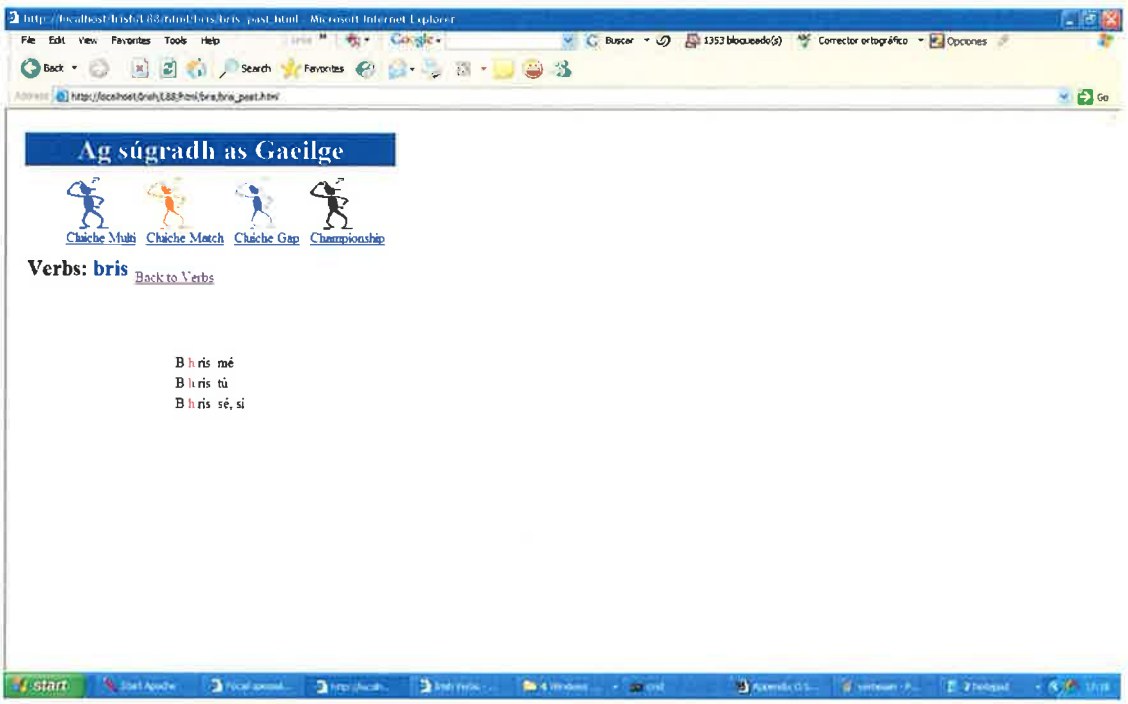

Figure 2.14 Static Verb Page for *bris* (to break)

Apart from the existing exercise types (multiple-choice, matching, mixed-up and gap-fill), a new exercise type, called the "Championship", was created in the VCC. The Championship contains a mix of multiple-choice and gap-fill questions and is used to monitor students' scores. An example is shown in Figure 2.16.

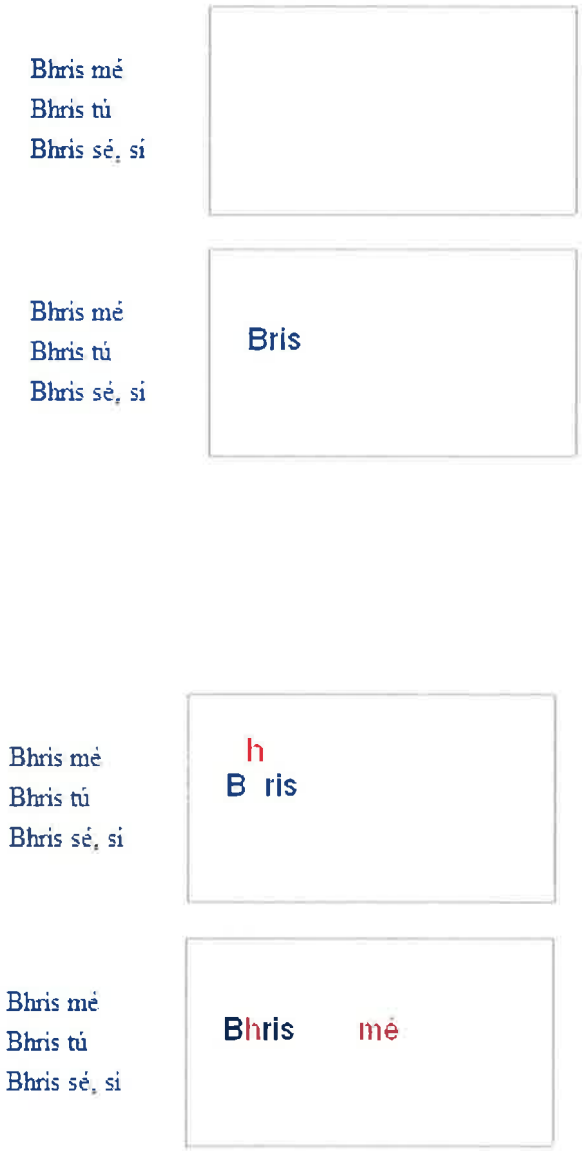

Figure 2.15 – Animated Verb Page for bris (to break) – Part 1

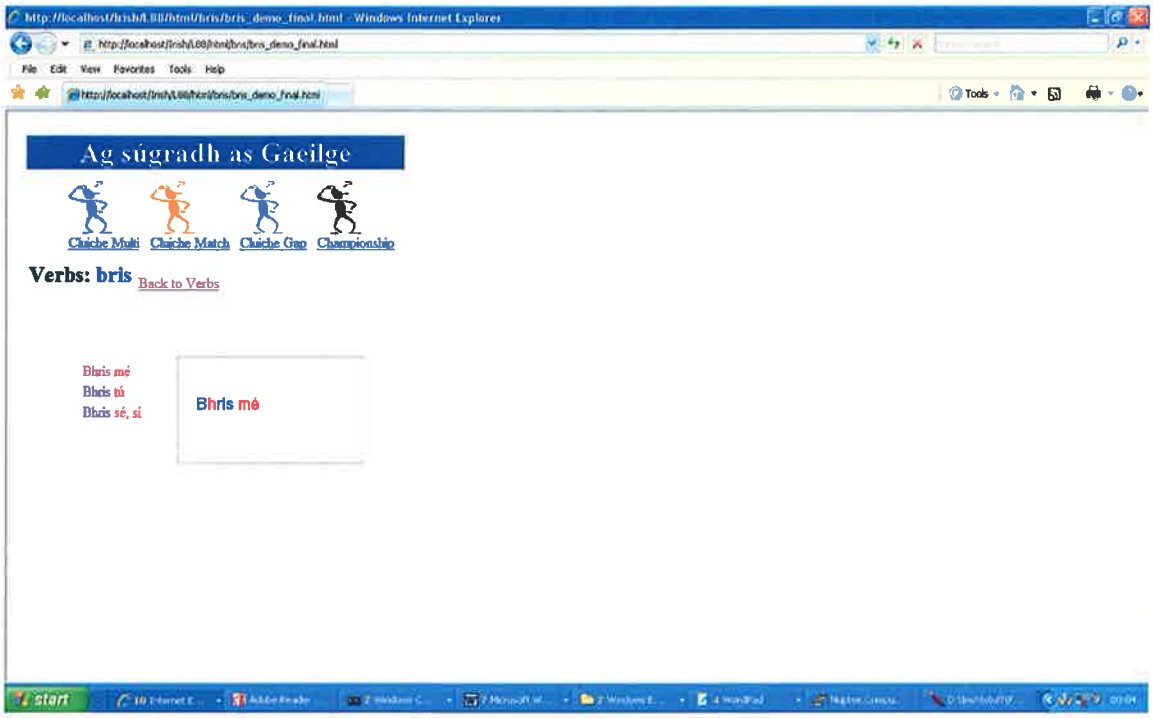

Figure 2.15 Animated Verb Page for *bris* – Part 2

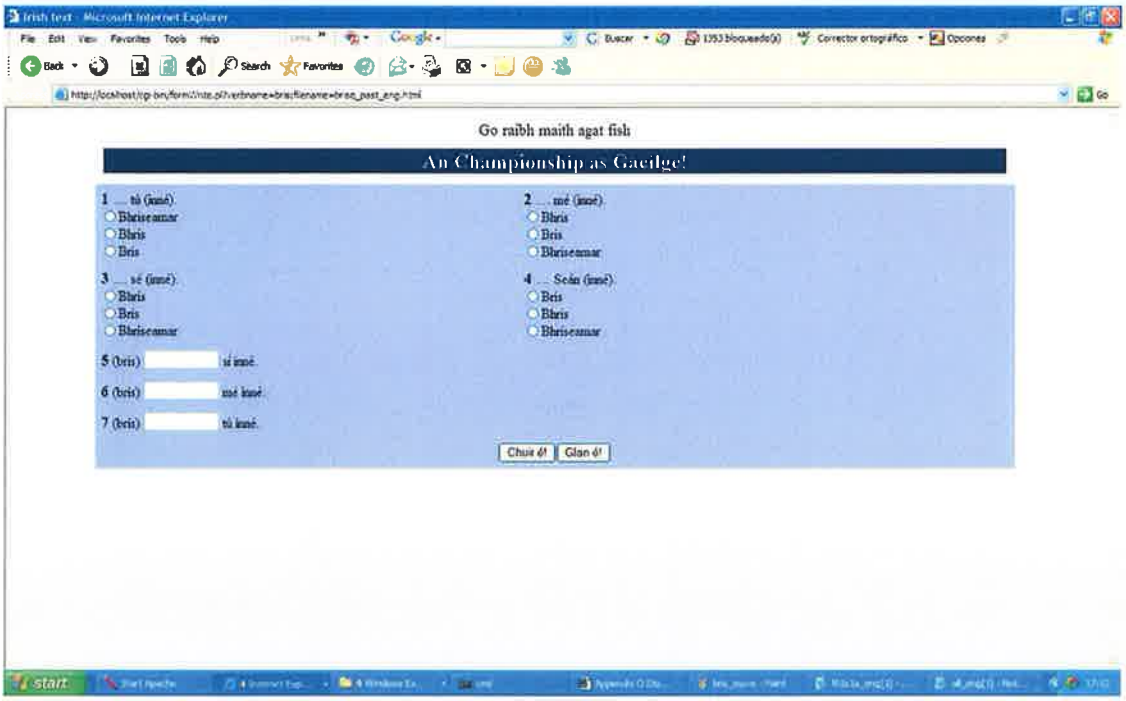

Figure 2.16 Championship Exercise Example

Irish Finite State Morphology Engine

Uí Dhonnchadha's (2002) Irish Finite State Transducer Morphology Engine uses the Xerox Finite-State Tools (Beesley and Karttunen, 2003) to provide an analyser and generator for Irish inflectional morphology for nouns, adjectives and verbs. Replace rule triggers (for stems and affixes) and replace rules written as regular expressions (for word mutations) are combined to produce a two-level morphological transducer for Irish. The system is designed for broad

coverage and covers most of the commonly used nouns, adjectives and verbs in Irish. The morphological information provided by the system is more reliable than the equivalent manually created data would be (due to the possibility of typing errors) and is very comprehensive. For example, the Irish Finite State Morphology Engine provides 52 conjugation forms for each verb (e.g. there are 5 forms provided for the past indicative – see Figure 2.17). The VCC only uses a very small subset of these forms, but with minor modifications, it could use many more forms, if required.

```
bris+Verb+PastInd                b^FHhris
bris+Verb+PastInd+1P+Pl          b^FHhris^FSear
bris+Verb+PastInd+Auto           bris^FSeadh
bris+Verb+PastInd+Auto+Neg       bris^FSeadh
bris+Verb+PastInd+Auto+NegQ      bris^FSeadh
bris+Verb+PastInd+Auto+Q         bris^FSeadh
```

Figure 2.17 Past Indicative Information for bris (to break) supplied by the Irish Finite State Morphology Engine (Ui Dhonnchadha, 2002)

Animation Tool

Koller's (2004) animation tool is a flexible resource that provides Flash (2006) animation for data provided at runtime. The Flash-based interface dynamically displays XML data read in at runtime and generates the required animation (either insert, deletion or replacement of letters or words). The animation tool is language-independent. The transformation of the linguistically tagged data supplied to the animation tool into the XML data format required for animation is carried out by Perl scripts that can be tailored to individual language needs. The animation tool has been used for the development of plurilingual language resources for three Romance languages (French, Spanish and Italian) (see Koller (2006) for details).

Table 2.2 provides a summary of the VCC.

Feature	Information
Purpose	To provide a tool to produce static and animated verb conjugation web pages based on externally supplied verb data.
External resources used	Irish Finite State Transducer Engine (Uí Dhonnchadha, 2002); Animation Tool (Koller, 2004)
Functionality	Produces static and dynamic web pages that highlight the changes required to conjugate a verb in a given tense. It also automatically creates related exercises for the learner.
Resources created	Static and animated web pages for 20 verbs, along with related exercises

Table 2.2 Summary of the Verb Conjugation Component

2.6 Writing Checker Component

The Writing Checker Component (WCC) provides a resource that checks the learner's (unrestricted) text input and provides feedback on spelling and grammar errors. The WCC provides a wrapper around an existing grammar checker (*Gramadóir*, Scannell (2005) – see below) and combines it with locally defined (additional) rules. The WCC adapts the messages supplied by *Gramadóir* for the target learner group. Figure 2.18 shows an overview of the WCC. Figure 2.19 shows the flow of information for the WCC.

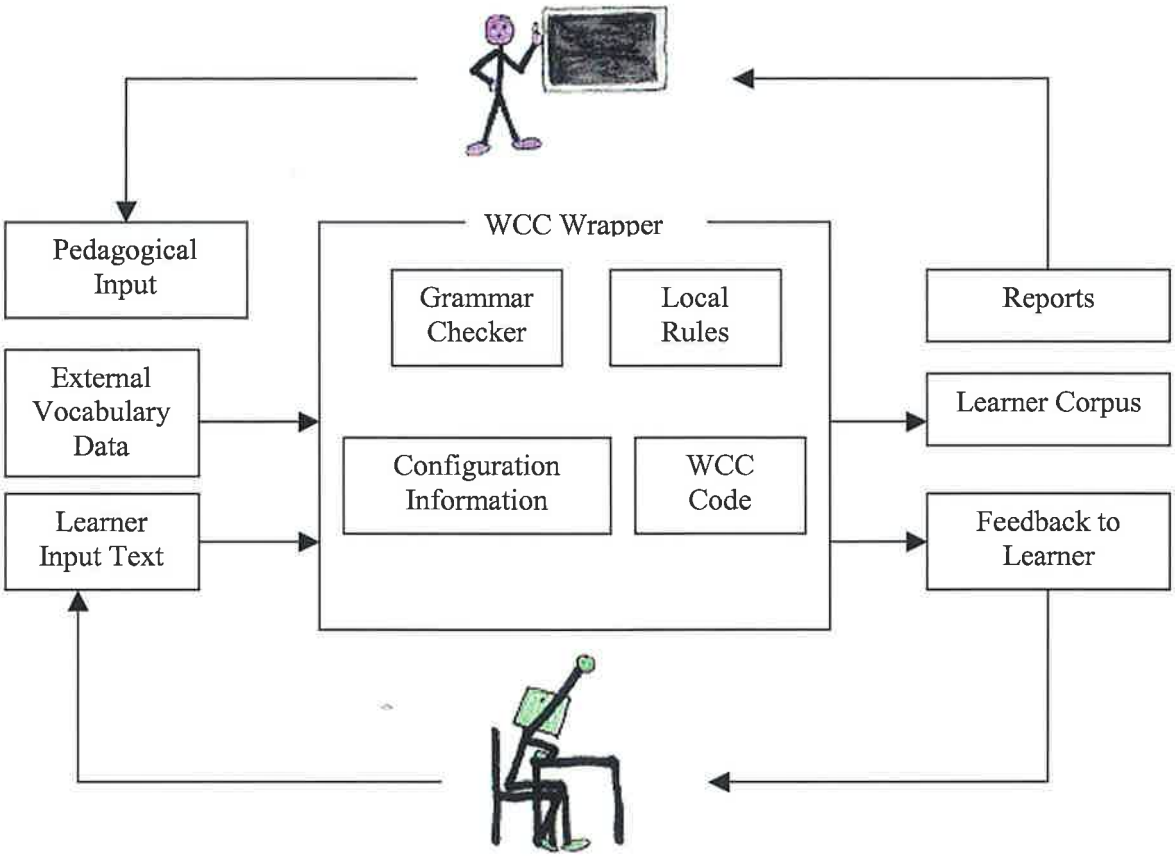

Figure 2.18 Overview of the Writing Checker Component

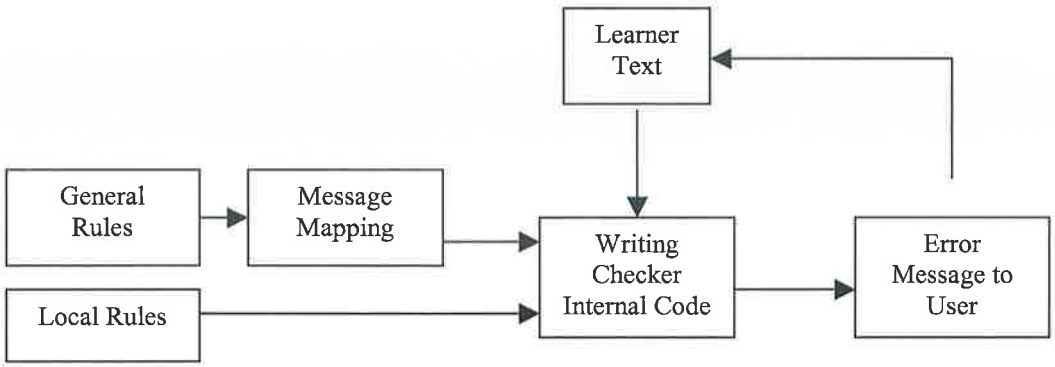

Figure 2.19 Information Flow for the Writing Checker Component

Gramadóir is an open-source grammar checking engine that has been implemented for Irish (see below for more details). While *Gramadóir* is a very useful resource for checking Irish texts, it had to be adapted to suit primary school students. For example, the command line version *Gramadóir* does not distinguish between spelling and grammar errors, so the WCC had to separate these different error types[1]. The decision to separate these errors was based on a pedagogical requirement specified by one of the teachers involved in the project and the general recommendation for a Grammar Checker to focus on grammar rather than orthographical errors (Tschichold, 1999). The WCC also had to identify and manage false-positive (i.e. when the system reports an error when there is no error) and false-negative (i.e. when the system does not report an error when there is one) responses from *Gramadóir* relative to the primary school context (e.g. it is very unlikely that a primary school student would intend to use the subjunctive tense in Irish, and therefore error messages from *Gramadóir* relating to subjunctive errors had to be filtered). *Gramadóir*'s error messages also had to be rephrased to make them more understandable by young learners. For example, *Gramadóir*'s error message "`Unnecessary eclipsis`" (i.e. nasalization) was changed to "You do not need a letter before the word here" by the WCC. WCC also facilitates the addition of local rules and the deactivation of certain general rules.

The learner can make changes to the text, resubmit it and receive updated feedback if desired. Spelling and grammar errors are displayed separately to make the feedback easier to understand. Figure 2.20 shows an example of a learner's text with one spelling error and one grammar error. The spelling error is shown on the right-hand side of the screen, while the grammar error is displayed below the text.

Gramadóir

Table 2.3 shows a summary of the main features of *Gramadóir*. *Gramadóir* (Scannell, 2005) is an open-source grammar checking engine that is intended as a platform for the development of sophisticated natural language processing tools for languages with limited computation resources. *Gramadóir* is portable and runs on a variety of platforms including Linux, Sun Solaris, Macs and MS Windows. It is modular, providing separate interfaces for segmentation and part-of-speech tagging for example. It has an easy to use command line interface and there is also a web interface. It is a corpus-based engine that can be bootstrapped from corpora harvested by Irish web crawling software *An Crúbadán* (Scannell, 2004). Scanell (2005) claims that it is easy to develop a specific grammar checker as the language developers' pack is designed so that no programming experience is required. *Gramadóir* is also scalable, language independent and freely available. Table 2.4 provides a summary of the WCC.

[1] The underlying *Gramadóir* engine does facilitate the separation of spelling and grammar errors, but the command line version, which the WCC uses, does not report these errors separately.

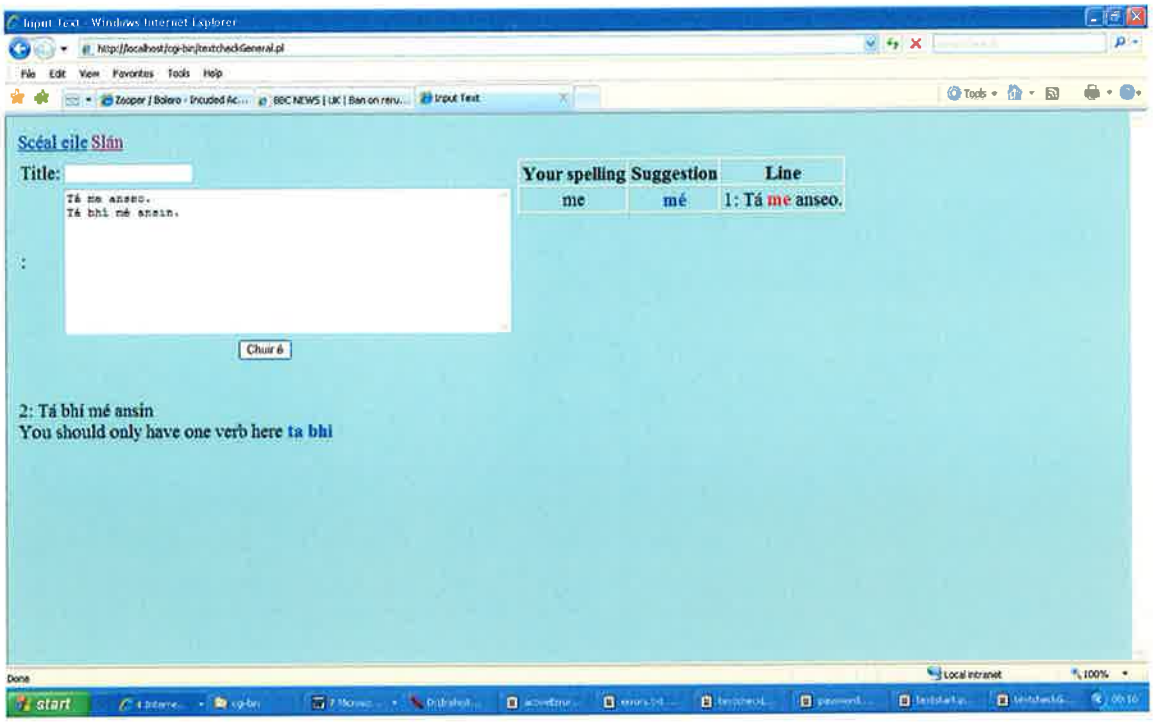

Figure 2.20 Example Learner Text with WCC Feedback

Feature	Comment
Portable	Can be used on a variety of operating systems, include Linux, Mac and MS Windows
Modular	Provides separate components for sentence segmentation, spell checking, part-of-speech tagging and grammar checking.
Easy to use	There is a simple command line interface and a web interface to the software.
Corpus-based	Bootstrapped from web-based corpora.
Easy to develop	The language developers' pack designed so that no programming experience is required.
Scalable	Spell checking packages can be developed in a few hours while the engine also facilitates the development of a full-scale grammar checker.
Language independent	Unicode support and support for rich morphological phenomena found in many non-European languages.
Free Software	Released under the Gnu General Public License that permits copying, modification and selling as long as the redistributed versions retain the same freedoms.

Table 2.3 Summary of the Main Features of *Gramadóir*

Feature	Information
Purpose	To provide a writing checker that adapts an externally supplied grammar checker to the needs of the target learner group.
External resources used	*Gramadóir* (Scannell, 2005)
Functionality	The WCC allows the learner to input unrestricted text and provides feedback on spelling and grammar errors.
Resources created	A writing checker for Irish that adapts (rephrases or filters out) 31 grammar errors and 9 spelling errors (from *Gramadóir*) and adds 6 local error rules and one punctuation rule (see Chapter 7, Section 7.8 for details on the WCC; Appendices D, E and F show the mapped error messages, the grammar errors detected and the spelling errors messages of the WCC respectively).

Table 2.4 Summary of the Writing Checker Component

2.7 Summary

This chapter provides an overview of the CLICI system. Section 2.2 outlines the motivation behind the chapter. Section 2.3 gives a brief high-level overview of the CLICI system. Section 2.4 introduces the Lesson Generator Component (LGC), which uses the CALL Template (Ward, 2001) to produce lessons and related exercises. The Verb Conjugation Component (VCC) is described in Section 2.5, along with the two external resources it uses, namely the Irish Finite State Transducer Morphology Engine (Uí Dhonnchadha, 2002) and the animation tool (Koller, 2004). Section 2.6 outlines the Writing Checker Component (WCC) and gives an overview of *Gramadóir* (Scannell, 2005), the underlying engine of the WCC.

Chapter 3 Computational Linguistics and CALL

3.1 Introduction

This chapter looks at Computational Linguistics (CL) and CALL. Section 3.2 clarifies some of the terminology relating to this area, especially in the context of this dissertation. Section 3.3 provides a brief overview of CL. The interaction of CL and CALL is reviewed in Section 3.4, looking at the history of the interaction between the two fields and the current situation. The section also provides a mini -classification of the two fields and shows an example of two CL/CALL systems, GLOSSER (Dokter and Nerbonne, 1998) and FreeText (FreeText, 2004). Section 3.5 considers the integration difficulties that exist between CL and CALL. Section 3.6 provides a Strengths/Weaknesses/Opportunities/Threats (SWOT) analysis of CL/CALL. Future directions for CL/CALL are discussed in Section 3.7, while Section 3.8 offers some conclusions. Section 3.9 gives a summary of the chapter.

3.2 Terminology

"ICALL" stands for Intelligent CALL that draws mainly on Natural Language Processing (NLP) and Intelligent Tutoring Systems (ITS) (Matthews, 1993). In Europe, the term "Language Engineering" has been replaced by "Human Language Technologies" (HLT), which, as the name suggests, covers language technologies that interact with humans. HLT includes ICALL but is much broader in scope. Borin (2002) uses the term "Language Technology" to cover "Computational Linguistics" (CL), "Language Engineering" (LE) and NLP. The focus of the CLICI research is on how NLP, and more specifically CL, can be used in CALL.

3.3 Computational Linguistics Overview

CL is the 'application of computers to the study of linguistic problems' (O'Grady et al., 1997:660). It has two main goals: to build and model linguistic theories using the computer and to build systems that use linguistic information (O'Grady et al., 1997). CL covers phonology, morphology, syntax, lexicology, semantics and pragmatics. Computational phonology pertains to speech recognition, analysis and synthesis. It involves recognising uttered sounds or producing sounds (speech) for humans to understand. Computational morphology analyses form by computational means. This includes the use of morphological knowledge to find stems (word parts) or identify parts of speech. In some cases, it also covers morphological subcategorisation, partial semantic analysis, recognition of morphosyntactic categories. Computational syntax is used for natural language analysis and generation. The syntactic rules that pertain to a particular language, i.e. its grammar, are encoded in the computer and a parser applies these rules. Computation lexicology involves creating electronic databases of lexical information. These databases usually contain morpho-semantic and syntactic information about a given word. Computational semantics deals with the meaning, rather than the structure, of

words and phrases. The final component of CL is computational pragmatics. Computational pragmatics deals with how language is used in communication.

In the early days, the main use of computers in HLT was in the area of Machine Translation (MT). From 1956 to 1964 (Buchmann, 1987) the USA and the Soviet Union invested in MT and expectations were high. However, by 1964 the lack of success meant that intense MT activity ceased. The sense of disappointment may have dampened enthusiasm for research into using NLP technology in other areas, including language learning. However, as computer technology improved and faster and more reliable machines became available, great strides were made in the area of CL. Low-level CL tools were integrated in other computer programs, e.g. spell checking facilities in word processing programs. Large-scale NLP resources are now available to researchers and have enabled them to automate tasks that were previously impossible. For example, CL researchers can now use the Penn-II Treebank of sentences from the Wall Street Journal to induce a grammar automatically. This task is computationally intense and takes several hours to complete, but is infinitely quicker than if it were carried out manually (which would take several person-years to complete). Jurasfky and Martin (2000) is a standard text on CL and NLP that covers the important sub-fields in a comprehensive and accessible format.

3.4 Computational Linguistics and CALL

This section gives an overview of the interaction of CL in CALL. It outlines a brief history of the field and looks at the current situation. It provides a mini-classification of the areas in which CL has been or could be used in CALL. It also describes two example NLP/CALL systems (GLOSSER and FreeText) that are relatively recent and demonstrate the potential of NLP/CALL. NLP/CALL is considered by some to be a poor relation of Computer Science and the CALL communities (Schulze, 2003a) and there are comparatively few general books on the subject. Swartz and Yazdani (1992), Holland et al. (1995) and Jager at al. (1998) are some of the more recent publications that deal specifically with ICALL. Chambers and Davis (2001) is a more generalist HLT CALL book that has two chapters that deal with ICALL (see Jager (2001) and Schulze (2001). Nerbonne (2003) and Vandeventer Faltin (2003) are two of the more recent NLP/CALL publications and they provide a good overview of the field. There have been several ICALL related conferences and workshops in recent years (e.g. EUROCALL 2001 and 2003) that indicate that there is growing interest in the area, although it is still a relatively new area in CALL. This chapter looks at NLP and CL specifically and does not address the role of speech technology in CALL. Bernstein (1994), Ehsani and Knodt (1998), Mostow et al. (1993), Waters (1994) and Neri et al. (2001) provide examples of this particular area.

ICALL is a mix of AI techniques and CALL (Matthews, (1992) and the term is used by researchers to cover a broad spectrum of Intelligent CALL programs. However, Schulze (2001) prefers the term parser-based CALL for those CALL programs that use parsers rather than referring to them as ICALL programs. Many of the modern NLP/CALL programs could be classified as parser-based CALL programs. Parser-based CALL programs can enable the learner to enter in some cases unconstrained input and received feedback on the text (e.g. the presence of errors) (Heift and Schulze, 2007). Parser-based CALL has several limitations including the fact that parsers are not foolproof and that they can tend to concentrate on syntax rather than communicating meaning (Holland, 1993). More recent parser-based CALL programs attempt to include pedagogical considerations (e.g. Schwind, 1995; Holland, 1994) as well as wider error coverage. Nerbonne (2003) outlines a range of NLP technologies that can contribute to CALL including concordancing, morphological processing and syntactic processing. Corpora and CALL can be useful for advanced students, for example, Johns (1994) discusses the benefits of data-driven learning. Bilingual corpora and text alignment is useful for translation. Jager (2001) points out that NLP technologies can either be used as tools or embedded in CALL systems. Holland et al. (1993) report that ICALL is good for form-focused instruction. It seems to work for intermediate, analytic, confident students who can tolerate ambiguity. Perhaps the main contribution that NLP technologies can make to CALL is that they can enable CALL students to practice their production skills (Holland et al., 1993), as these technologies can provide error recognition, error correction and automatic feedback.

3.4.1 Brief History

It is only relatively recently that NLP technologies have been used in CALL. Indeed, even though the word computer is used in the acronym CALL, intelligent computing (in the AI sense) is rarely used in CALL (Jager et al., 1998). Rather, the computer is used as a medium or as a tool to display and receive information, but that information is seldom intelligently generated or interpreted. Back in 1948, Turing mentioned that computers could be used for learning languages (Hutchins, 1986). Although Page's 1966 Project Essay Grade (PEG) program (Borchardt and Page, 1994) did not use NLP technology, it was a forerunner of other similar automatic essay marking programs. Weischedel et al. (1978) is credited by Bowerman (1993) with producing the first ICALL system. It used syntactic and semantic knowledge to check learners' responses to comprehension questions. Although these early systems had some success, they made no significant impact on CALL. The difficulties in developing and deploying NLP/CALL applications (see Sections 3.5 and 3.6.2) hampered their use in language learning in the past and many of these difficulties continue to the present day. Heift and Schulze (2005) identified 119 publications relating to NLP and CALL in the literature from 1978 to 2004. The publications were heterogeneous and covered a broad variety of themes. They reported that many of the articles discussed prototype systems that never made it beyond

the prototype stage. Last (1989) and Farrington (1989) provide some early thoughts on the role of AI in CALL. Matthews (1992) lists an ICALL bibliography, while Dodigovic (2005b) gives an overview of the use of parser-based CALL applications. Krüger-Thielmann (1992) provides a summary of the early ICALL projects including ALICE, ATHENA, BOUWSTEEN & COGO and LINGER. Holland et al. (1995) and Jager et al. (1998) provide examples of NLP/CALL systems in the USA and Europe respectively. More recent examples include BRIDGE (Weinberg et al., 1995), RECALL (Murphy et al., 1998), GLOSSER (Glosser, 1997) and FreeText (FreeText, 2004). BRIDGE (Weinberg et al., 1995) was a parser-based CALL application for USA military personnel learning German. RECALL was a knowledge-based error correction application (Murphy et al., 1998) for English and German. GLOSSER (Glosser, 1997) and FreeText (FreeText, 2004) are examples of NLP/CALL projects that show how NLP technologies can be used in CALL. Vandeventer Faltin (2003) provides a good overview of the short history of NLP usage in CALL.

In the USA, funding for ICALL projects has mainly come from the Department of Defence (DoD) and Department of Education (DoE). While its links with the DoD may help in terms of funding, the low priority in the USA that is given to foreign language education limits funding from the DoE. In Europe, the European Union (and its predecessors) has funded ICALL research. The impetus comes from the multilingual nature of Europe and the desire to create greater mobility for its citizens. One of the main problems for ICALL is that it lacks critical mass, in terms of researchers and resources. Unlike other areas where NLP techniques are used, ICALL has no uniform impetus due to the fact that the main players come from different research perspectives (from CL specialists to language teachers).

3.4.2 Current Situation

Gamper and Knapp (2001) carried out a review of past and present ICALL systems. They reviewed 40 systems and analysed them by type. However, only 23 of them specifically use NLP or Natural Language Generation (NLG), which underlines the fact that NLP/NLG technologies are still underutilised in CALL. Borin (2002) points out that the main use of CL technology in CALL is in email and chat programs. Nerbonne (2003) provides an overview of ICALL and looks at some of the fields that feed into it. He states that CALL must provide understandable L2 material in spoken and written form, it must help students understand the L2 material and it should provide exercise and test material. He proposed that ICALL can help provide these materials. Linguistic theories are behind many NLP/CALL systems. For example, Lexical Functional Grammar (LFG) is used by the CALLE system (Feuerman et al., 1987). The BRIDGE system (Weinberg et al., 1995) uses a principle-based parser using Government and Binding theory for computational compactness and cross-language extendibility. Some NLP/CALL systems avail of communicative theory and use animated

computer scenarios (e.g. microworlds) where the learner interacts using the target language (e.g. Hamburger, 1995). Second Language Acquisition (SLA) research indicates that learning materials must hold the attention of the learner. SLA theories are less influential in NLP/CALL (Gass and Selinker, 1994; Larsen-Freeman and Long, 1991) than some researchers and practitioners would like. This is mainly because NLP/CALL researchers come from a technical rather than a pedagogical background. However, some more recent projects recognise the importance of pedagogy in the development and usage of CALL artefacts.

Handke (1989) identified three areas of deficiencies in CALL software (in 1989): didactic deficiencies, software engineering deficiencies and deficiencies in the linguistic material. Heift and Schulze (2007) report that many of these problems have been overcome, in part with the use of AI techniques. NLP/CALL researchers have sometimes tried to learn from previous ICALL projects. They are aware of the need for a multidisciplinary approach and have CALL in mind at their inception (e.g. FreeText (2003)), rather than as an afterthought. Heift and Schulze (2005) report that expectations are now more realistic than in the past and researchers are focusing on smaller-scale, more specific projects. Last (1989) claimed that relatively straightforward programs can achieve a good deal of success in CALL. Heift and Schulze (2007) note that many technological changes have taken place in the last 25 years that have had an impact on NLP/CALL. They note the use of Unicode (to cater for most human languages), the improved oral ability of computers (via text to speech systems), increased storage capabilities, improved handling of the spoken word (e.g. speech-to-text systems) and improved hardware as important contributors to NLP/CALL. They also say that improved programming languages, the development and availability of linguistic resources and improved understand of language learning methodology have enhanced the field of NLP/CALL. Heift and Schulze (2007) state that only recently has it been possible to develop fully functional parsers - this explains why there are very few NLP/CALL applications currently available.

Although progress has been made in the NLP/CALL field, many problems remain. Despite the fact that previous NLP/CALL projects demonstrate the potential of NLP usage in CALL, for a variety of reasons (see Section 3.6.2 and Section 3.6.4), they still have not been widely used by mainstream CALL. Heift and Schulze (2007) report that the development of NLP/CALL resources is still complex, difficult, time-consuming and expensive. Even projects that involved researchers, teachers, publishers and industry (e.g. ReCALL (Murphy et al. 1998)) have not been continued (Jager, 2001). Semantic and pragmatics are still on the periphery of NLP/CALL (Heift and Schulze, 2007). There are special interest groups devoted to the area but it will be some time before NLP/CALL plays a bigger role in CALL than it does at present.

3.4.3 Mini-Classification

There are many different ways in which NLP technologies can be used in CALL. For example, Gamper and Knapp (2001) categorised NLP/CALL systems according to languages supported, Artificial Intelligence techniques used, language skills targeted, language elements involved and availability of the resources. A full classification of NLP/CALL systems is beyond the scope of this section, but it aims to provide a brief overview of some of the important categories of NLP/CALL systems based on the context of the CLICI project. The categories considered are language skills, form/ fluency focus, student level, student age, NLP technologies, CALL-phase usage (i.e. CALL materials development, CALL materials usage or post-CALL usage analysis), resource focus, deployment context, language, learner profile and CALL tool/tutor classification.

Language Skills

NLP/CALL applications can be used for all so-called four basic language skills, namely reading, writing, speaking and listening. For reading applications, lemmatisation, part-of-speech disambiguation, electronic dictionaries amd corpora (e.g. Roosmaa and Prószéky, 1998; Dokter and Nerbonne, 1998) can be used to provide a suitable resource for students. GLOSSER (Dokter and Nerbonne, 1998) is an example of a system that aids reading by providing additional resources for learners to help them understand a text. For writing, grammar and style checkers (e.g. NativeEnglish Writing Assistant (Hu et al., 1998)) can be used to help students. Grammar checkers can aid students with writing by pointing out (potential) errors and sometimes providing suggestions. Although some researchers doubt the success of Grammar Checkers (e.g. Pennington, 1992), they are potentially useful. Section 6.8 reviews the potential benefits and pitfalls of Grammar Checkers in CALL. NLP technologies can be used to check the learners' understanding of spoken language by analysing their responses to questions about spoken material. NLP technologies, combined with speech processing technology, can be used in CALL applications that focus on spoken language. Carson-Berndsen (1998), Skrelen and Volskaya, (1998) and Jager (2001) provide examples of the use of speech technology in CALL applications.

Form vs. Fluency

Given its very nature, NLP/CALL mainly concentrates on form-focused instruction, rather than fluency (Holland et al., 1993). This is because it is easier for NLP systems to deal with a written language at a morph-syntactic level, rather than oral input or written text at a semantic/pragmatic level. Ellis (1994) distinguishes between *focus on forms* and *focus on form*. *Focus on forms* concentrates on individual grammatical phenomena (e.g. the conjugation of verbs in a given tense). *Focus on form* refers to the process of reflecting on the language produced. The majority of NLP/CALL systems reported in the literature (e.g. Holland et al.,

1995; Jager et al., 1998) focus on grammar related issues (e.g. they use a *focus on forms* approach), although ICALL systems can also use a *focus on form* approach by providing a refection phase on an recently performed activity. Heift and Schulze (2007) give the example of the introduction of a grammar checking phase in the text production process as an example of how CALL tools can adopt a *focus on form* approach. Focus on forms and focus on form are important as learners rarely acquire new L2 forms instantaneously (Larsen-Freeman and Long, 1991). Aside from grammar related issues, Schultz (2001) notes that NLP/CALL can be used for communicative activities. LingWorlds (Douglas, 1995), the Athena Language Learning Project (Murray, 1995) and FLUENT (Hamburger, 1995) have elements of the communicative approach in their design. E-mail editors with some built-in NLP resources (e.g. spelling and syntax checkers) can help in Computer-Mediated Communication (CMC) which can help with fluency.

Student Level

Holland (1995) reported that ICALL appears to work for intermediate proficiency students (e.g. students at Level B of the Common European Framework of Reference for Languages (CEFRL, 2001). However, the limited L2 of beginner learners (Levels A1 and A2 of CEFRL) means that restricted coverage CL/CALL applications, that would be unsuitable for more advanced proficiency students, could successfully be used by this student group. On the other hand, advanced proficiency students could be expected to cope with the uncertainties associated with NLP (e.g. incorrect analysis of learner input) and use their knowledge of the target language to interpret intelligently information and feedback provided by the NLP/CALL application.

Student Age

Most CALL applications appear to be aimed at adults and NLP/CALL systems are not different. Holland (1995) noted that confident learners with a tolerance of ambiguity seem to benefit from ICALL applications. While confident learners can come from any age group, they are less likely to be found in younger learner groups. The limited L1 and L2 knowledge of young learners could paradoxically make them a suitable target group for NLP/CALL applications. As their inputs to a NLP/CALL system are limited in scope and linguistic complexity, it means that the underlying NLP-engine does not have to provide wide-coverage and can focus on the most likely inputs rather than having to cope with more advanced and complex linguist structures. Decoo and Colpaert (1999) report on the use of NLP technologies to develop CALL material for primary school students of French in Belgium.

NLP technologies

In theory, the applications of NLP technologies in CALL are unlimited and to date a wide variety of such technologies have been used in ICALL applications. However, Nerbonne

(2003) suggests that the following NLP technologies can contribute to CALL: concordancing, text alignment, speech recognition and synthesis, morphological processing, syntactic processing and perhaps Machine Translation (MT). Lemmatization i.e. the breaking up of a word into its constituent parts to establish the root form (or lemma), has the potential to support reading skills and dictionary based activities such as translation. Dokter and Nerbonne (1998) and Roosmaa and Prószéky (1998) use lemmatization and indexation. Parsing is useful in restricted linguistic domains. Murphy et al. use parsing and error recognition in their RECALL application. Van Hueven (1998) uses parsing and pattern matching in his ICALL program. Yablonsky (1998) uses morphological generation in his Slavic language applications. McCreesh (1998) uses vocabulary information in her grammar exercises. Part-of-Speech (POS) disambiguation can be used to help the student explore meaning. NLP/CALL applications have tended to focus on the lower-end of NLP technologies, i.e. on morphology and syntax, rather than semantics and pragmatics. Frederiksen et al. (1995) have developed a discourse processing application but semantics and pragmatics are under-served by NLP tools at present.

Pre/During/Post CALL Usage

NLP/CALL applications have a role to play in the development of CALL materials, their usage by students and in the subsequent analysis of their output. NLP technologies have been used to automate or semi-automate the development and correction of CALL exercises (e.g. BRIDGE (Weinberg et al., 1995)). Some systems provide an authoring tool for content providers to help them avail of these facilities. NLP/ technologies can be used to automate aspects of answer prediction and evaluation (e.g. Levin and Evans, 1995; Dorr et al., 1995). Although Nesselhauf and Tschichold (2002) state that NLP technologies are not required for vocabulary building CALL applications, they have the potential to contribute to their usefulness. ICALL can be used to analyse a textbook to see what vocabulary items and verbs are being taught. Textbook word frequencies can be compared with native speaker texts and along with pedagogical input, can be used to improve future textbooks, if required. Dodigovic (2005a) provides a good example of how vocabulary profiling helped to improve teaching for EFL students. Another area where CL tools can be used is in the preparation of verb conjugation tables. For example, Decoo and Colpaert (1999) use CL tools to generate verb information in their Verbapuces programme.

NLP tools are most visible to learners when they actually use an ICALL resource. For example, assistance can be provided when the learner is reading a foreign language text for comprehension (e.g. GLOSSER (Nerbonne and Smit, 1996)). Grammar checkers can provide help to the learner when writing in the target language. An emerging area where NLP technologies can be used in CALL is that of Computer Adaptive Testing (CAT), where the test items presented to the user can be adapted as the learner moves through a particular test. If the

system perceives that the learner is having difficulty with the items, it can ask the student easier questions or, alternatively, it can ask more difficult questions if the learner seems to be well able for the current level of questions.

NLP resources can also be deployed after the learner has finished using the ICALL resource. In the Post-CALL phase when the learner has finished using the CALL resource, analysis of the user output can contribute to SLA research and subsequent findings can be fed into future ICALL resources. For example, tools can be used to analyse learner texts to spot common errors and under- or over-usage of certain phrases and constructions. Chapelle (2001) and Granger (2003) discuss how ICALL can be used to carry out SLA research.

Resource Focus: Presentation or Underlying Engine

Most NLP/CALL applications remain at the prototype stage and often few resources are devoted to presentation or to the user interface. Therefore, the intended target group may actually find them difficult to use. However, some ICALL applications have less focus on grammar and more on interface and interactions. For example, the MILT system (Kaplan et al., 1998) uses learning psychology (practice, feedback and motivation) in its design to improve the learning experience for the student.

Context

In Europe and some US universities, many NLP/CALL programs have been developed for adult university students. The NLP/CALL researchers come from and work in this environment and the universities' language students provide a ready-made target group for their work. In the US, the Department of Defence has developed systems specifically for its military personnel (e.g. BRIDGE (Weinberg e al., 1995)).

Language

Not surprisingly, NLP/CALL applications are mainly available for the Most Commonly Taught Languages (MCTL), including English, German, French and Spanish. However, applications also exist for other languages including Japanese (e.g. ALICE), Arabic and Basque. The existence of an NLP/CALL application for a given L1/L2 pair depends more on the researchers' background, interests, resources available and CALL user needs, rather than inherent NLP difficulties for a given language. Another dimension to consider is the relationship between the L1 and the L3. If they are close (e.g. languages from the Romance language family), then a plurilingual NLP/CALL system (e.g. ESPRIT (Koller, 2004)) may be a useful learning aid.

Learner Profile

NLP/CALL programs are often designed with the independent, motivated learner in mind. Analytical learners seem to benefit most from NLP/CALL programs (Holland, 1995). Also, the learners' willingness to tolerate, and comfort with, ambiguity can determine how successful NLP/CALL programs will be for them. It is probably an advantage if the learners have learnt another language before, as this may increase the chances that they will "know" how to go about learning a third language and will use the NLP/CALL program in a way that suits them.

CALL Classification

The Tool/Tutor distinction was defined by Levy (1997) as a way of classifying CALL systems. A Tool is simply a means to an end (e.g. a word processor) while a Tutor plays an evaluative function. It is best to consider the classification as a continuum rather than a dichotomy. Often NLP/CALL systems have been geared towards the Tutor end of the spectrum, but providing NLP/CALL embedded as hidden resources in Tools, may also be beneficial. Hincks (2003) places spell checkers and grammar checkers somewhere in the middle of the tool-tutor spectrum.

3.4.4 Two Examples of Computational Linguistics and CALL systems

This section reviews two computational linguistics systems: GLOSSER (Dokter and Nerbonne, 1998) and FreeText (FreeText, 2004). They are chosen on the basis of being relatively recent CL/CALL systems that (and this is important in the context of the present dissertation) reuse some resources from previous CL projects. These projects illustrate the difficulties involved in CL/CALL projects – even though they were funded by the European Union and were developed by multidisciplinary teams, they have not managed to move from the prototype stage to producing resources that are actually used by CALL learners.

GLOSSER

GLOSSER was a research project that aimed to show how NLP tools could be used in language learning and for helping readers understand a Foreign Language text (Dokter et al., (1998)). GLOSSER provides students with morphological analysis, Part-Of-Speech (POS) disambiguation, a dictionary and examples of word use from especially collected bilingual corpora. It aimed to remove the tedium of dictionary use from intermediate language learning (Dokter and Nerbonne, 1998). Dokter et al., (1998) report that GLOSSER made it easier for students to approach a foreign language text. They tended to look up more words and reading time was decreased. Both of these can contribute to vocabulary acquisition. GLOSSER is interesting because it reused existing NLP resources. It reused Locolex (a morphological analysis/Part-Of-Speech disambiguation package from Rank Xerox Research Centre) and an existing dictionary (Hedendaags Frans (Van Dale Lexicografie, 1993)). GLOSSER

demonstrated that it was possible to use available NLP technology in communicative CALL. GLOSSER was developed for four language pairs: English-Estonian, English-Hungarian, English-Bulgarian and English-French. Figure 3.1 shows a diagram of the GLOSSER architecture (from Roosmaa and Prószéky, 1998). It outlines how a sentence with a selected word is preprocessed before being passed to a morphological analyser/disambiguator and how its output is used to present information on the screen. Figure 3.2 shows a screen shot from GLOSSER, with the source text on the left-hand side of the screen, and the expanded morphological information shown in three separate panes on the right-hand side of the screen.

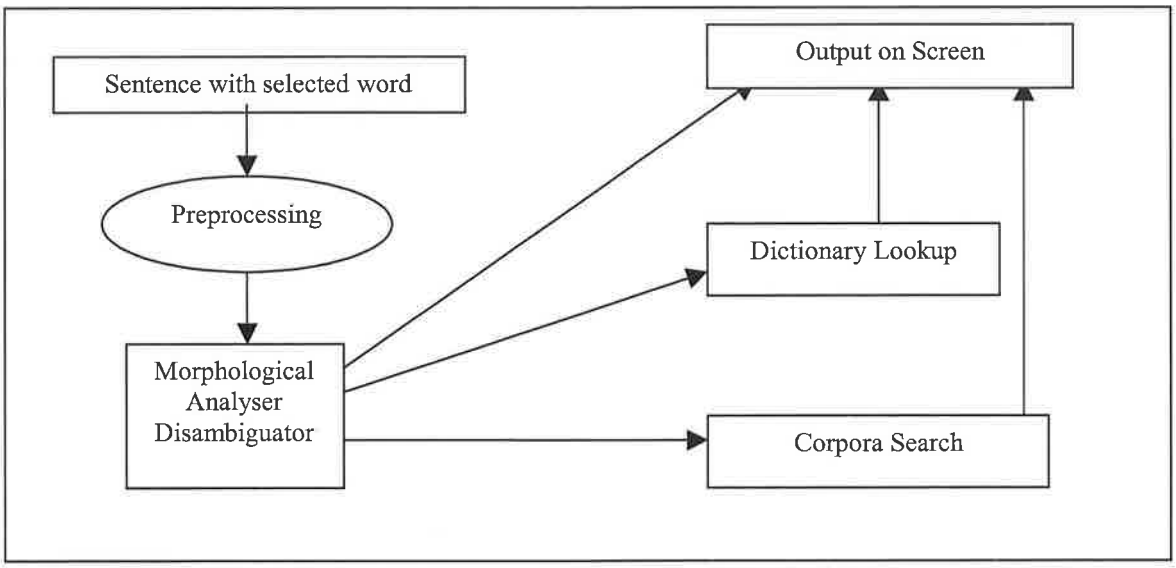

Figure 3.1 GLOSSER Architecture (from Roosmaa and Prószéky, 1998)

FreeText

The FreeText project (FreeText, 2004) was funded under the Fifth Framework Programme of the European Commission. The aim was to create a CALL environment for French as a foreign language for intermediate to advanced students. It used authentic documents and a communicative approach to language learning with task-based activities. Learner corpus analysis was used to design exercises for the target learner group as well as the development of error typologies. NLP tools were used for error diagnosis. They included a spell checker, a grammar checker and a semantic checker. A speech synthesizer, a sentence reformulation tool and a translator were also used. FreeText was a collaboration between four partners: the University of Manchester Institute of Science and Technology (UMIST, Department of Language Engineering), Université Catholique de Louvain, (Centre for English Corpus Linguistics (CECL)), the Université de Genève (Department of Linguistics) and Softissimo (a software company specializing in natural language software). Each partner had a specific role – UMIST was responsible for didactics, CECL for corpora related issues and project validation, the Université de Genève for the NLP tools and Softissimo for the user interface. FreeText

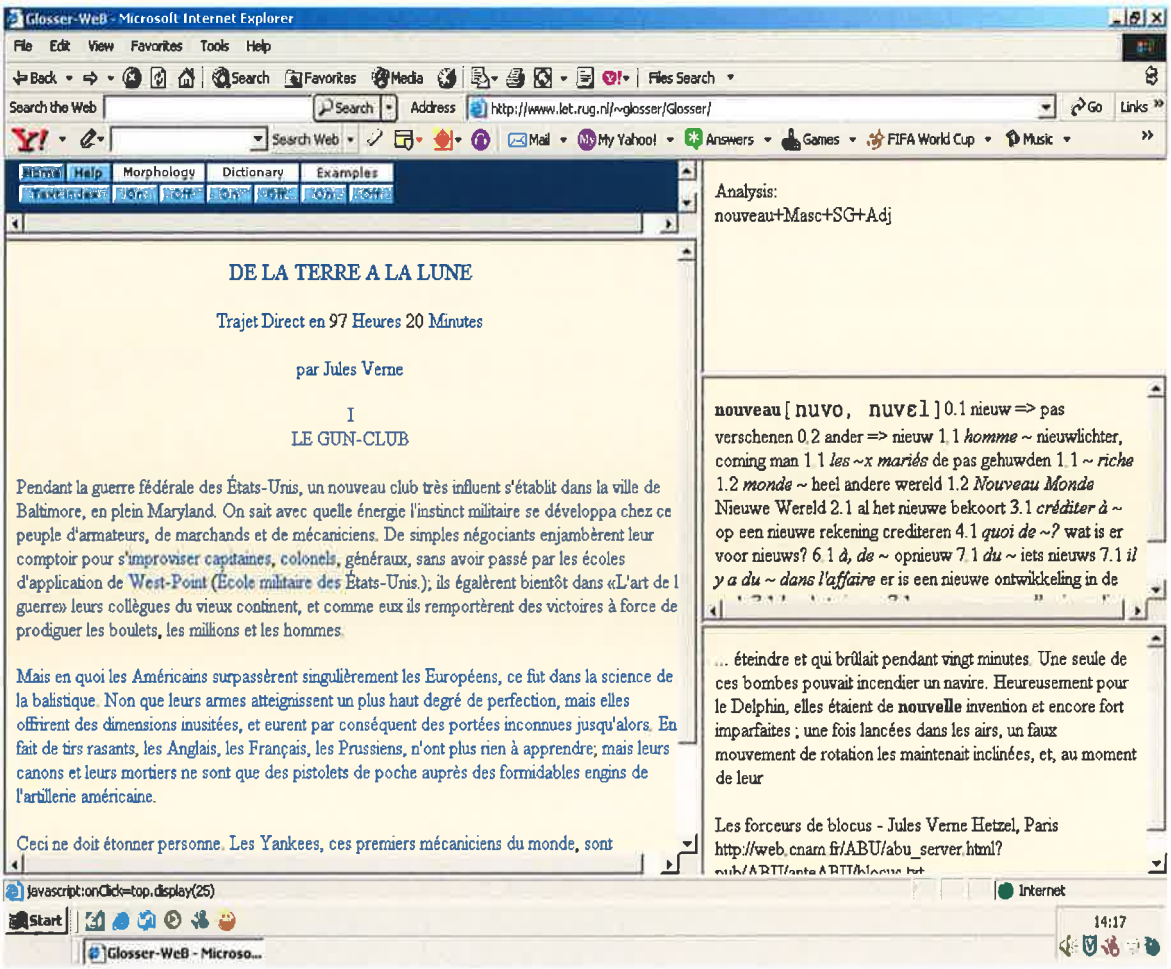

Figure 3.2 GLOSSER Screen Shot

FreeText aimed to handle unrestricted user input and provided feedback to the learners. It also provided an authoring tool for teachers to develop their own exercises. The aim of the FreeText system was to contribute to European Union policies, including those relating to education, training, language and information policies. The project demonstrated that constraint relaxation and phonological reinterpretation (including handling homophones which are especially prevalent in French) are diagnosis techniques that can be used in this particular context. Although it was a prototype, it demonstrated its potential for language learners (Vandeventer Faltin, 2003). The error categories, the use of phonological information and non-prescriptive feedback make it suitable for these learners. Vandeventer Faltin (2003) also reports that the FreeText project showed that grammar error diagnosis can be used on free learner productions (input) and that it is feasible to adapt an existing syntactic parser (Fips parser (Laenzlinger & Wehrli, 1991)) for grammar checking. It provided large coverage of French, was robust and, in terms of development time, it was very competitive (around 30 person-months). Although there are areas that could have been improved, the FreeText project demonstrated the possibilities for using NLP in CALL.

3.5 Integration Difficulties

There are several reasons why CL techniques are not more widely used in CALL, mostly due to difference in research focus, research methodology and research traditions between CL and CALL, but also due to sociological factors such as prestige associated with particular research activities in the two fields (Schulze, 2003a). A further factor is that CL is inherently complex. It is a specialist area, hard to comprehend for those outside the field and this includes language teachers and CALL practitioners/researches. On the other hand, CL researchers are not CALL-focused, in other words, they do not set out to work on CALL related resources. They prefer to concentrate on other target areas, including machine translation, the development of CL tools or on testing particular linguistic theories. There are difficulties in integrating CL techniques and resources in CALL. Ideally, a large team of developers with different expertise is required to build a good CL/CALL system. The learning curve for NLP/CALL is even steeper than for CALL alone.

Many of the NLP/CALL systems developed up to now have remained at the prototype stage and have not been comprehensively tested and evaluated. There is a lack of knowledge amongst CALL practitioners about NLP/CALL, and it is hard for NLP/CALL to find acceptance in many CALL quarters. For those new to the area, it is difficult to visualise the potential of NLP/CALL. The few systems that do exist (compared to traditional CALL systems) are not well known or limited in scope and it is hard for those outside the area to get a sense of the possibilities. There is also the lack of proven ability of NLP/CALL. It has not yet been shown that NLP/CALL is any "better" than traditional CALL, although it may be at least as good. However, "better" may not necessarily be the only criterion, especially if NLP/CALL can provide resources that would otherwise not exist or be extremely difficult to develop.

From a CALL point of view, many NLP/CALL resources lack a proper pedagogical basis. This does not apply to all NLP/CALL systems, but several NLP/CALL resources grew out of a CL research domain rather than a CALL one and so may not be built on sound pedagogical principles. A NLP/CALL pedagogy may be required for NLP/CALL resources, which would be similar to that advocated by Garrett (1995) for the design of CALL pedagogy. There is limited interaction between CL and CALL researchers, although this is improving (e.g. NLP-SIG workshops at EUROCALL 2001 and 2003).

There are also socio-cultural factors to consider. Language teachers insist, quite rightly, that pedagogy must come first and, often, NLP/CALL systems fail in this regard. However, more recent NLP/CALL systems have aimed to integrate pedagogical principles (e.g. FreeText (2004)) and perhaps this issue is less of a problem than in the past. Schulze (personal communication) suggested that this insistence on "pedagogy first" in part could stem from

language teachers' lack of knowledge and understanding of how NLP systems work. Another issues is that teachers do not like using general technology they are not familiar with. Furthermore, they do not like the concept that language is "reduced" to a formal level, especially as many language teachers come from a humanities background. From a language learner's viewpoint, there are also issues. There is the black-box syndrome, where the learner does not understand how the system actually works and may be afraid of using it or be over-trusting of the information it provides. In some cases, it may not be culturally appropriate or confusing. For example, in cultures where there are several degrees of politeness or where there is a secret/restricted register, the learner may not know what register to use with the computer. From the CL side, there are also socio-cultural hurdles. Schulze (2003a) argues that there exists a hierarchy within computer science departments. Researchers working on difficult algorithms are top of the hierarchy, followed by those working on more general computing problems. Those working on CL are viewed with some suspicion (is it really computer science?), while those who work on NLP/CALL research are at the bottom of the pile. Schulze notes that NLP/CALL researchers' work is often undervalued by both the CL and CALL domains and this can be discouraging for some researchers. Table 3.1 provides a summary of why CL is not more commonly used in CALL.

Why CL is not used in CALL
CL is inherently difficult
Difficulty in integrating NLP/CALL
CL researchers and research is not CALL-based
Difficulty in visualising CL CALL
Lack of knowledge amongst CALL practitioners
Lack of proven ability of NLP/CALL
Lack of pedagogical basis of NLP/CALL
Socio-cultural factors: teachers, learners NLP/CALL researchers

Table 3.1 Why CL is Not Used in CALL

3.6 SWOT Analysis

Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is a tool used to evaluate a project or business venture. Strengths and Weaknesses are attributes of a project that are helpful and harmful, respectively, to achieving an objective – they are internal to a project. Opportunities and Threats are external conditions that are helpful and harmful, respectively, to achieving an objective. This section provides a SWOT analysis of using CL in CALL.

3.6.1 Strengths

This section reviews the strengths of using CL in CALL. Using CL resources can help to develop resources that would otherwise be near to impossible to develop manually. In limited-use scenarios, it may be quicker for the content developer to manually create CALL resources. However, to be able to provide more complete learning resources some level of automation is required. CL can provide this automation (e.g. Dorr et al., 1995). Using CL techniques, variable feedback can be provided automatically to the learner, without the content developer having to supply a message for every possible input scenario. For example, the content developer can state that the correct answer is any verb in the third person singular and the CL engine can determine if the learner has entered the correct conjugation of the verb. Otherwise, the content developer would have to manually supply the correct conjugation of the third person singular for all the verbs that the learner may know. NLP/CALL can handle flexible input and does not require the user to input a fixed set of sentences or answers to a CALL system. For example, the system ALICE-chan (Levin and Evans, 1995) allows the content developer to provide a template answer and the system can handle a number of correct variations that the learner might enter. CL can facilitate the development of material automatically. For example, a CL system might be able to create a suitable vocabulary learning resource based on an electronic dictionary and pedagogical information. CL tools can also automatically provide links to dictionary entries and glosses.

There are several areas in which NLP/CALL has been successful. Although it is naturally good for form-focused instruction, DeSmedt (1995) notes that it can also address the needs of communicative language teaching. Nagata (1992) and Levin and Evans (1995) report that it is good for syntax-based language tutors. NLP/CALL can be used for tracking students' constructions and errors (Bailin, 1995; Garrett, 1995). NLP/CALL is good for vocabulary-driven exercises (Decoo, 1996; McCreesh, 1998). From a pedagogical point of view, NLP/CALL can be useful for timid students as it allows them to try things out on the computer before attempting to do so in real life (Holland, 1995). It can encourage learner autonomy as students have to decide on the validity and usefulness of the response provided by an NLP/CALL application. Using CL resources to perform corpus analysis is a further strength of CL in the realm of CALL. Corpus analysis, both native and learner, can feed into the design of materials. Learners can use corpora tools on native corpora to obtain information on e.g. verb conjugations and concordances. Data-driven learning (Johns, 1994) aided by bilingual and aligned corpora is a useful tool for advanced learners. Furthermore, corpus analysis on learner corpora can contribute to SLA research (Granger, 2003).

3.6.2 Weaknesses

The weaknesses of NLP in CALL mainly pertain to inherent difficulty, integration issues, limited number of non-prototype NLP/CALL systems and high expectations. Overall, NLP tools are inherently difficult and take a long time to develop and CL, or more generally, NLP analysis is uncertain (Holland, 1995). Section 3.5 outlined the NLP/CALL integration difficulties, including the difficulty of developing NLP/CALL resources, the lack of a pedagogical basis of NLP/CALL, the lack of knowledge about NLP/CALL and the socio-cultural problems that can arise. Many of the NLP/CALL systems that have been developed have remained at the prototype stage or have not been comprehensively evaluated. Holland (1995) reports that many of the NLP/CALL systems in existence remain at the prototype stage due to funding difficulties. While those outside NLP/CALL are often (understandably) not very knowledgeable of the field, even those within the area are often unaware of what other researchers are doing (Holland, 1995). Furthermore, as Felix (2005) points out, evaluation in CALL needs to be improved and this also applies to NLP/CALL systems. The FreeText system (see Section 3.4.4) appears to be a useful NLP/CALL resource, but the developers themselves admit that they would like to have spent more time and effort on evaluation. Apart from funding difficulties, there is also the issue that prototypes are easier to develop than full-scale systems and the question of scalability of the prototype arises. A NLP/CALL resource can be developed for a particular sub-domain of language or usage area, but if it is not scalable to cover a larger number of domains, then its value is limited. The relative ease of developing a prototype can lead to over-ambitious claims that cannot be met in reality.

Another area that NLP/CALL resources often fall down on is that of the user interface. All the development resources are focused on the internal engine, with sometimes scant regard paid to the interface (Holland, 1995), due to lack of time, interest or understanding of its importance. This means that it is very hard, if not impossible, for non-expert users to actually use the system. It also alienates potential users, who have come to expect a certain minimum standard of usability in terms of interface design. Another problem that arises with regard to users is that of high expectations. They may assume that given the technology behind the system, that it is foolproof and always correct. This is not the case and this can cause learners to be disappointed with the NLP/CALL system. Levin and Evans (1995) note that it is impossible to provide complete coverage of human languages. Salaberry (1996) is often quoted in this regard, as he says that this inability of CL systems to provide complete cover for human languages dooms them to failure, at least in terms of their usability in CALL. NLP/CALL researchers have responded that this is not necessarily the case, especially for those systems that focus on a particular domain. Nevertheless, user expectations can be a problem for NLP/CALL.

One of the main weaknesses of NLP/CALL is lack of pedagogical awareness. NLP/CALL systems may not be driven by pedagogical need or theory. NLP/CALL researchers mainly come from a CL or computer science background and are often motivated by trying to implement CL techniques in CALL, rather than trying to build a pedagogically sound system. Jager (2001) notes that they often do not cater for different learning styles or are not designed around a particular didactic theory. Ideally, a CALL specialist or language teacher would be involved in the design of a NLP/CALL system, but in reality, unfortunately often this is not the case. Funding difficulties are the norm for multidisciplinary or interdisciplinary projects and this makes it difficult for NLP/CALL designers to assemble people with a range of specialisations. Like general CALL applications, there are several variables that contribute to the success or otherwise of an NLP/CALL application. The student's learning style can affect the effectiveness of an NLP/CALL application, with analytical learners benefiting more from them than other learner types (Holland, 1995). The usefulness of an NLP/CALL application also depends on the fit with the learning task, with some tasks more naturally suited to the use of NLP technologies than others. Jager (2001) notes that NLP/CALL effectiveness also depends on the didactic method, linguistic domain, student competence and the role of the teacher. Finally, although NLP and CL specialists may find it hard to accept, sometimes it is easier to provide CALL resources manually rather than automatically (Jager, 2001).

3.6.3 Opportunities

Jager et al. (1998) summarise the oft-cited problems within the CALL community with NLP/CALL e.g. exaggerated claims and subsequent disappointment, infrastructure problems and fear of replacement (of human teachers). Despite these problems there are many opportunities for NLP/CALL. Computing resources are improving all the time and this means that tasks that were previously only feasible on special, high performance machines are now feasible on standard machines. Holland (1995) also notes that previous hurdles (e.g. need for large machines, long and costly development, fragile analyses and narrow scope) are being overcome. As more CL resources are developed, there are more reusable CL resources being made available, which means that there are more opportunities for NLP CALL integration. The Army Research Institute (ARI - Dorr et al., 1995; Kaplan and Holland, 1995)) have reused lexical databases and applied automatic techniques for acquiring lexical features to develop an Arabic lexicon of over 40,000 words (Dorr, et al., 1994). Tools are becoming available which make ICALL more streamlined and cost-effective (Holland, 1995).

There are some relatively mature CL techniques that can provide the necessary level of correctness and robustness required in CALL applications. CL is becoming more acceptable as people become acquainted with low-level CL resources in general (e.g. spell-checkers in word processing programmes). Awareness of NLP/CALL continues to grow within the wider CALL

Component	Prototype
Lesson Generator	No prototype required
Verb Conjugation	Prototypes required for information extraction and animation
Writing Checker	Prototype required for concept due to novelty (adapting a linguistically-aware adult-oriented grammar checker for younger learners)

Table 7.6 System Components and Prototypes

7.6 Lesson Generator Component

Lesson Generator Component – Conceptualisation Stage

In the context of the CLICI project, Lesson Generator Component (LGC) refers to the lesson generator tool (in the software engineering sense of the word) and the Irish language lessons produced using this tool. The aim of the Lesson Generator Component (LGC) was the easy creation of lessons and languages exercises ("games"). It was initially envisaged that the teacher could use the CALL Template (Ward, 2001), however, given the demands on the time available to primary school teachers, this proved to be unrealistic. The CALL Template is a tool that enables the content developer to create lessons and exercises, but it has an XML-interface and inputting accented characters is cumbersome. Therefore it was decided to create a LGC that would provide a simpler interface to the CALL Template. This could be accomplished by providing a wrapper around the CALL Template. The content provider would place the required didactic material in plain text files and the tool would then map these files to their corresponding file in the CALL Template. Some consideration was given to automating or semi-automating the lesson creation process, especially the creation of exercises. However, this would have required some powerful computational linguistics resources which were not available and the cost-benefit analysis meant that this research direction was not pursued. Given the aim of reusing existing resources where possible (e.g. MALTED (Malted, 2000) provides a good authoring environment for teachers), the development of a LGC may seem paradoxical. However, it was envisaged that the creation of such a tool could facilitate the possible future automation of content. In terms of evaluation, the LGC would be deemed a success if it made the lesson generation process more efficient.

Although the provision of Irish lessons would not incorporate CL technologies, it would serve several purposes. It would provide a suitable environment for familiarising students with CALL and for embedding the other CLICI resources, rather than delivering them in isolation. More importantly, it would address a pedagogical need for improving reading assistance in Irish. Hickey (2001) notes that children cannot be expected to read in Irish just for the sake of it, when it is accepted that they read in their L1 for enjoyment, pleasure and information. The benefits of

L2 reading include the reinforcement of oral learning and the development of automaticity of decoding (Day and Bamford, 1998). It improves oral skills (Elley, 1991), L2 reading comprehension (Caruso, 1996) and it helps to develop L2 vocabulary (Krashen, 1993). From a Minority Language point of view, L2 reading provides input when other forms of input are limited (Hafiz and Tudor, 1990) and successful L2 reading experience can increase positive attitudes to L2 learning (Rodrigo, 1995). Hickey (2001) has some recommendations specifically in the case of reading for Irish. Children need help with their reading decoding skills due to their problems with some aspects of Irish orthography (Máirtin, 1992). There is a need to provide good models of Irish reading (e.g. the teacher reading aloud) as flawed reading discourages the development of sufficient reading speed to synthesise meaning from text (Hamp-Lyons, 1985). Greater access to Irish books, the development of interesting books and greater use of existing books could also provide better reading resources in Irish. Hickey (2001) advocates the use of taped books (i.e. where the text is available in spoken format), as she noted (1991) that children are more motivated to read a taped book as opposed to one with no accompanying tape. She also noted that assisting parents to help their children would be useful as 70% of parents have low Irish ability (Harris and Murtagh, 1999). With this in mind, the aim of the LGC to provide recorded narration along with the on-screen text should cover the role provided by taped books, but in a more flexible manner. It should also help them to receive the benefits of reading aloud, at their own pace and as often as they like. The use of colourful images to accompany the text should make the text more visually appealing to the students. The presentation of on-screen text and narration together can be beneficial for learners (e.g. Clarke and Paivio, 1991; see also Section 7.7 below for information on the integration of multimedia, cognitive load and pedagogy).

Document Level and Item Level

The LGC is a tool and as such does not produce Documents or Items directly (these are produced by the CALL Template (Ward, 2001)).

Lesson Generator Component – Specification Phase

An overview diagram for the LGC is shown in Figure 7.1. It shows how the LGC provides a wrapper around the CALL Template to facilitate the creation of lessons and exercises pages.

An overview of the flow of information in the LGC is shown in Figure 7.2. It specifies that the input to the tool is a plain text file which the LGC maps to the corresponding file in the CALL Template. The CALL Template is then used to produce the lesson and language exercises. The LGC is not particularly complex – it mainly involves mapping one file structure to another – and therefore a detailed specification was not required.

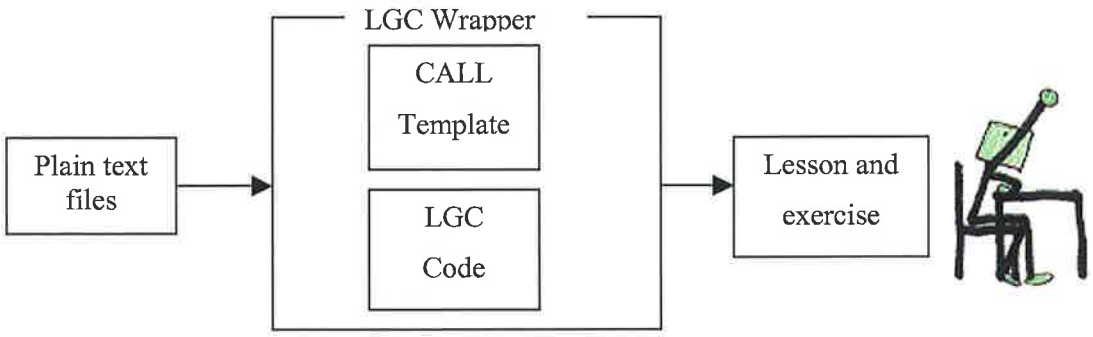

Figure 7.1 Overview of the Lesson Generator Component

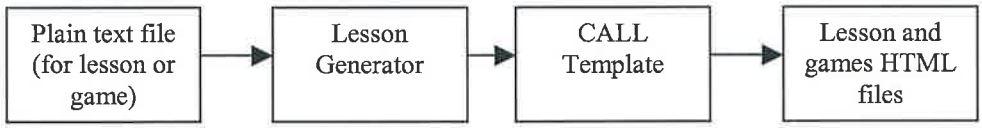

Figure 7.2 Information Flow for the Lesson Generator Component

Lesson Generator Component –Prototype Phase

The LGC did not involve any new technology and it was to provide a wrapper around a CALL Template that had successfully been used before to create CALL lessons and games. Therefore using Colpaert's criteria (Colpaert, 2004) there was no need for a prototype for this component.

7.7 Verb Conjugation Component

Verb Conjugation Component – Conceptualisation Phase

Verb conjugation is an essential component of language learning and can pose problems for students (Harley, 1986). Although communicative language teaching has held sway in recent years, it is important that learners are aware of the lowest levels of learning (e.g. verb conjugations) and achieve automaticity through practice and reinforcement (DeKeyser, 2001; Maingard, 1999). SLA researchers have shown that drawing students' attention to form is beneficial for acquisition (e.g. Hulstijn and Hulstijn, 1984) and accuracy (Robinson, 1996)). In recent years, there has been increasing interest in bringing grammar back into the classroom (Joyce and Burns, 1999), especially within a communicative framework (Rogers, 1996).

Doolittle (2001) stated that there is a need to integrate technology and pedagogy with some thought, rather than just talking about it. Doolittle et al. (2004) provide a good introduction to the interaction between multimedia, cognitive load and pedagogy. They define working memory as a set of cognitive processes responsible for supporting complex cognition (e.g. learning). Cognitive load is the demand on working memory created by instruction and how it affects learning. Most of the work of learning using multimedia takes place in working memory (Mayer, 2001) and, as it is a limited resource, it is important to try to decrease cognitive load

and increase learning, rather than the other way around. Researchers (e.g. Mayer et al., 2001; Sadoski and Paivio, 2001) have shown that greater learning occurs when processing input verbally and visually, rather than in only one mode. However, both verbal and visual channels are subject to memory limitations and overload may occur which can impact negatively on learning. Therefore care must be taken when designing multimedia learning resources. There are three types of cognitive load (Gerjets and Scheiter, 2003): intrinsic, extraneous and germane. Intrinsic cognitive load is the inherent working memory load required to do a task. For example, in the context of the CLICI project, the intrinsic cognitive load would be the inherent difficulty of learning the Irish verb conjugation system. Extraneous cognitive load is the effort required to process the learning materials that do not contribute to learning. For example, animation and text should be presented on the same page, as Mayer and Moreno (1999) report that extraneous cognitive load is increased if presented separately. Germane cognitive load is processing designed to improve the overall learning process (e.g. inferencing) and is only possible if intrinsic and extraneous cognitive loads are less than the learner's working memory. Doolittle et al. (2004) state that the aims of good instruction are to create tasks with low to moderate intrinsic load, to reduce extraneous cognitive load and to facilitate germane cognitive load. The inherent difficulties of the Irish verb conjugation system cannot be changed but presenting the information in small pieces can somewhat ameliorate this. Care must be taken to minimise unnecessary text and other visual information (e.g. the menu bar) and therefore reduce the extraneous cognitive load. Doolittle et al., (2004) outline seven cognitive principles of multimedia (based on research by Moreno and Mayer (1998)). The multimedia and modality principles identify the benefit of multimodal instructional materials, while the remaining principles extend or clarify these principles. They are defined in Table 7.7 along with their application to the VCC.

The teachers consulted as part of the CLICI project believed that learners, even young learners, can benefit from knowing the rules of verb conjugation. Although there are guidelines suggesting that these rules should be taught from 4th class (approximately 9, 10 years of age), both the principal teachers involved in this research project introduced the rules to students earlier. However, grammar rules, including those for verb conjugations, are generally not very popular with students. Therefore, one of the aims of the Verb Conjugation Component (VCC) was to try to make learning the verb conjugation rules more interesting for the students. Ideas included presenting the same information in different formats, including highlighting the changes using colour and animation. Animation has been shown to be appealing to boys (Leong and Hawamdeh, 1999).

Principle	Definition	Application to CLICI Project
Multimedia principle	Individuals learn, retain, and transfer information better when the instructional environment involves words and pictures, rather than word or pictures alone.	Words and animation will be used to display the verb conjugation information.
Modality principle	Individuals learn, retain, and transfer information better when the instructional environment involves auditory narration and animation, rather than on-screen text and animation.	Narration is not a possibility given the desire to automate the process and the lack of a Text-To-Speech (TTS) system for Irish.
Redundancy principle	Individuals learn, retain, and transfer information better when the instructional environment involves narration and animation, rather than on-screen text, narration, and animation.	The option to use narration and animation only is not yet a possibility for the CLICI project.
Coherence principle	Individuals learn, retain, and transfer information better when the instructional environment is free of extraneous words, pictures or sounds.	Only the necessary information will be displayed. Displayed text will be kept to a minimum.
Signalling principle	Individuals learn and transfer information better when the instructional environment involve cues that guide an individual's attention and processing during a multimedia presentation.	Colour and movement will be used to draw the learner's attention to the changes that occur to conjugate a verb in a given tense.
Contiguity principle	Individuals learn, retain, and transfer information better in an instructional environment where words or narration and pictures or animation are presented simultaneously in time and space.	Mayer and Moreno (1998) report that learner experience attention split when on-screen text and animation are presented spatially separate, but this can be overcome by presenting them together. The VCC will animate the display of the on-screen text information.

Table 7.7 Cognitive Principles of Multimedia (Doolittle et al., 2004) and their Application to the CLICI Project Part 1

Segmentation principle	Individuals learn and transfer information better in an instruction environment where individuals experience concurrent narration and animation in short, user-controlled segments, rather than as a longer continuous presentation.	Only a particular person conjugation format will be animated at any one time. Also, the learner will be able control how often it is displayed.

Table 7.7 Cognitive Principles of Multimedia (Doolittle et al., 2004) and their Application to the CLICI Project Part 2

However, as noted above (Doolittle et al., 2004) there are dangers of cognitive overload if the information is presented in too many formats at the same time. Given the desire to automate the creation of the verb display pages, from a pragmatic point of view it was decided to use colour and animation rather than sound. The issues involved in using a Text-To-Speech (TTS) system for Irish were too great for this project and it is likely that similar problems would exist for other (minority) languages.

The VCC consists of two parts: the underlying architecture and the verb data. The underlying architecture aims to be (relatively) language independent, while the verb data is obviously language dependent. The VCC architecture is responsible for receiving and processing the verb data to generate the required verb conjugation pages. The VCC has four exercise types: multiple-choice, matching, gap-fill (developed using Hot Potatoes software (Holmes and Arneil, 1998)) and a combination of multiple-choice and gap-fill (in-house module). In the case of the Hot Potatoes exercises, the documents are pre-formatted and there is no tracking of user information. As mentioned above, one of the technical aims of the project was to automate the creation of the verb conjugation information pages and related games pages. This meant that instead of the CALL developer having to hand code each page, the VCC would provide the developer with a mechanism to provide necessary, minimal information and the VCC would process the information and create the required pages. Ideally, the tool would provide a more efficient and effective means of learning verb conjugation rules, although the more modest aim of making it useful for students was adopted.

Document Level

The system will display the verb conjugation information for students (generates items). This information will be generated in advance and will not be generated at run-time. The system will store some learner information during the students' use of the VCC (stores tracking information). This information will include their answers and overall result for a particular

exercise. The learner will be able to navigate through the VCC pages as he wishes (navigates between items), read the VCC information, attempt the various language exercises and send them to the system (outputs document). There will be two types of exercise: one with recorded results and one that does not record the students' input and results. The system will show material (shows document) and results to the learner (shows scoring/evaluation).

Item Level

The system will track the students input for a particular exercise (tracks item), analyse (processes input) and evaluate input to the VCC exercises (evaluates input). The learner can navigate through the VCC materials (navigates) and input answers to the language exercises (inputs answer). Table 7.8 shows a summary of the conceptualisation phase for the VCC component.

		Item level (Individual questions)	**Document level (Exercises)**
System		Tracks item Processes input Evaluates input	Stores tracking information Generates items
User Input	Learner	Inputs answer	Navigates between items Outputs document
System output to	Learner	Generates simple feedback	Shows document Shows scoring/evaluation

Table 7.8 Conceptualisation Stage for Verb Conjugation Component

Verb Conjugation Component – Specification Phase

Back-End Specification

A simplified overview diagram of the VCC is shown in Figure 7.3. The VCC provides a wrapper around the verb conjugation data (Irish Morphology Engine (Uí Dhonnchadha, 2002)), the animation code (Koller, 2004) and the CALL Template (Ward, 2001) to produce the required lesson and exercise pages.

Figure 7.4 shows an overview of the flow of information for the VCC. It specifies that an external source will provide the verb conjugation information. The VCC will then take this information and produce the required verb conjugation display pages and associated exercises. A more detailed specification is shown in Figure 7.5 and Figure 7.6. The figures show the required interaction between the external sources and the VCC. There is a component to generate the verb information that is specific to the target language. This component can either

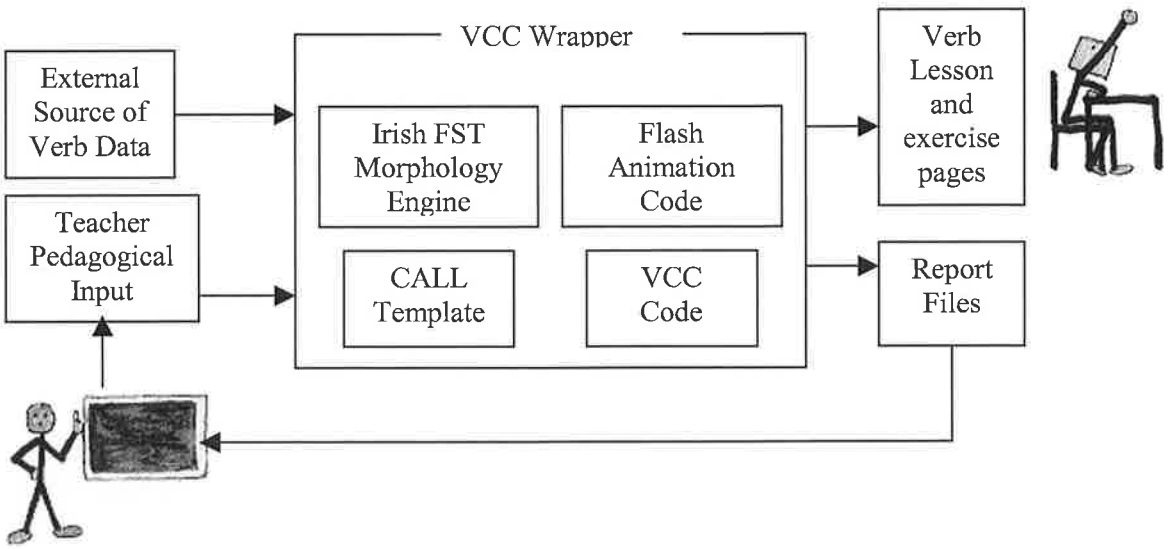

Figure 7.3 Overview of the Verb Conjugation Component

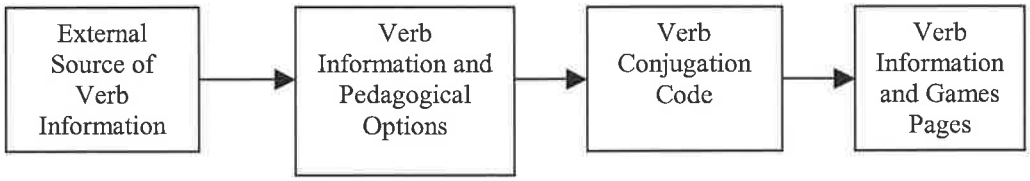

Figure 7.4 Information Flow for the Verb Conjugation Component

use an external data source, if one is available, or else generate its own verb conjugations. The local configuration files allow the content developer or teacher to decide what tenses, person, language type and information is to be displayed (see Table 7.9 for details). Flash animation code (Koller, 2004) links up with the verb files and animations are displayed to the student. The system generates activity files and report files on learner answers, which can be reviewed by the teacher and which feed into future post-CALL analysis.

Option	Explanation
Tense	Past, present and future
Person	1st, 2nd and 3rd person only or all persons
Language type	SVO (e.g. Nawat) or VSO (e.g. Irish)
Information	Positive, negative and question

Table 7.9 Options Available in the Verb Conjugation Component

In the text, when referring to boxes shown in the Figures in this chapter, square boxes are used to indicate the name of the box. For example, [External Verb Information] corresponds to the box of the same name in Figure 7.5.

Figure 7.5 shows the outline specification of the VCC and the VCC wrapper around the three external resources used by the VCC. Verb conjugation information is provided by the Irish FST Morphology Engine (Uí Dhonnchadha, 2002) [External Verb Information]. This data is converted into an internal format [Local Code Files] and passed to the VCC engine. The teacher can specify what verb conjugation is required (e.g. past or present tense) [Local Config Files] and this information is used internally in the VCC engine. The VCC engine uses these files and internal system files [System Config Files] to produce the static and animated the web pages [Verb Output Files]. The animated web pages involve the integration of code from the animation code (Koller, 22004) [Flash Animation Code]. The VCC engine also produces activity output files [Verb Output Files] and summary report files [Report Files] for the teacher.

Figure 7.6 shows the system specification for the VCC. The code to prepare the required verb conjugation information [Prepare Verb Info] uses system configuration information [System Config Files], and externally supplied data [External Verb Information] adapted to VCC needs [Local Code]. This code produces four verb file types: [verb data] (the verb conjugation information), [verbInfo] (a subsection of verb conjugation information for use in automatically generating the exercises), [Driver Files] (XML-related system internal files) and [Generate Files] (internal system batch files). The code to produce the verb pages [Verb Display File Generator] uses the conjugation information [verb data] and the animation code [Flash Animation Code] to produce the required pages. There is code to provide and format the required verb information for the different exercises [Prepare Activity Files]. The VCC produces five different exercises for each verb: multiple-choice, matching, gap-fill, mix-up sentence and a quiz (the Championship exercise which is a combination of multiple-choice and gap-fill). The multiply-choice [Multi Files], matching [Match files] and gap-fill [Gap Files] exercises are produced by the Call Template [Call Template]). The mix-up sentence files [Mix Files] are prepared by the mix code module [Mix Generator], while the quiz module [Quiz Generator] produces the quiz files [Quiz Files]. There is module [Report Generator] to prepare reports on the students' VCC interaction [Report Files] that the teacher can review to monitor VCC usage. (Note that for space-reasons the VCC wrapper is not shown in Figure 7.6).

Front-End Specification

The user interface to the VCC will be similar to the user interface of the CALL Template. The language exercises will be shown at the top of the page, with the verb conjugation information displayed below. The learner will either see static verb information or have the option of viewing an animated version. A simplified outline is shown in Figure 7.7.

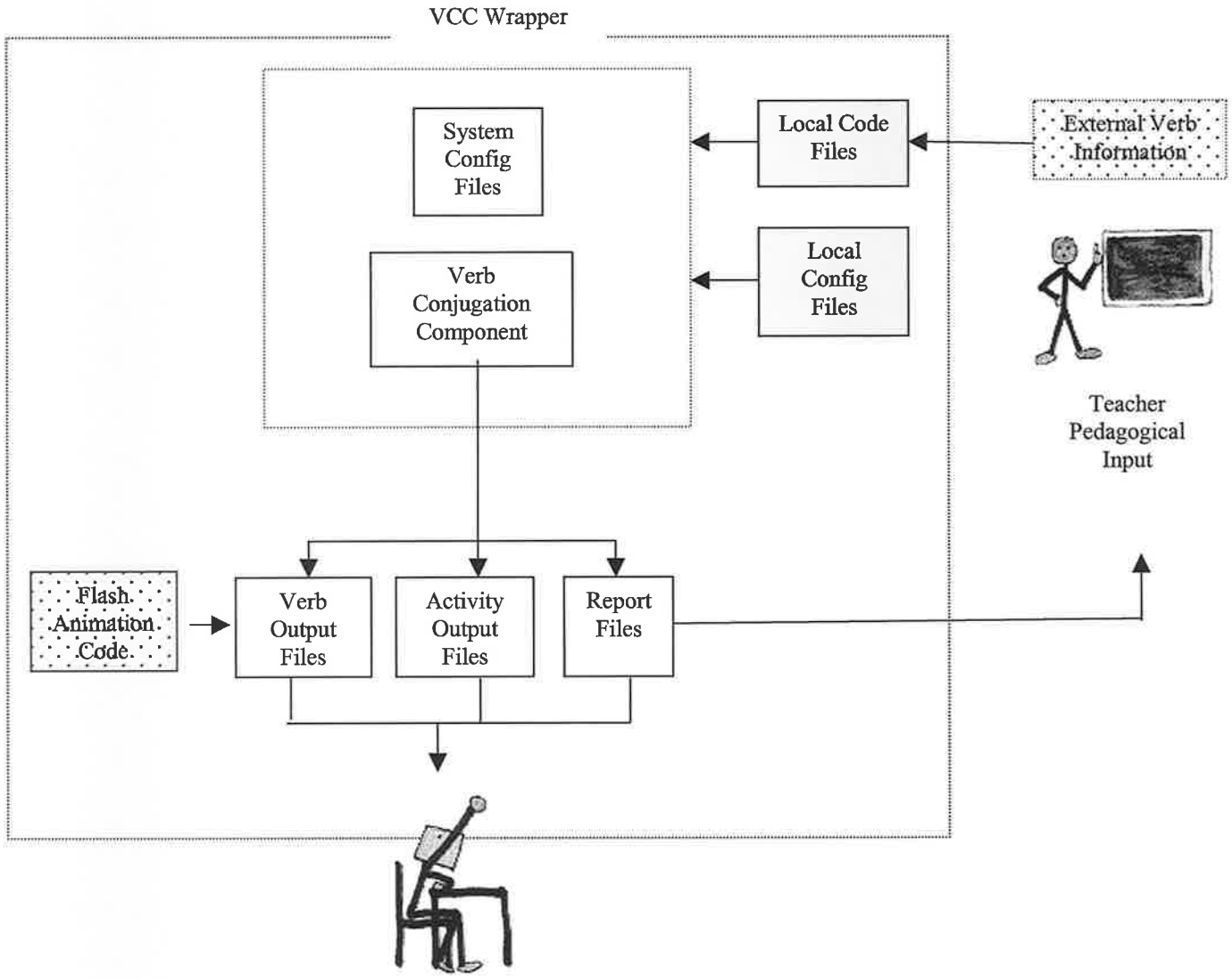

Figure 7.5 Outline Specification of the Verb Conjugation Component

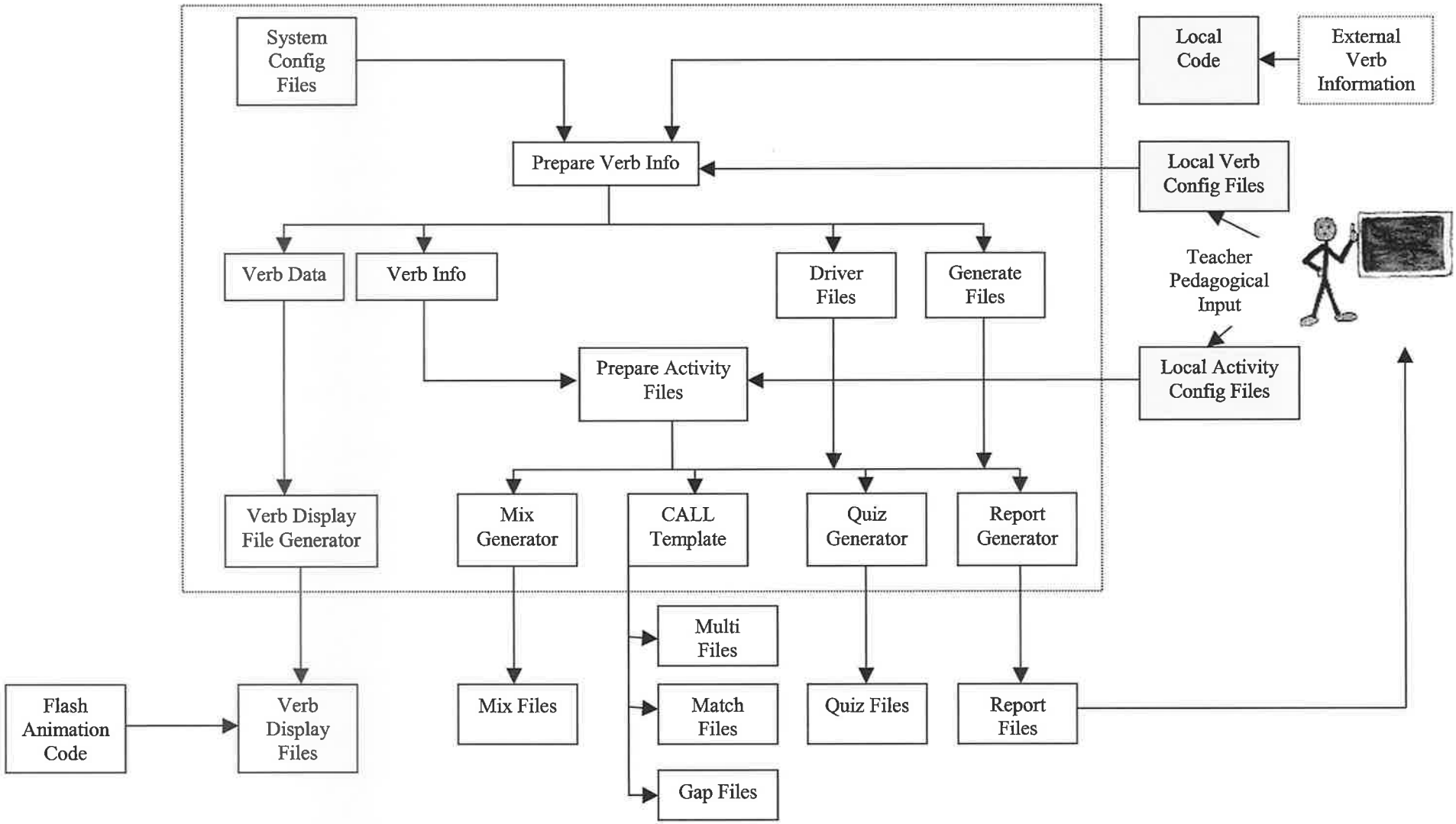

Figure 7.6 System Diagram for the Verb Conjugation Component

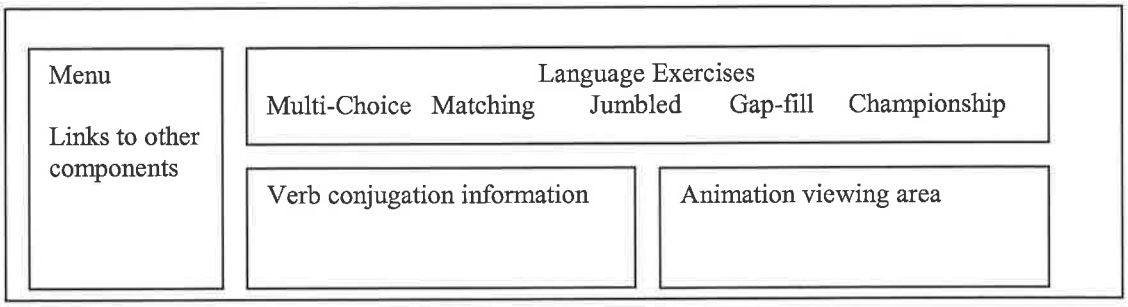

Figure 7.7 User Interface Specification for the Verb Conjugation Component

Verb Conjugation Component – Prototype Phase

A prototype phase was required for the Verb Conjugation Component. There were two reasons for this decision, one pedagogical and the other technical. From a pedagogical point of view, it was desirable to see if the proposed VCC would be suitable for the target users. Would it make sense to them? Would it be appealing? From a technical point of view, it was necessary to check a wrapper could be put around the Irish FST Morphology Engine (Uí Dhonnchadha, 2002) and Koller's (2004) animation code and that the information from the Irish Morphology Engine could be extracted and processed for use with the Koller's (2004) animation code. In order to test the proposed VCC, a prototype was developed for one Irish verb in the past tense. The verb chosen was *bris* (to break) as it is a verb that the students had studied and one that is regular. Conjugation information for *bhris* was extracted from the Irish FST Morphology Engine, parsed and processed for use with the animation code. The prototype was then tested with students from the target user group. Initial feedback was positive and the teacher also liked it. Subsequently, various display combinations were tried, showing all persons (i.e. 1st person singular through to 3rd person plural), positive, negative and question formats and also past, present and future tenses. From a pedagogical point of view, the teacher decided to show only the minimal necessary information at any one time. This meant that only the 1st, 2nd and 3rd persons singular would be shown in a given tense in positive mode only. The system would, however, give the teacher the ability to reconfigure the required presentation information if desired. A summary of the prototype phase for the VCC is shown in Table 7.10.

7.8 Writing Checker Component

Writing Checker Component – Conceptualisation Phase

The aim of the Writing Checker Component (WCC) was to provide an open-ended, exploratory learning environment for students. It was envisaged as a mechanism to stretch the better students and to encourage them to be a bit adventurous in their use of Irish. From a pedagogical and technical point of view, this would be the most challenging component. This section provides a brief overview of the use of grammar checkers in CALL. Heift (2003) and Heift and Schulze (2003b) have written extensively about error correction and more specifically error

feedback, while Vandeventer Faltin (2003) and Dodigovic (2005b) provide a useful and comprehensive overview of the area.

Question	Explanation
Why	• To check that these pages would be feasible for the target group. • To check that it was technically feasible to automate the creation of the verb information and related exercise ("games") pages.
How	A wrapper was placed around the Irish FST Morphology Engine (Uí Dhonnchadha, 2002) and the animation code (Koller, 2004). A prototype was developed for a regular verb in the past tense in Irish (*bris* (to break)). Information was extracted from Uí Dhonnchadha's (2002) Irish FST Morphology Engine, processed by the VCC prototype and linked with Koller's (2004) animation code.
Testing	The various technical modules were developed and sample pages were tested by students from the target group.
Findings	• From a pedagogical point of view, it was feasible to use the output with the students. Several display formats were tried, and it was decided to show only the minimal, necessary information. • It was technically feasible to put a wrapper around the external resources and to use external sources to supply the verb conjugation information and to link the processed data with Koller's animation code.

Table 7.10 Information on Prototype Phase for Verb Conjugation Component

Grammar Checkers in CALL

Grammar Checkers (GCs) focus on writing, which for many students is the most difficult language skill. Errors are more noticeable than in speech, the other language production skill. For example, an utterance, such as "aɪ laɪk dɛ kæts" (IAI laik de kats - I like the cats) requires more mental processing in written form than in oral form. The level of difficulty (as perceived by the learner) is language dependent. The target language's writing system can also contribute to learner problems. The written and spoken forms of words in English can cause problems for many learners (e.g. enough is pronounced "ɛn ʌf"). Spanish has a silent 'h' e.g. *hola* (hello) is pronounced "əʊl ə". Languages that use pictorial characters, such as Chinese and Japanese, can cause problems for learners. Languages with less standardised writing systems e.g. Endangered Languages, can also present difficulties. For example, in Nawat, "Good Day" can be written as "*Yehyek tunal*", "*yehyek tunal*" or "*Yejyek tunal*". Obviously, a fundamental assumption for the use of a GC is that the learner is literate. While many learners

are literate in their L1, some learners (e.g. from developing countries) may not be literate in their L1, but are literate in the L2.

GCs are usually designed for L1 writers. Native speakers can make mistakes and need to be able to correct their texts. Certain grammar errors can be detected by GCs and reported to the user. The writer then decides to correct the error if s/he deems that what has been flagged by the GC it is indeed an error. In theory, use of a GC leads to more correct texts. A language student may use a GC for different reasons than a native speaker. Teachers are not always available to L2 writers. GCs can provide immediate feedback and point out mistakes. Explanations may also be provided in some cases. Learners can learn from these corrections and improve their L2 writing skills. GCs designed for L1 writers generally provide good coverage for spelling errors but grammar coverage is variable. Style feedback may also be available, but some users may find this annoying and/or unhelpful. Overall, GCs are useful for pointing out (potential) errors but writers must use their own judgement on whether or not the advice provided is correct or useful. There are difficulties for L2 writers who use GCs targeted at L1 writers (Tschichold, 1999). These GCs are not usually tailored to the needs of language learners. The feedback is normally provided in the target language and can be quite technical. This limits its usefulness for learners, especially beginners and intermediate learners. Furthermore, the information may be misleading or incorrect which can confuse learners who tend to believe the GC without question. The GC may not actually be able to deal with the level of incorrect input that learners may produce. Although there are strategies for dealing with ill-formed input (e.g. rule relaxation (Matthews and Fox, 1991), mal rules (Reuer, 2003), using L1 and L2 grammars and using robust parsing with semantic and pragmatic disambiguation), general GCs do not usually use them. Tschichold (2003) also notes that the lack of semantic and pragmatic knowledge and checking hinder their usefulness for language learners.

Grammar Checkers' Potential for Learners

GCs have the potential to reduce learner frustration. GCs can respond to lower-order and easily detected errors (e.g. a simple "Wrong – please try again"). They can quickly identify where the error is, facilitating immediate correction and longer-term rule learning. GCs can be adapted to tolerate errors. This gives them the potential to provide didactically valuable feedback to learners. Also, GCs never lose patience and will endlessly corrects texts and give users feedback. GCs also allow students to correct lower-order errors and spelling errors, enabling the teacher to focus on higher order problems (e.g. more difficult errors). Ideally, GCs used in CALL would provide wide-coverage, although this is complex and would require many resources. They should be able to anticipate learner errors. These can be drawn from pedagogical experience in general and in some instances may be language independent. Specific learner errors from a given L1/L2 group could also contribute to the list of errors that a

GC can handle. Information about learner errors can also be gleaned from learner corpora. However, very few exist and even if the relevant corpora exist, there are issues relating to how they are tagged and the accuracy of the tags and coverage. The topic of learner corpora is discussed more extensively later on in this section. A GC can be developed for a particular version of the target language. In the case of English, there are many possible varieties including British, Irish, American and Caribbean English. Despite their potential, GCs have had limited success in CALL. Reasons for this have been outlined above. However, there is the fundamental question of how to measure success. Fewer errors in the text? Longer learner texts? Lower error/text ratios? Less basic errors? Findings to date are patchy. Pennington (1992) reports a failure of GCs to improve the editing skills of non-proficient writers. Brock (1993) notes a low error detection rate of less than 30%. However, in recent years researchers have reported more positive findings, including the fact that learners respond to feedback (e.g. Heift, 2001 and Pujolà , 2001) and it can be more efficient (Nagata, 1995, 1996).

Several researchers, including Tschichold (1999), have come up with suggestions for improvements. It is important to take the learner's L1 into account and to provide messages in the L1. She also recommends that unimportant errors are automatically corrected, but the GC should not automatically correct all errors, as this would hinder the learning process. Over-reporting of errors should be avoided. Training learners to be sceptical is helpful so that they know that the GC is not always right. Offering online help can be useful. There are, however, difficulties relating to these suggestions. Although it would be desirable to have a GC for each L1/L2 combination (e.g. an English GC for Spanish speakers and another one for Japanese speakers), this could be very difficult to develop. A filter could be used to prevent unimportant or lower priority errors being reported (e.g. Heift, 2003), but what errors are unimportant? The learner's L1 and ability level are key elements to consider in this regard. Training is a good idea but demand a certain time-commitment and interest level on the learner's part. There are also difficulties in having access to suitable learner corpora to help identify learner errors. Aside from these factors, there is also the important matter of the pedagogical issues involved in pointing out and describing errors (see Heift and Schulze (2003) and Schulze (2003b) for a fuller discussion).

Writing Checker

Combining the findings with the needs of the target learners, it was decided to develop a Writing Checker Component (WCC) for Irish for use by primary school students. Although GCs and WCs could be considered to be practically synonymous, in the context of this project the term "Writing Checker" is broader in nature, with the potential to check for grammar and

stylistic errors[1]. The WCC consists of two parts: the underlying architecture and the error checking code. The underlying architecture specifies how the language checking code is combined to provide the student with a Writing Checker (WCC). The WCC would check for spelling and grammar errors. Although it might seem straightforward, checking for errors actually involves four steps: error detection, error identification, error correction and diagnosis. Error detection means identifying that an error exists, error identification means picking out where the error occurred, error correction means righting the error and error diagnosis means determining why the error occurred. Dulay et al. (1982) identified two main error taxonomies: linguistic category (e.g. passives) and surface structure alterations (e.g. omission), while Granger (2003) advocates a three dimensional taxonomy: error domain (e.g. grammatical or lexical), error category (e.g. gender) and word category (e.g. part of speech). These taxonomies are useful for grammar checking. Even if an error is detected in learner text, there is always the issue of what to correct (if at all) and how to provide feedback to the student. Freiermuth (1997) outlines criteria for deciding what errors to report to the learner. These include the amount of exposure the learners have had to the language structure, the seriousness of the error and student need. In the context of the CLICI project, only the more common errors in structures the students have learnt will be corrected. Once the errors have been detected, the next issue is what type of correction information to provide. James (1998) identifies three different types of error correction: intervention feedback where the learner is only alerted to the error, correction proper where the correction information is provided and remediation where the learner can revise linguistic rules (similar to Spada and Lightbowns's (1993) overt meta-linguistic feedback). Given the target learner group, it was felt that intervention feedback would be too frustrating, while remediation might overwhelm the learner. Therefore, where possible, corrections (correction proper) would be suggested to the student.

Good feedback is an important component of any grammar checker for language learners. In the CALL domain, the term feedback has come to mean any type of information given to the learner after finishing a production or a comprehension task (see Schulze (2003b) for a summary of the term). Several authors including Kreindler (1998) and Heift (2003) have written about the characteristics of good feedback. The characteristics most pertinent to the CLICI project include feedback that is simple, clear and economic (Kreindler, 1998), non-threatening and sensitive (Dodigovic, 2005b), accurate (Van der Linden, 2003) and only one error message should be shown at a time (Van der Linden, 2003). Heift (2003) warns against providing too much instructional feedback as this may overwhelm the student. In the CLICI

[1]Stylistic errors are errors relating to semantics, register, voice and sentence length (Wei and Davies, 1996). In the CLICI context, the term 'stylistic errors' refers to punctuation errors (e.g. using a lower-case letter for the first letter of a name). The WCC identifies names in the input text by checking against a list of names known to the system (drawn from textbooks) and checks to see if the initial letter is capitalised.

context, the error messages had to be in English, the L1 of the students. The messages had to be suitable for children i.e. phrased appropriately for young learners with little or no knowledge of grammar terms. There was also a requirement to be able to check for other errors. These additional errors could come from the teacher and from analysis of learner corpora. As no suitable corpora existed, this highlighted the additional need to gather and analyse learner texts for errors (see below). Evaluation was also considered at this stage. As noted above, it is very difficult to define success. It was decided to ask learners their subjective opinion and carry out some empirical analysis of their texts. The teacher would also provide feedback and comment on the pedagogical usefulness of the WC. Evaluation is covered in Chapter 10. Table 7.11 shows a summary of the CLICI design decisions.

Computer Learner Corpus

This section provides a brief overview of Computer Learner Corpora (CLC) and the reader is referred to Granger et al., (2002) for a good introduction to the topic. CLCs are electronic collections of text from language learners and can make an important contribution to SLA and in particular to the development of grammar checkers (Granger (2002) provides a fuller definition based on Sinclair (1996)). CLC can also be used in Foreign Language Teaching (FLT), which aims to improve the helps the development of CLC. Also, the development of Corpus Analysis (CA) tools has facilitated the analysis of both Native Speaker Corpora (NSC) and CLC. Explicit design criteria are important in CLC and include learner and text-setting variables. Learner variables include learning context, L1, other foreign languages and level of proficiency. Task setting variables include time limit, use of reference tools, exam and audience. CLC may contain raw text or annotated data. Granger (2002) states that a CLC should be documented properly with regard to these variables. Information on whether the corpus is monolingual/bilingual, general/technical (e.g. Business English), synchronic/diachronic (i.e. use at a particular point in time vs. over a period of time) and written/spoken should also be provided. Granger (2003) notes that although the tagging process is onerous, the benefits are enormous.

Feature	Design Decision
What errors to check for	Common errors in structures that the students have learnt
Correction type	Correction proper
Feedback	Simple, clear, economic, non-threatening, sensitive.
Language of messages	English, non-technical
Extendibility	The system should permit the addition of new errors
Evaluation – type	Both subjective and objective
Evaluation – who	Teacher, students and researcher

Table 7.11 Design Decision Features for the CLICI Writing Checker Component

Once a CLC has been gathered, linguistic analysis can be carried out. Contrastive Interlanguage Analysis compares qualitatively and quantitatively Native Speaker (NS) and Non-Native Speaker (NNS) data or Non-Native Speaker/Non-Native Speaker (NNS/NNS) data. Computer-aided error analysis either focuses on a particular error type (e.g. syntactic structure) and uses software tools to check for it, or on error tagging the corpus. The first method is fast, and while the second one is more time consuming, it opens many more possibilities. CLC-based pedagogical research can contribute to curriculum and materials design and classroom methodology.

In the context of the CLICI project, it would not be possible to gather a CLC of any respectable size. However, as Granger has stated (2002), it would be beneficial to collate even a small corpus. This could provide insights into typical learners and also act as a starting point for future corpus development. With this in mind, it was decided that the texts submitted to the WCC would be saved into a CLC. In order to abide by best practice, it was important to seek the students' approval. As the students in this case were under 16 years of age, it was necessary to seek approval from the local Ethics Committee (in this case the Ethics Committee of Dublin City University), from the students themselves and, due to their age, from their parent or guardian also. The necessary documentation was submitted and approved by the Ethics Committee. Only those texts from students and parents who gave their consent would be stored in the CLC and all texts would be saved anonymously. Table 7.12 shows a summary of the characteristics of the CLICI CLC.

As no CLC existed to examine *Gramadóir* (Scannell's (2005) Irish grammar checker) in this respect, it was considered important to evaluate *Gramadóir* to see that it could check for typical errors from primary school learners., it was necessary to build one manually. This meant entering segments of text from the students' hand-written texts. Although they were mainly transcriptions from texts the teacher had written on the board or texts from their Irish book, there were also some free texts. In any case, there was a reasonable amount of errors for analysis purposes. Many of the errors re-occurred and only one example of each was entered.

Document Level

The system will store information on the users' texts (stores tracking information). Learners can navigate between items as they wish (navigates between items). The system will show the student text along with error messages and a list of spelling mistakes (shows scoring/evaluation).

Characteristic	CLICI CLC Value
Learner Variables	
Learning context	Classroom
Mother tongue	English
Other Foreign languages	None
Level of proficiency	Beginner
Age Group	Primary school
Task-setting Variables	
Time limit	20 minutes (approx)
Use of reference tools	None
Exam	No
Audience	Student, teacher
Other characteristics	
Monolingual/bilingual	Monolingual
General/technical	General
Synchronic/diachronic	Mainly synchronic
Written/spoken	Written

Table 7.12 Characteristics of Proposed CLICI Computer Learner Corpus

Item Level

The system will process the learner's text (processes input), evaluate it for grammar and spelling errors (evaluates input) and store the text (tracks item). The student will input free-format text to the system (inputs answer). The system will provide feedback to the learners on errors in the text (generates simple feedback). A summary of the conceptualisation phase is shown in Table 7.13.

		Item level (Individual questions)	**Document level (Exercises)**
System		Tracks item Processes input Evaluates input	Stores tracking information
User Input	Learner	Inputs answer	Navigates between items
System output to	Learner	Generates simple feedback	Shows document Shows scoring/eval.

Table 7.13 Conceptualisation Phase Table for the Writing Checker Component

Writing Checker Component –Specification Phase

Back-End Specification

The WCC must provide a wrapper around the external grammar checker and output feedback in a suitable format for the learner. The system must be able to take in general rules (i.e. externally supplied rules that apply to all learners) and local rules (i.e. specific to the target learner group) and use them to provide appropriate error messages to the user. If the general rules are provided by an external source, the errors it detects and reports along with its messages must be processed and converted to messages that are comprehensible by the target user where appropriate. It should be possible to add local rules to the system. Once the WCC has processed the input, it will provide appropriate error messages (if any) to the learner. An overview diagram is shown in Figure 7.8. It shows the interaction with the learner, the teacher and external data sources with the WCC. The teacher provides pedagogical input to the system by specifying what errors are reported to the learners. Figure 7.9 shows a simplified diagram of the flow of information for the WCC. More details on the interfaces are shown in Figure 7.10. A detailed specification is shown in Figure 7.11, while Table 7.14 provides accompanying information.

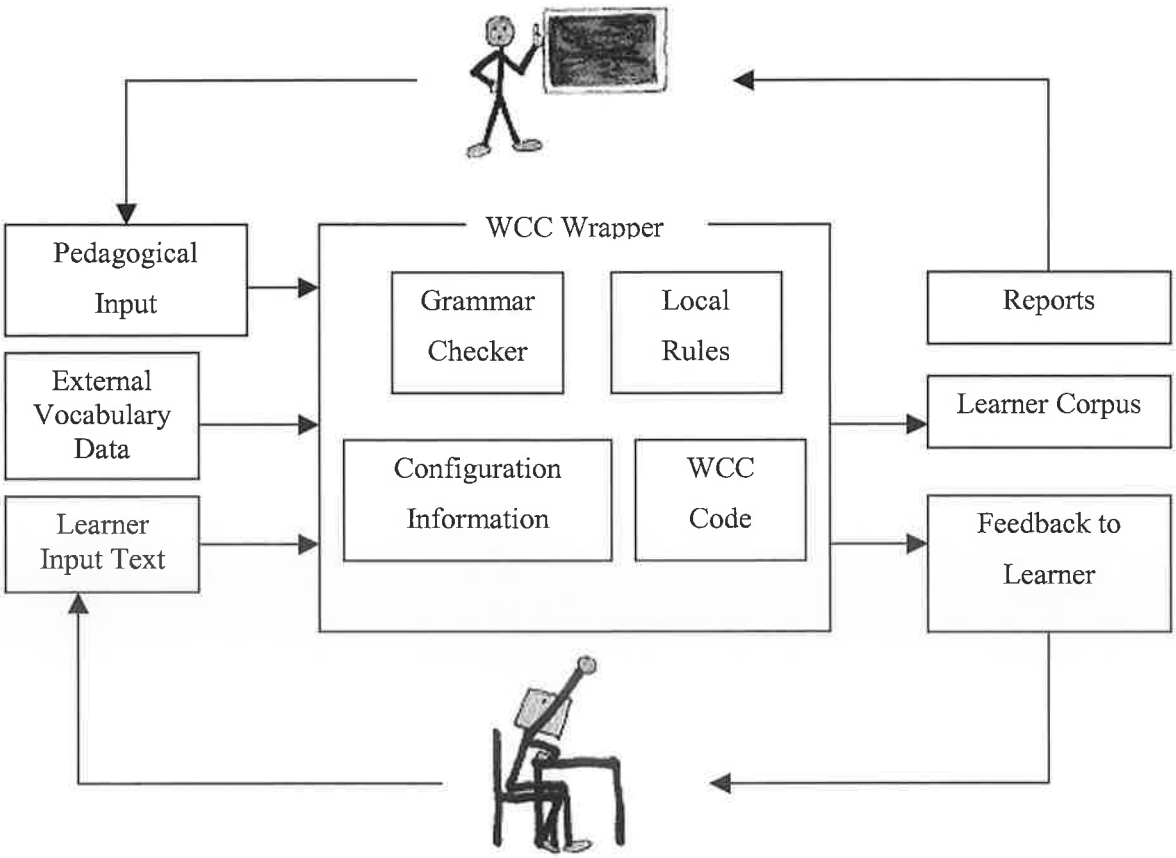

Figure 7.8 Overview of the Writing Checker Component

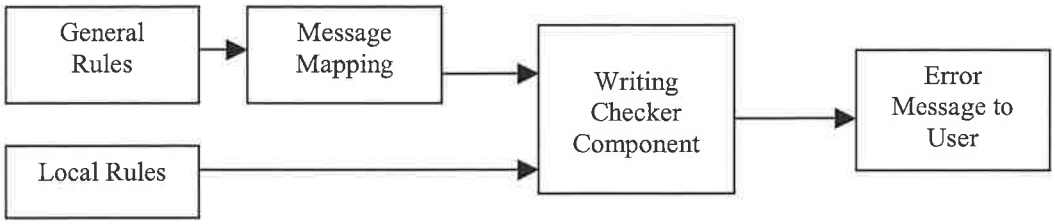

Figure 7.9 Information Flow for the Writing Checker Component

Figure 7.10 shows the externally supplied files to the WCC. The Irish FST Morphology Engine (Uí Dhonnchadha, 2002) [FST Engine] provides verb data to the VCC which in turn produces verb data [Verbs] that is available to the WCC. The text from the lessons [Text] is processed by a dictionary tool [Dict Tool] to produce a (small) dictionary file [Dict] that can be used by the WCC. Language-specific information is provided by the error configuration file [Error Config], the particles file [Particles], the list of error messages [Error Msgs] and a special characters file [Special Chars]. The learner's input text [User Text] is processed by the WCC, providing feedback [Error Report] and saving the data [File] for use in a learner corpus [Learner Corpus] and for later analysis [Analysis].

Figure 7.11 shows the internal modules of the WCC. The language information [Lang Info] represents the language-specific information shown in Figure 7.7. The [Textbook] and [Dict] are as in Figure 7.10. The student's input [User Text] is fed into the WCC to produce spelling errors [Spell Msgs] and grammar errors [Grammar Msgs]. The input text is checked for general errors by *Gramadóir* (Scannell, 2005) [*Gramadóir*] and local errors by locally specified code [Local Errors]. The *Gramadóir* errors are split into grammar errors [Gram Err] and spelling errors [Spell Err]. The grammar errors are analysed for false positives [False Err], errors that need to be reassessed and a different error analysis reported [Adapted Corr], messages that need to be localised for the target learner group [Map Msgs] and errors that are to be copied without changes [Copy Msgs]. The spelling errors are split into spelling errors with a suggestion for correction [Spell Errs] and those without a suggestion [Unknown word]. The spelling errors are errors reported by *Gramadóir* (Scannell, 2005) that are classified by the WCC as being spelling errors (see Appendix F for a complete list). In many cases the decision as to whether a given error is a spelling or a grammar error was straightforward (e.g. if *Gramadóir* (Scannell, 2005) offered an alternative spelling, the error was deemed to be a spelling). In other cases, knowledge of the deployment context was used to classify errors. If *Gramadóir* (Scannell, 2005) reports an [Unknown word], the WCC checks for the word in a small local dictionary (n = xx) and uses the Levensthein algorithm to offer a suitable suggestion to the learner. The local error checking code [Local Errors] checks for punctuation errors [Punc] and other errors [Other Errors]. The punctuation error code checks for capitalisation errors [Capital Errs].

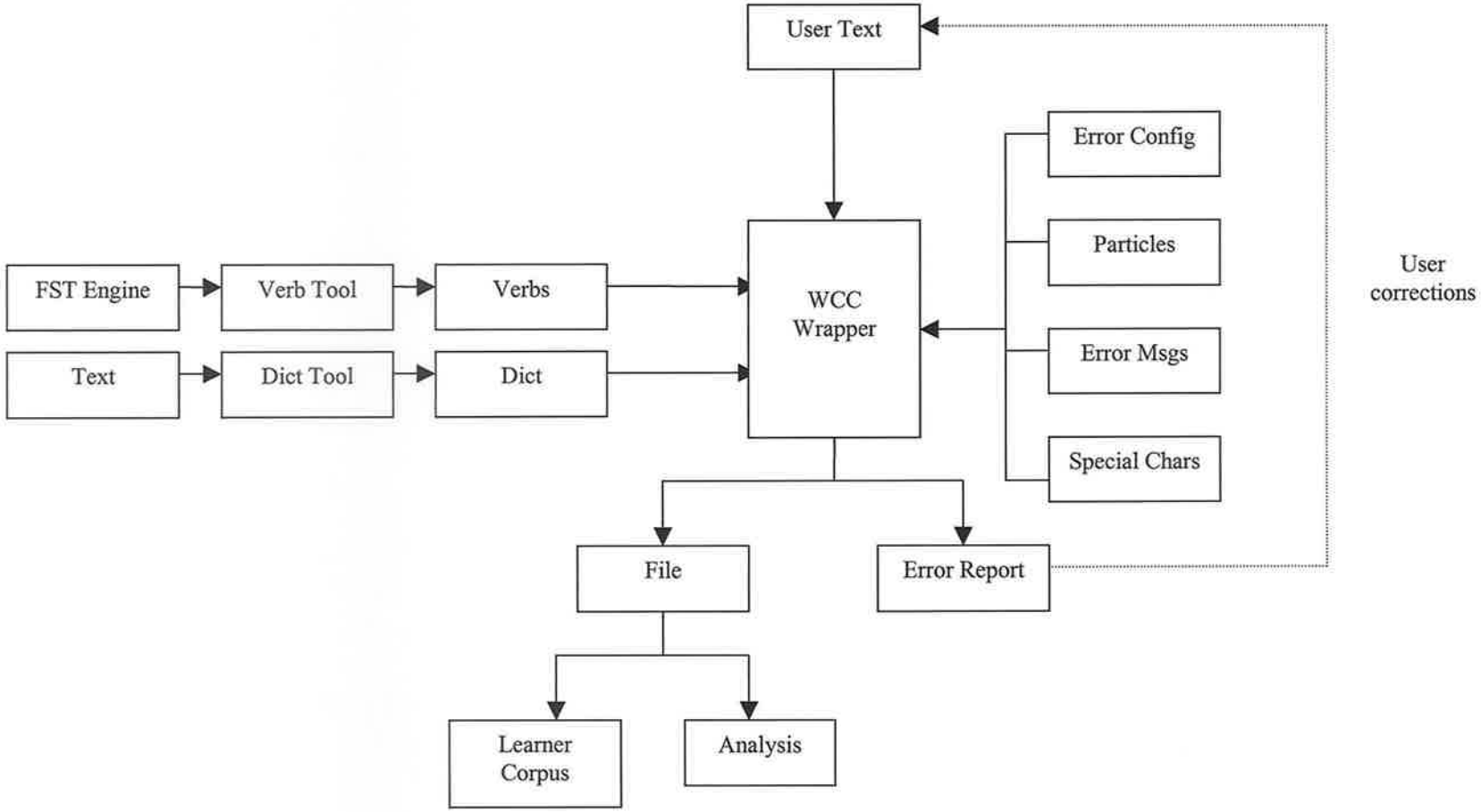

Figure 7.10 Interface to the Writing Checker Component

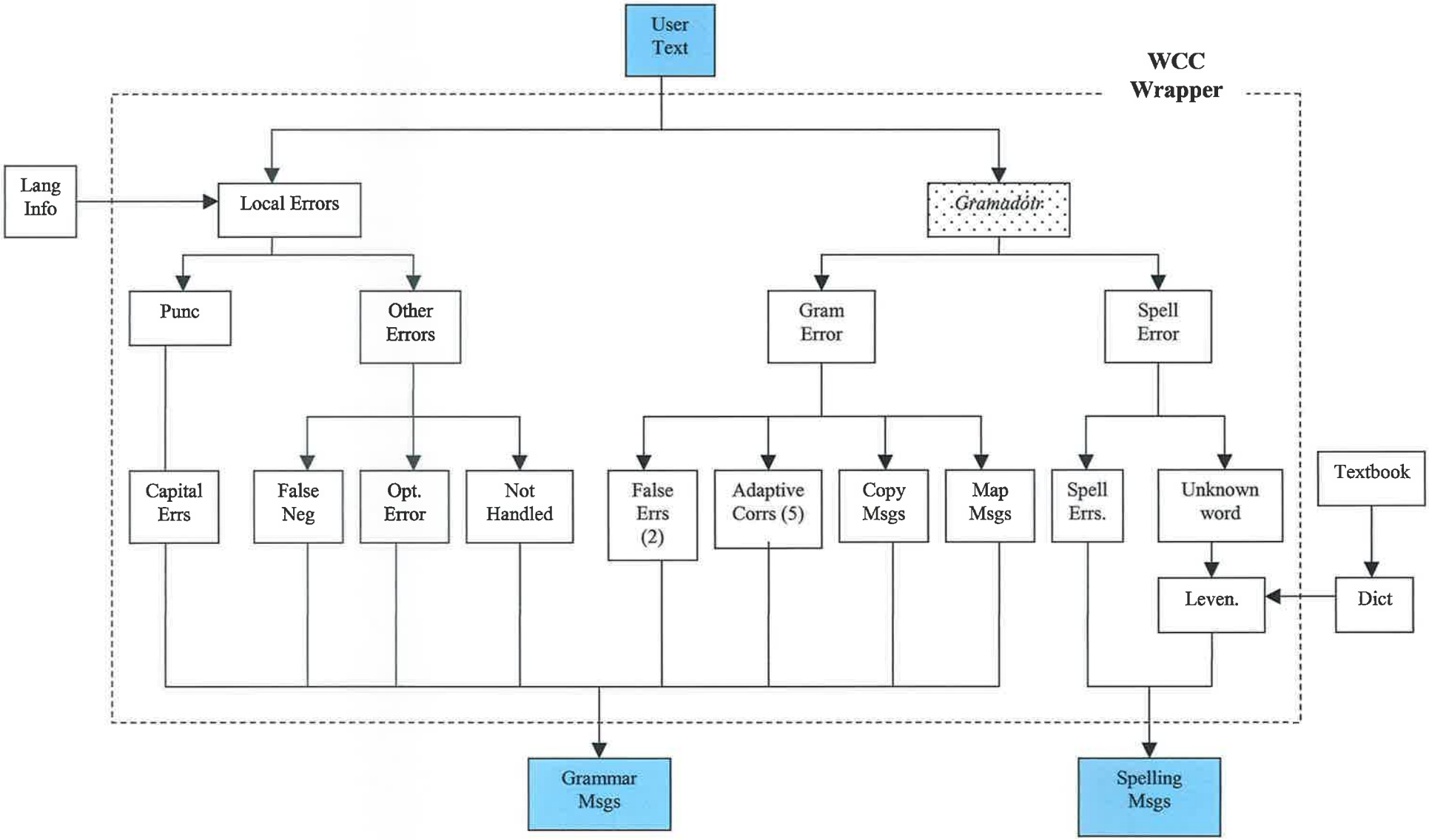

Figure 7.11 Specification for the Writing Checker Component

Item	Information
User Text	Text entered by the learner
Gramadóir	A grammar analysis tool for Irish (Scannell, 2005)
Gram error	Grammatical errors
Spell Error	A error judged to be a spelling (as opposed to a grammatical) error
Textbook	The textbook used by the target group of students
Lang info	Language information (including verb information and particles)
Learner corpus	A corpus of selected learner sentences (obtained from the learners' workbooks)
False Neg	False negatives i.e. errors not detected by *Gramadóir*. There are 2 of these errors detected.
False Errors	Errors reported by *Gramadóir* that are not errors.
Adapted Corrections	Errors reported by *Gramadóir* that have been reassessed and a different error analysis reported to the learner.
Leven.	Levenshtein algorithm. This algorithm calculates the distance between words (in this case between the user's word and those in the dictionary)
Dict	Dictionary. This is a dictionary extracted from the students' textbook.
Punct	Punctuation errors. Currently 1 detected.
Gram	Grammatical errors. Currently 21 detected.
Map Msgs	Mapped messages. These are error messages that have been reformulated for the target user group.
Grammar Msgs	Grammar Messages. These are the grammar error messages that are reported to the user.
Spelling Msgs	Spelling Messages. These are the spelling errors messages that are reported to the user.
Other spelling errors	All spelling error messages that are not of the type "Unknown word".
Unknown Word	Spelling error messages of the type "Unknown word"
CLICI Wrapper	The software wrapper around *Gramadóir*.

Table 7.14 Information for Modules in the Writing Checker Component Specification (Figure 7.11)

The other errors include errors not detected by *Gramadóir* [False Neg] and optional errors [Opt Error] (e.g. check for two verbs together – an error sometimes produced by the target learner group). There is also a facility to detect errors but not provide any explanation of the error [Not Handled].

Front-End Specification

The front end will have links to the other components of the system on the left-hand side of the screen. The student text that has been entered by the student will be shown at the top of the screen, with separate panels for system feedback, grammar errors and spelling errors (see Figure 7.11). This is consistent with the VCC Front-End specification (see Figure 7.7).

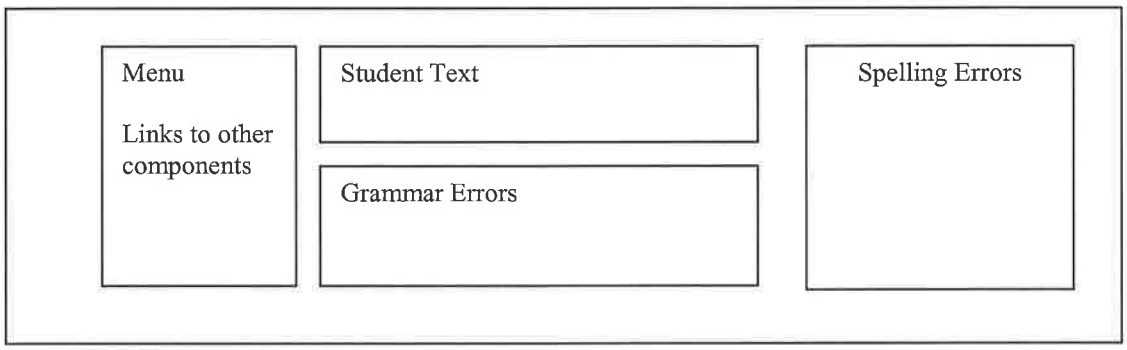

Figure 7.12 User Interface Specification for the Writing Checker Component

Writing Checker Component – Prototype Phase

A prototype phase was required for the WCC. From a pedagogical point of view, it was not clear if the proposed system would be useful, usable or even of interest to students from the target group. From a technical point of view, it was necessary to see if a suitable Writing Checker engine (i.e. a parser) could feasibly be developed or reused given the time and financial resources available to the project.

Pedagogical Issues

Although a prototype could not conclusively answer the pedagogical questions that exist in relation to providing a Writing Checker for primary school students, it could at least throw some light on the issues. Would the students understand the concept of the system? Would they be able to use it? Would they understand the feedback? Would they actually use it? Would it be beneficial for them to use it? Would they enjoy using it? In the context of the CLICI project, where the students may have an ambiguous attitude to the language and may not enjoy studying it in class, a CALL resource in this area might be of interest to them.

Technical Issues

There were two alternatives in terms of the Grammar Checking underlying engine – either develop one from scratch or use an existing one. Definite Clause Grammars (DCG) are relatively easy to implement in PROLOG and can be fast and precise (Allen, 1995). A small-scale prototype was developed as a possibility for the developing an engine in the WCC. DCG are good for dealing with agreement errors, although Matthews (1993) suggests that this may not be the most frequent type or learner error. Research has shown that lexical errors seem to be the most common (James (1998) and Singleton (1999)). Although there is a corpus of Irish

(NCI, 2005), there are currently no corpora of learner Irish for primary school students. If the 'develop from scratch' option was chosen, a process would have to be undertaken to determine what learner errors were common in the target group. Obviously, primary school teachers would have insights into the common errors based on their classroom experience, but they would still have to be documented and analysed. The other alternative was to reuse an existing grammar checker – in this case Scannel's (2005) *Gramadóir* was a possibility. Although Vandeventer Faltin (2003) mentions that using other people's software means that some compromises must be made, there are several advantages to reusing software if it is appropriate. These include availing of an already developed and tested resource, which frees up time to focus on other project specific issues. In the case of the CLICI project, one of the aims was to test the feasibility of reusing already existing resources, and therefore, using *Gramadóir* as the engine for the WCC seemed to be a good option. Furthermore, *Gramadóir* provided fairly comprehensive error checking for Irish, and certainly much more than could possibly be covered using a DCG during the lifetime of the CLICI project. In order to test the feasibility of using *Gramadóir*, it was necessary to check that a wrapper could be placed around it and that it could actually be used and combined with system-specific software to produce a suitable writing checking system. Although *Gramadóir* has a facility whereby the developer can make modifications to the system, in keeping with the aim of reusing other people's software, it was decided to use *Gramadóir* as a black-box i.e. to take it as it is without looking or trying to modify the internal code.

A prototype system was developed which provided a wrapper around *Gramadóir*. It used *Gramadóir* as the underlying grammar checker and combined its output with a User Interface that would be suitable for younger learners. Initial designs were discussed with the teacher using simple paper-based drawings, to explain the concept and to see if both the teacher and the developer had the same understanding of the proposed system. There were several technical difficulties that had to be overcome during the development of the prototype (mainly to do with the installation of the appropriate software on the target machine), which served as a good test from a technical point of view as to the feasibility of using *Gramadóir* in a larger system. The prototype was installed and tested by students from the target group and teacher feedback was also sought. The feedback from the students was very informative. They made suggestions with regard to the layout, mainly about the need to be able to resubmit corrected texts and to make the error messages easier to see. It also became apparent that the language of the error messages would have to be changed. *Gramadóir*'s error messages were aimed at linguistically-aware adult writers and were not appropriate to young learners who were not familiar with linguistic terminology. Furthermore, it was difficult for the students to pick out the spelling errors from other errors and a mechanism would be required for the system to separate the two types of errors automatically, and to display them on different parts of the screen.

Another facet of the prototype phase of the WCC was the ability to gather a very small learner corpus. This was beneficial for future development as it provided an indication of the type of language and level that the students would use. It also provided an opportunity to analyse the user input in detail and to check the error messages produced by *Gramadóir* to see if they were suitable. This highlighted the need for a slightly larger learner corpus that could be analysed to see what errors occurred, which ones should be reported and which ones could be ignored for the target learner group. Anonymous representative texts from student copies were typed into the computer and analysed. This information was used to improve error detection and the error messages. It revealed the fact that *Gramadóir* reported some false positives (i.e. reported errors that were not really errors or errors that were not relevant to the target learner) and some false negatives (i.e. it did not detect some learner errors).

Overall, feedback from the teacher and students was positive and it was decided that it would be worthwhile to go on and develop a larger system. A summary of the prototype phase is shown in Table 7.15.

Question	Explanation
Why	• To check if the proposed WCC would be useful and usable by the target group. • To check if the proposed system would be technically feasible.
How	A prototype system was developed which put a wrapper arouind Scannell's (2005) Grammar checker for Irish and combined it with a User Interface in which the students could type in their own texts and check the correctness of their input.
Testing	Students from the target group tested the prototype which underwent several revisions, mainly in how the errors messages were displayed and the screen layout.
Findings	• There was a need to convert the adult learner-oriented language of the Grammar Checker's error messages to language more appropriate to younger learners. • There was a need to separate out spelling errors from other errors. • There was a need to be able to correct and resubmit a text. • There was a need to improve the screen layout so that more information could be viewed at once and to minimise scrolling. • There was a need to review the errors detected and not detected by the Grammar Checker and to make the necessary adaptations.

Table 7.15 Information on the Prototype Phase of the Writing Checker Component

Writing Checker – Learner Corpora and Error Analysis

As stated above, there was a need to gather and analyse texts from the target learner group. Although there was an Irish corpus available (NCI, 2005), it was a collection of (correct) texts from previously published sources. At the time of the prototype development, there was no electronic corpus of leaner texts available, let alone texts from younger learners. Two corpora were assembled, one from the students' copies and one from texts submitted to the WCC prototype. A comparison was made between the text in the students' copies, the CLICI texts, the language used in a representative sample from one of the classroom textbooks and the National Corpus of Irish (NCI, 2005). It was interesting to note that "*an*" (the definite article "the") was the most frequent word in the textbook and corpus of texts from the students' copies. "*mé*" (me) was the most frequent word in the CLICI corpus, closely followed by "*an*". This was probably due to the fact that the texts in the CLICI corpus were student compositions, in which they could write whatever they wanted and so they tended to talk a lot about themselves. Details of the corpus analysis are shown in Appendix C – Irish Corpora Comparison.

Texts from both corpora were passed through *Gramadóir*. Errors were then classified by type. If the *Gramadóir* error message was correct and suitable, it was left unchanged. If the error was correctly detected, but the text of the error message was unsuitable, a more appropriate error message was created. If an error was detected but deemed not important or relevant for the target group, it was to be filtered out. If an error was incorrectly reported, it had to be blocked. If an error was not reported, a suitable error check and related message would have to be added to the system. Appendix D Mapped Error Messages shows the original *Gramadóir* error messages and their CICLI equivalent learner appropriate versions. Table 7.16 shows a sample of each error type. A full list of errors tested is shown in Appendix E – Errors Detected.

Gramadóir (when called from the command line as in the CLICI project) has no concept of the difference between a spelling error and a grammatical error (although internally it does distinguish between them). Indeed, often the categorisation of an error is subjective. However, as the prototype stage with the learners demonstrated, there was a need to separate out the reporting of the two types of errors. In order to achieve this separation, the error messages reported by *Gramadóir* were analysed for spelling/grammar error categorisation purposes. There were eight different error message types that could be classified as spelling error messages. Table 7.17 shows some examples. The table lists the key error phrase reported by *Gramadóir*, a sample sentence, the source of the sentence, the full error message reported by *Gramadóir* and the proposed error message from CLICI. Note that CLICI opts to display "???" when an unknown word is encountered, rather than report a message that would be difficult to

understand for younger learners. A more comprehensive list is provided in Appendix F – Spelling Error Messages.

Error Type	**Text**	***Gramadóir* Error Message**	**Expected Error**	**New Error Message**
Gramadóir error OK	Tá bosca beag agam ach tá níos bosca lú agat..	`Usually used in the set phrase /níos lú, is lú/`	As expected	Usually used in the set phrase /níos lú, is lú/
Gramadóir error OK, but msg not suitable	Tá trí gloine atá an mbord.	`Unnecessary eclipsis`	As expected	Maybe you should have **ar an mbord**
Error detected, but should be ignored	Shuigh Ciara agus Maire sa suite ar an tolg.	`It seems unlikely that you intended to use the subjunctive here (Maire)`		
Error incorrectly detected	Fuair **Ríona** páipéar.	`Unnecessary use of the genitive case`		
Unreported error	Shuil Eoin isteach seomra folctha.			Maybe you should have **sa** after the word **isteach**

Table 7.16 Error Types and Proposed Changes

7.9 Concluding Comments

Design is a complex process and it is useful to undertake it in a systematic manner. Colpaert's (2004) model serves this purpose. Clearly stating the design space as advocated by Levy (1999)

helps clarify design decisions, not only for the external reader but also forces the designers to be explicit about the assumptions. The effect of putting a lot of effort in the Design Phase means that clear information is available to developers about *what* is required, but not necessarily *how* to provide it. Although technology does have an impact on design, the ADDIE model tries to avoid technology-driven design. Thus, in the Development Phase the developers can decide what technologies are most appropriate for the specifications provided by the designer.

Error Phrases	Example	Source	*Gramadóir*	CLICI
Do you mean	Nior tharraing sé	Learner	Do you mean /níor/ ?	**Níor**
Unknown word	Torraing	Learner	Unknown word	**???**
Not in database	Picture	Learner	Not in database but may be a compound /pic+túr/?	**???**

Table 7.17 Key Error Phrases for Spelling Errors

Advantages and Disadvantages of Using Colpaert's Model

Colpaert's model was designed specifically with CALL in mind and therefore the advantages should outweigh the disadvantages in this context. The model is well-structured and the boundaries of each phase are clear. The output of one phase feeds into the next phase in a logical manner. In terms of design, the concept design stage of the Design Phase is especially useful in the CALL context. It is comprehensive and iterative in nature. Checking the concept design activities (personas, practical goals, scenarios and system tasks) against the usefulness criteria is beneficial. Evaluation is often not considered at the Design Phase in CALL and this can lead to weak evaluation in CALL (e.g. Felix, 2005). However, Colpaert's model explicitly includes evaluation in the Design Phase and forces the designer to think about evaluation before the development process begins. The model also seeks to involve the users (in the CLICI context, mainly the teacher) in the design process. While this may seem obvious, it may not always be the case. The real-world knowledge and experience that the teacher brought to the process was invaluable. For example, while the designer may have thought that the use of a computer laboratory was the preferred or 'better' option, the logistics involved meant that it was not really feasible to do so for the CLICI project.

There are several disadvantages in using Colpaert's model, but in reality, they could apply to almost any comprehensive design model. The model as presented by Colpaert is logical, but may present some difficulties when actually trying to map the model to a real-world situation. For example, the author had to re-read the documentation (Colpaert, 2004) several times before understanding the delineation between the different levels at the concept stage (application, modus, documentation and item) and how they mapped to the CLICI process (even though they were clearly presented in documentation). At a high level, the model is easy to understand, and the division of the design process into conceptualisation, specification and prototyping phases makes sense. To a non-technical CALL person, the details may seem complex, but they are no more detailed that other design models and the model gives quite a degree of freedom to the designer. For someone working on a small-scale project, the model might seem too comprehensive and demanding. However, this is not really the case and anyway, it is possible to pick those elements of the model that are appropriate to the project under consideration and focus on them. How the model is actually used (e.g. strictly adhered to or used as a guide only) will depend on project specific factors and it is up to the designer to decide on which point on the continuum the model will best suit the project. Table 7.18 lists these advantages and disadvantages.

Advantages	Disadvantages
1. Well-structured	1. Initial difficultly in mapping of model to real-world situation
2. Concept design stage is comprehensive and usefulness criteria checking worthwhile	2. Slightly complex at a detailed level
3. Considers both user knowledge and evaluation from an early stage in the project lifecycle	3. Too comprehensive

Table 7.18 Advantages and Disadvantages of Colpaert's Model

7.10 Summary

This chapter looks at the Design Phase of the CLICI project. The link between analysis and design is discussed in Section 7.2, which also refers to Levy's (1999) design space distinctions. The high-level design questions raised by Colpaert (2004) are discussed in Section 7.3 and his conclusions are concurred with. Section 7.4 outlines his design model with its three sub-phases: conceptualisation, specification and prototyping. The application of this model to the CLICI project is described in Section 7.5. The design sub-phases (conceptualisation and specification) are detailed for the Lesson Generator Component (LGC) in Section 7.6. Section 7.7 looks at the sub-phases of the Verb Conjugation Component (VCC), which included a prototype stage. The sub-phases for the Writing Checker Component (WCC) are explained in Section 7.8. This section also provides information on grammar checkers in language learning and a brief overview of Computer Learner Corpora (CLC). Section 7.9 gives some concluding comments.

Chapter 8 Development + Testing

8.1 Introduction

This chapter reviews the development and testing of the CLICI software. Section 8.2 looks at the development principles adopted during the project and highlights the importance of testing. The overall architecture is discussed in Section 8.3. Section 8.4 reviews the development of the Lesson Generator Component (LGC), while Section 8.5 explains how the Verb Conjugation Component (VCC) was developed and tested. The programming logic behind the Writing Checker Component (WCC) and the testing of the WCC software is presented in Section 8.6. Concluding comments are given in Section 8.7, while Section 8.8 provides a summary of the chapter.

8.2 Development Principles

The output of the Design Phase is a specification of the project requirements and the rationale behind these requirements. It does not specify how the requirements should be implemented at a technical level. Technical decisions are made in the Development Phase and are informed by the developers' experience and knowledge as well as insights gained with any project prototypes. Some of the basic development principles adopted during the CLICI project were those from the field of software engineering e.g. modularity, generality and anticipation of change.

Given the intended deployment setting, i.e. the primary schools that have their calendar fixed by the Department of Education, it was important that basic project management techniques were used to ensure that project deliverables were ready for the school year and terms. There is sometimes a tendency in CALL software to include features that are not strictly necessary, but are interesting and doable from a development point of view. These features have been avoided in the CLICI project. Development details of the three components are given in the Sections 8.3 to 8.5 below. In Colpaert's ADDIE model, this phase is called the Development Phase, but as he points out, it also includes testing. Colpaert outlines 8 stages of testing that the DIDIASCALIA team carry out and these are shown in Table 8.1. DIDIASCALIA produce market-ready CALL products and this is reflected in the level of testing it carries out. CLICI project testing involved routine checking, content implementation, beta-testing and research evaluation. Testing details for each component are provided in the relevant sections in this chapter. Many of the programme files are quite small. Some developers may consider them to be too small and that larger files with more functionality would be better. However, based on previous software engineering experience, smaller files are easier to modify and maintain, and usually produce loosely coupled code with tight cohesion (desirable software characteristics). Smaller files are also suitable for multi-person teams, and although only one developer was actually involved in the project, it is good practice to work with small independent units.

Testing Type	Summary
Pre-testing: specification checking	This is similar to prototyping, where developers can judge feasibility and can try to foresee conflicts between linguistic, didactic and technical specifications.
Testing 1: routine checking	Each individual routine is checked by the programmer.
Testing 2: content implementation testing	Combined elements of the system are tested together.
Testing 3: operational testing	This refers to debugging carried out by external users.
Testing 4: content testing	Native speakers check the linguistic content of the system.
Testing 5: beta-testing	The program is tested by real users in a real environment.
Testing 6: real world testing	The program is tested in the real world by buyers of the product.
Testing 7: research evaluation	Courseware evaluation can be used for research testing purposes

Table 8.1 DIDASCALIA's Testing Process (from Colpaert (2004))

8.3 Overall Architecture

The Design Phase specified that three components were to be developed: a Lesson Generator Component (LGC), a Verb Conjugation Component (VCG) and a Writing Checker Component (WCC). Each component is independent of the others, but ideally should be presented to the learner in an integrated fashion. Based on technical suitability, developer experience and knowledge, and existing resources, it was decided that XML (eXtensible Markup Language) technologies (XML, 2000) would be used in the CLICI project. They would be complemented by Perl to develop the required resources. XML technologies provide a clear separation between data, its processing and its presentation. This feature is very important and useful in software engineering in general and CALL artefacts in particular, where the ability to modify and adapt to individual learner needs may be required or desirable. XML technologies make it easy to structure data according to local needs. XML technologies are also non-proprietary – they are decided on by the World Wide Web Consorsium (W3C, 2006) which aims to get agreement of interested stakeholders while at the same time avoid the problems of proprietary standards. XML manages to combine the theoretical soundness of SGML without its complexity (XML, 2000). XML technologies are flexible and support Unicode (Unicode, 2007). XML technologies have become increasingly commonplace in recent years, including in the CALL domain (e.g. Ward, 2001; Cushion, 2003). Perl is a compact and powerful scripting language. It can be used for the data processing modules as well as the real-time engine behind the dynamic parts of the CALL resources.

The User Interface (UI) platform was not explicitly specified in the Design Phase, although basic outlines were provided. There are several issues to consider in UI design. These include consistency, the use of text, colour and font usage, information alignment and user control and freedom. The CLICI UI uses a common UI for most of the pages, with a menu panel in green on the left-hand side of the screen, a title clearly visible on the top of the page, puzzled-men for the games and sound icons where appropriate. It uses minimal, student-comprehensible text in Irish and 'error messages' to the students are framed positively. The system enables the students to navigate freely to avoid frustration. A web-interface was used for the CLICI project as it was a familiar one for the target users. A web page lends itself to the language learning process as it allows the incorporation of multimedia elements into a screen in an almost seamless manner. Thus, images and audio parts of language lessons can be easily made available to the learners. Links can be used to direct the learner to related information. Standard UI guidelines for web sites such as Nielsen (1996; 1999) and Bunday (2006) were followed. For example, Nielsen (1996; 1999) in his "Top Ten Mistakes" says that frames, scrolling text, long scrolling pages and non-standard link colours should be avoided. Bunday (2006) notes the need to conserve bandwidth, to keep graphics small and to make the site navigable. With these guidelines in mind, the CLICI UI avoided the Nielsen Mistakes and aimed to ensure easy navigation. In terms of the target audience, bright colours were used and clutter was kept to a minimum.

From a development point of view, the UI was easy to implement and fitted in with the XML technologies and Perl. The CLICI project runs on an Apache server (Apache, 2006) version 1.3.29, which hosts the static and dynamic web pages. The static pages are stored under the `htdocs` directory, while the dynamic pages are in the `cgi-bin` directory. The CLICI `tools` directory contains the Perl scripts for each of the components. The generated lessons and verb information are saved under the target language directory (i.e. Irish). Some run-time components of the VCC are stored in the `cgi-bin` directory, specifically those that relate to the run-time creation of web pages (e.g. the Championship exercise type – see Section 8.5). The WCC code and configuration files are stored under the `cgi-bin` directory. The tools directory contains some Perl libraries which contain code for common functions, as well as component specific code. There is a configuration directory which contains system configuration files as well as a global configuration file called `parameters.dat`. The overall project architecture is shown in Figure 8.1.

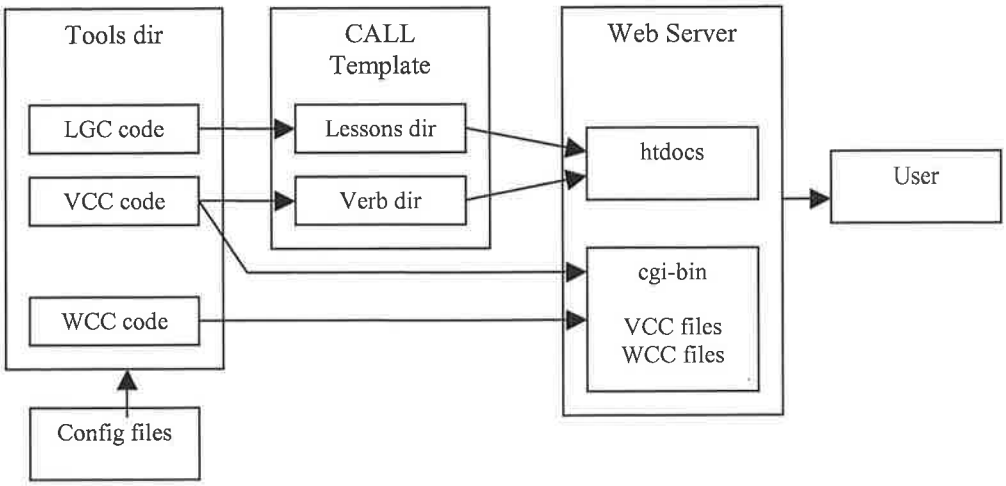

Figure 8.1 Overall CLICI Architecture

Documentation

There are three User Manuals provided with the CLICI system: the Learner User Manual (Appendix O), the Content Developer User Manual (Appendix P) and the Teacher User Manual (Appendix Q). Each of these manuals aims to provide the relevant usage information for a particular user group. The Technical Manual which provides technical information on the three components is shown in Appendix R. The CLICI system installation manual is given in Appendix S, while an overall introduction to the system is shown in Appendix T.

8.4 Lesson Generator Component

The overall aim of the Lesson Generator Component (LGC) was to provide a tool that would make it easier to develop CALL lessons and exercises using the CALL Template (Ward, 2001). The specification for the LGC was to put a wrapper around the CALL Template and provide the necessary code to create the required tool. No CL resources were used but the possibility of using NLP technologies to generate exercises might be explored at a later date. The CALL Template has four sub-directories for each lesson. The driver directory contains XML wrapper information, the generate directory contains the files to generate the html files, the source directory contains the data files (e.g. the lesson information) and the html directory contains the web pages. The LGC converts the flat data files into the required XML format for use in the CALL Template. The coding required was quite simple. Table 8.2 shows the LGC files and their function. Figure 8.2 shows the LGC architecture for the multiple-choice exercise. The other exercises (i.e. matching, mix-up sentence and gap-fill) follow a similar pattern.

Figure 8.3 shows a lesson that was generated using the LGC architecture. It uses the format of the CALL Template. The courseware menu is on the green panel on the left-hand side of the screen, the 'games' are on the top and the lesson content occupies the main part of the screen. There is a speech icon for the entire lesson, as well as one for each line of text.

File	Function
convertGen.bat	Calls createGen.pl
convertMatch.bat	Calls createMatch.pl
convertMix.bat	Calls createMix.pl
convertMulti.bat	Calls createMulti.pl
convertSection.pl	Calls createSection.pl
createGap.pl	Creates the gap-fill exercise XML file
createGen.pl	Creates the generate batch file
createMatch.pl	Creates the match exercise XML file
createMix.pl	Creates the mixed-up sentence XML file
createMulti.pl	Creates the multiple-choice exercise XML file
createSection.pl	Creates the lesson XML file
gap.pl	Extracts the gap exercise XML file data to a flat file format
match.pl	Extracts the match exercise XML file data to a flat file format
mix.pl	Extracts the mixed-up sentence XML file data to a flat file format
multi.pl	Extracts the multiple-choice XML file data to a flat file format
what.pl	Extracts the lesson XML data to a flat file format

Table 8.2 Lesson Generator Component Files

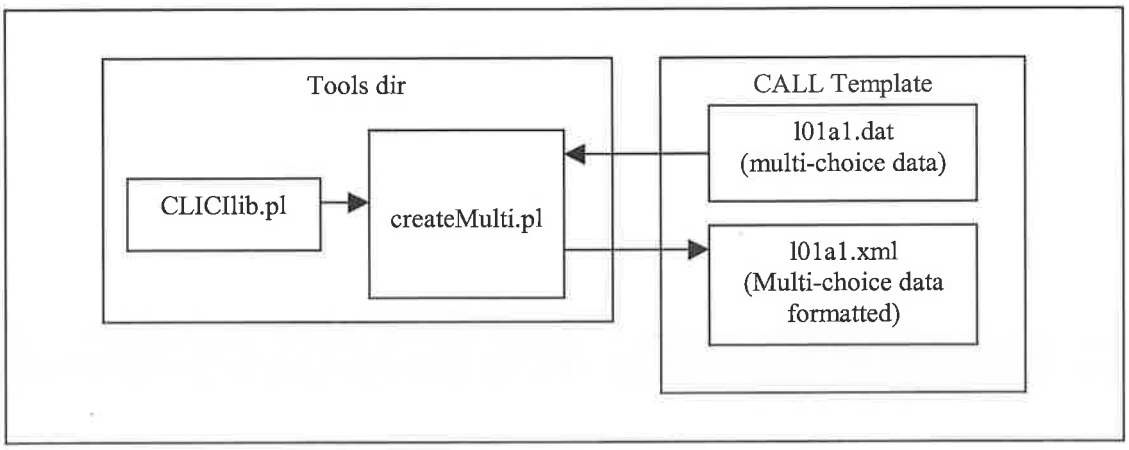

Figure 8.2 Lesson Generator Component Architecture for a Multiple-choice Exercise

Testing

A lesson and each exercise type (multi-choice, match, mix-up and gap-fill) were manually tested. The LGC source files were manually passed through *Gramadóir* to check for errors. The resources to create the flat files from existing XML files were also manually tested. To check

for reusability, tests were carried out on existing lessons and exercises from the Nawat CALL courseware (Ward, 2001). Table 8.3 shows a summary of development and testing for the LGC.

Figure 8.3 Screen Shot of CLICI Lesson

Component	Information
Purpose	Provide an authoring tool to aid the production of CALL resources
CL Resources reused	None
Software tools	CALL template (Ward, 2001)
Testing	Manually tested one lesson and each activity
Deployment Testing	Tested that the software worked as intended in the target environment
Difficulties	Deciding on the contents of the activities at a pedagogical level
Modular	Content developer can decide what components to include
Reusable	Used to develop Nawat material

Table 8.3 Summary of Development and Testing for the Lesson Generator Component

8.5 Verb Conjugation Component

The aim of the Verb Conjugation Component (VCC) was to display animated verb conjugation information and provide exercises, feedback and track student progress. The specification for the VCC from the Design Phase stated that the VCC should put a wrapper around three external resources (Irish FST Morphology Engine (Ui Dhonnchadha, 2002), animation code (Koller, 2004) and the CALL Template (Ward, 2001) to achieve this goal. In order to increase the prominence of the morphological changes required to the root form of the verb for a particular person/tense combination, it was decided to show the changes in red in the static viewing area

as well as showing them dynamically using Koller's (2004) animation code in the animation panel. Obviously, as the amount of information shown on the screen increases, the animation panel may not be aligned beside all the verb conjugation data and some scrolling may be required. A screen shot of the verb animation for *bris* (to break) is presented in Figure 8.4. The screen shot shows that a '*h*' is added to form the past tense of the verb. One part of the VCC was to convert an external data source (i.e. Uí Dhonnchadha's (2002) Irish Finite-State Morphological Analyser data) into the CLICI verb file format.

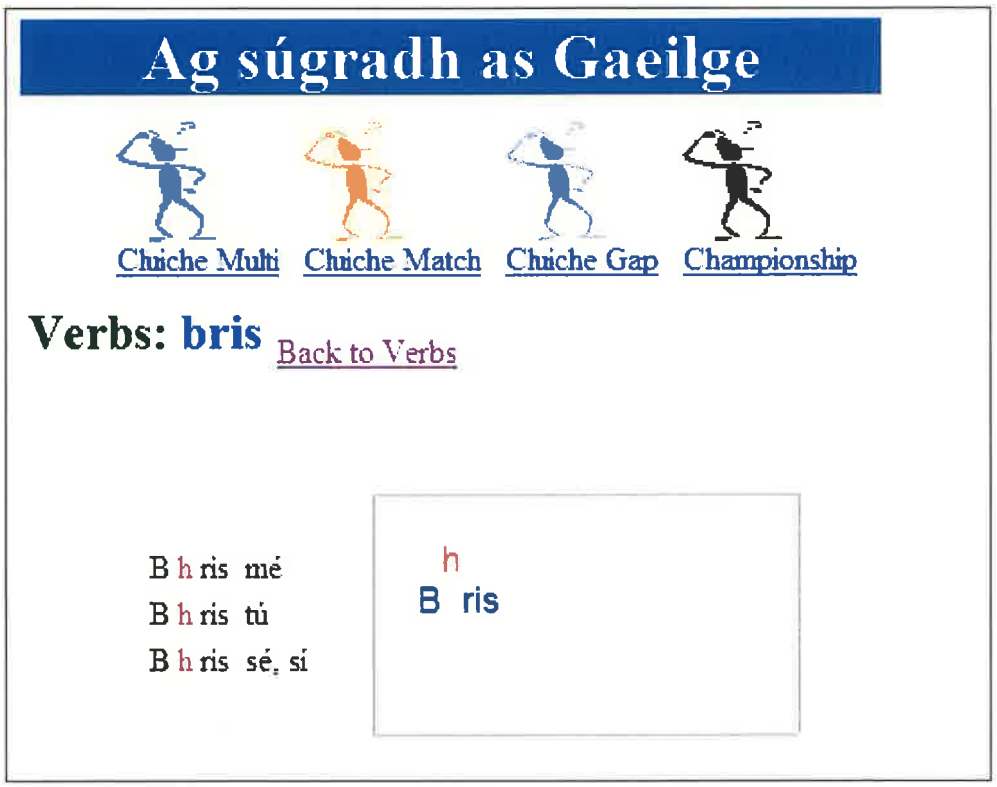

Figure 8.4 Screen Short of the Verb Conjugation Component

An overview of the programme logic is shown in Figure 8.5. Note that the VCC produces two files for each verb: one with xml formatted information and the other with flat file information. The principal part of the VCC was software to create verb display information automatically, as well as the associated exercises. These exercises are built upon Hot Potatoes (Holmes and Arneil, 1998) software (via the CALL Template) and consist of multiple-choice, matching, mixed-up sentence and gap-fill exercises. Figure 8.6 shows how the match exercise is automatically created.

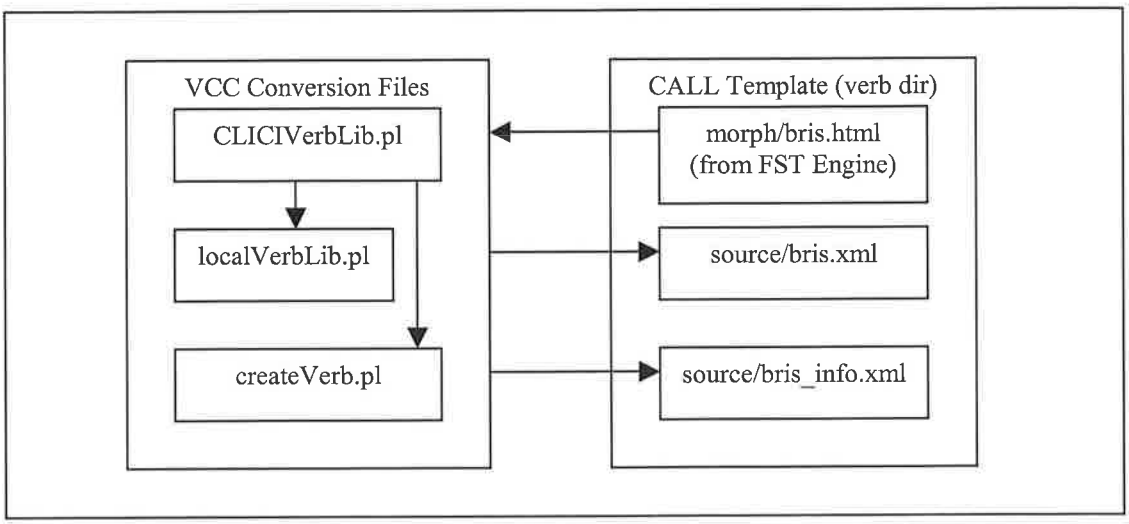

Figure 8.5 Verb Extraction Part of the Verb Conjugation Component

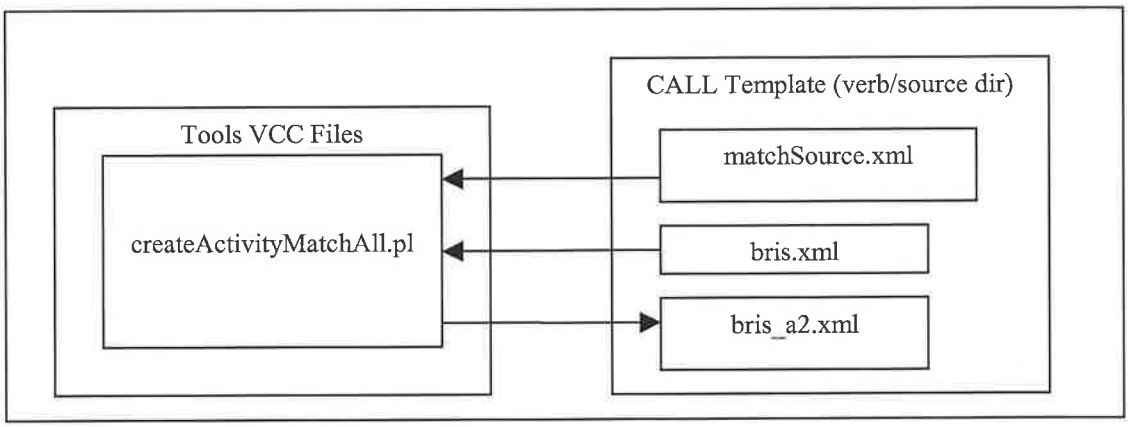

Figure 8.6 Automatic Creation of the Match Exercise File

A new exercise was added for the VCC. It uses a combination of multiple-choice and gap-fill questions. The html files for this new exercise type are dynamically generated and, in order to ensure flexibility and maintenance, the relevant section of header and other similar data is stored in the data files which are combined with the relevant verb data at run-time. The exercise reuses the questions from the multiple-choice files (e.g. `bris_a1_ans.txt`) and gap-fill files (`bris_a4_ans.txt`). In the context of the CLICI project, it is called the Championship (after the Championship competition for hurling and Gaelic football - two of Ireland's traditional and popular sports). Figure 8.7 shows a screen shot of the Championship exercise while Figure 8.8 shows a screen shot of the Championship answer page. The answer page shows the correct answer, alongside the student's answer. Figure 8.9 shows the architecture of the Championship part of the VCC. The students' responses are saved and the results are reported back to them, which shows their input together with the correct answers.

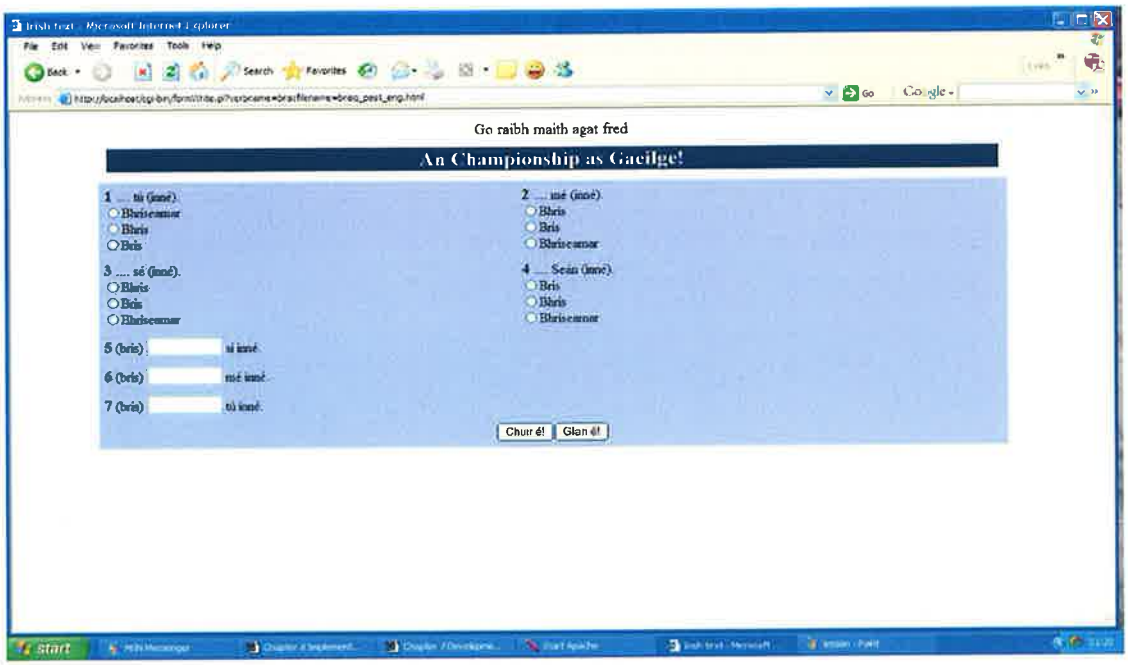

Figure 8.7 Screen Shot of the Championship Exercise Page

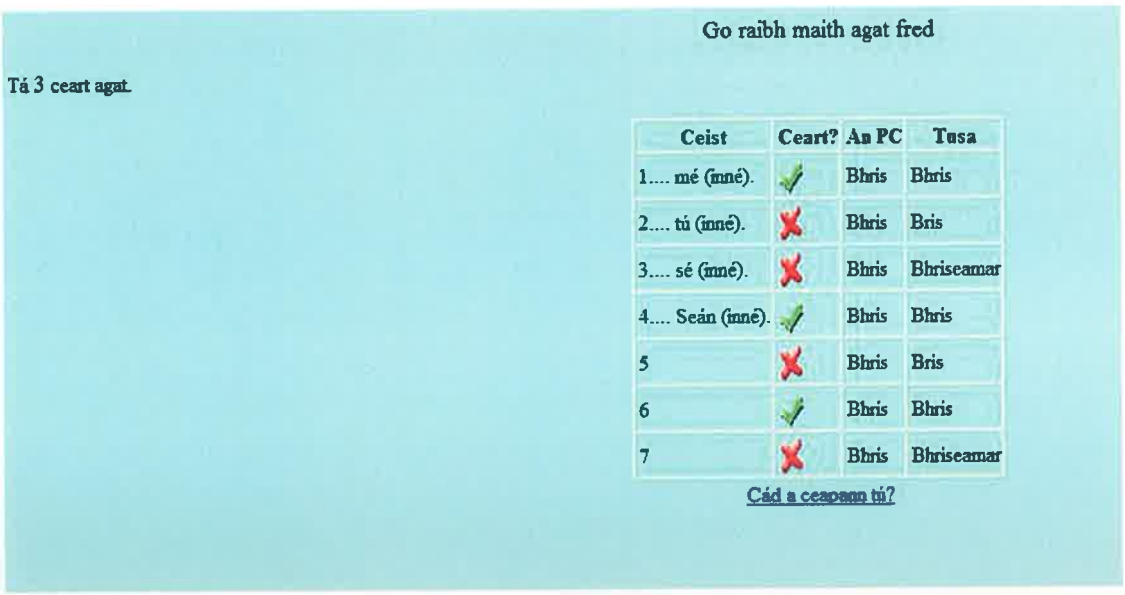

Figure 8.8 Screen Shot of Championship Answer Page

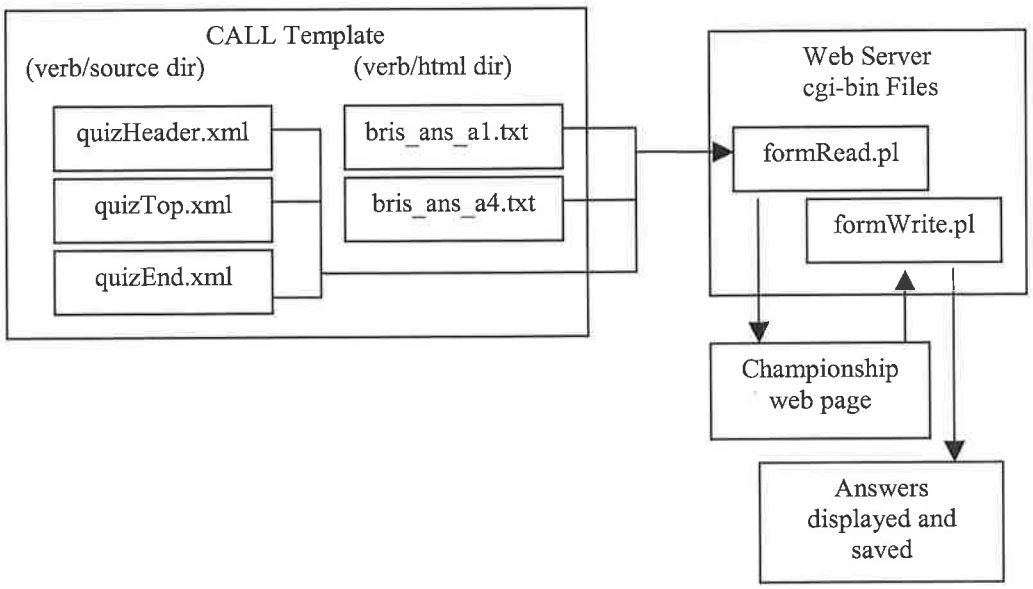

Figure 8.9 Automatic Creation of the Championship Exercise Page

The configuration directory contains three sub-directories: source, system and a language specific directory. The source directory contains `parameters.dat`, the global system configuration file. The system directory contains general header and wrapper information for the various VCC related files. The language specific directory (i.e. config/Irish) contains configuration files with language specific information. The contents of the three configuration sub directories are shown in Table 8.4. A list of VCC files and their functionality is shown in Table 8.5.

Several configuration files are used for flexibility. Each exercise type has its own configuration file (e.g. `matchSource` contains the configuration information for the gap-fill exercise). Figure 8.10 shows a portion of `matchSource.xml` which specifies the questions and answers to be automatically generated by the system.

Although one of the aims of the VCC was to animate the verb conjugation information, it was important to have the option to display only static information. This was accomplished by automatically producing a static and animated web page for each verb and allowing the teacher (or another person) to specify which format would be shown for the individual user. It should be noted that the animation was not automatically displayed when the learner opened the page. To activate the display, the learner had to place the cursor over the static information and click. The animation is then shown in the right-hand display panel. The animation feature used code developed by Koller (2004). He developed the `irish.swf` file which reads in the specified XML data at run-time to produce the animation. This means that once an XML file contains the

necessary data (i.e. Flash header code, the verb conjugation data in the required structure and code to call `irish.swf`), its information can be displayed dynamically. Figure 8.11 shows how this works. Previously, only precoded data could be used by flash code, which would not have been very desirable, and special thanks are due to Koller (2004) for researching the possibilities and developing the required code to dynamically generate Flash animations.

Directory	Filename	Purpose
source	parameters.dat	Global parameters for the system
language	parameters.dat	Local copy of parameters
	pronoun.dat	Pronoun information
	verbInfo.dat	Information on verbs (if required)
	verblist.dat	List of the verbs
	verbType.dat	Information on the verb type (if relevant)
system	end.dat	End text for xml wrapper file
	endDriver.xml	End text for xml driver file
	flashHeader.xml	Header text
	gapEnd.xml	End text for gap xml wrapper file
	gapHeader.xml	Header text for gap driver file
	gapSource.dat	Information for gap exercise
	gapTop.xml	Header text for gap xml wrapper file
	matchEnd.xml	End text for match xml wrapper file
	matchHeader.xml	Header text for match driver file
	matchSource.dat	Information for match exercise
	matchTop.xml	Header text for match xml wrapper file
	mixEnd.xml	End text for mix xml wrapper file
	mixHeader.xml	Header text for mix driver file
	mixSource.dat	Information for mix exercise
	mixTop.xml	Header text for mix xml wrapper file
	multiEnd.xml	End text for multi xml wrapper file
	multiHeader.xml	Header text for multi driver file
	multiSource.dat	Information for multi exercise
	multiTop.xml	Header text for multi xml wrapper file

Table 8.4 Files in the config Directories

The development of the VCC was not particularly difficult. However, an important feature of the development process was to avoid hard-coding data and to produce flexible, reusable software that was independent of any given verb structure and that was somewhat language

independent. The list of options available in the VCC is shown in Table 8.6. Also, there were some minor difficulties in parsing the verb information for irregular verbs from the morphological analyser (Uí Dhonnchadha, 2002) due to differences between the underlying linguistic reasons for the morphological changes required for conjugation and the learner/developer's intuitions.

File	Function
`createActivityGapAll.pl`	Creates the gap-fill exercise XML file
`createActivityMatchAll.pl`	Creates the match exercise XML file
`createActivityMixAll.pl`	Creates the mixed-up sentence XML file
`createActivityMultiAll.pl`	Creates the multiple-choice exercise XML file
`createDriver.pl`	Creates the XML wrapper file for the verbs
`createDriverGames.pl`	Creates the XML wrapper file for the games exercise
`createDrivers.pl`	Batch file to call each of the exercise driver creation files
`createGenGames.pl`	Creates the batch file for the games exercises
`createVerb.pl`	Main file for creating verb output files for the VCC
Libraries	
`CLICILib.pl`	Library of general functions
`myVerbLib.pl`	Library of Irish specific verb related functions
`CLICIVerbLib.pl`	Library of general verb related functions

Table 8.5 Verb Conjugation Component Files

```
quest|0|.... mé (inné).
ans|0|0|past_s1
ans|0|1|name
ans|0|2|past_p1
```

Figure 8.10 Portion of `matchSource.xml`

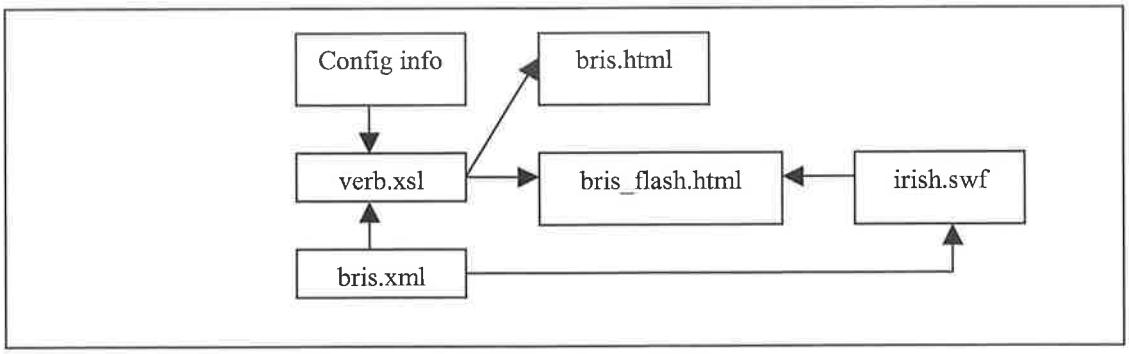

Figure 8.11 Static and Dynamic Verb Conjugation Architecture

Option	Explanation
Tense	Past, present and future
Person	1st, 2nd and 3rd person only or all persons
Language type	SVO (e.g. Nawat) or VSO (e.g. Irish)
Information	Positive, negative and question

Table 8.6 Options Available in the Verb Conjugation Component

Testing

Each part of the VCC was manually tested for a regular slender verb (*bris* (to break)) and a regular broad verb (*dún* (to close)). The fact that *dún* contains an accented character also enabled testing of accents. All 11 irregular verbs were manually tested for each part. A verb that does not change in the past tense was also manually tested (*leigh* (to read)). A summary of the components tested is shown in Table 8.7.

Component Testing	Testing
Verb extraction	To ensure the information was correctly extracted from the external source.
Verb page generation	To ensure that the web page was correctly generated.
Exercise generation	To ensure that each exercise was correctly generated based on options specified in the configuration files.
Static web page display	To ensure that the static web page was correctly displayed.
Dynamic web page display	To ensure that the dynamic web page correctly displayed the animation information.
Championship – display	To ensure that the correct questions were shown for the Championship exercise.
Championship – answers	To ensure that the correct answers were actually correct.
Championship – results display	To ensure that the results with the student's answers, the correct answers and the score were correctly displayed to the student.

Table 8.7 Testing for the Verb Conjugation Component

Deployment Testing

The static and dynamic verb html pages were checked in the target environment, i.e. on the machine that the students would actually use. A complete set of exercises (i.e. multi-choice, match, mix, gap-fill and Championship) were also tested for each verb type. One minor difference that emerged was that the screen size was smaller and the necessary changes were made to the software to accommodate this.

Software Engineering Testing

The software was also tested for configurability, modularity and reusability. Various combinations of tenses (past, present, future), forms (positive, negative, question), persons (singular, plural) and presentation modes (alone, within the CALL Template) were tested. In testing for reusability, the relevant verb pages were generated for Spanish verbs (a pro-drop language) and Nawat verbs (an Uto-Aztecan SVO Language). A summary of the features tested is shown in Table 8.8.

Person	Positive	Negative	Question	Source	Options
Irish (Celtic Language Family, VSO Language)					
Verb *bris* (to break)					
P1 P4	*Bhris mé* *Bhriseamar*	*Níor bhris mé* *Níor bhriseamar*	*Ar bhris tú?* *Ar bhriseamar?*	External [2]	P1, P2 and P3 only Past tense Positive, negative and question forms
Verb *téigh* (to go)					
P1 P4	*Chuaigh mé* *Chuamar*	*Ní dheachaigh mé* *Ní dheacamar*	*Ar dheachaigh tú?* *Ar dheacamar?*	External	(As above)
Nawat (Uto-Aztecan Language Family, SVO Language)					
Verb *chiwa* (to do)					
P1 P4	*Na chiwki* *Temet chiwket*	*Na tesu chiwki* *Temet tesu chiwket*	*Na chiwki ?* *Temet chiwket ?*	Generated [3]	All persons Past and present tense Positive and negative forms
Spanish (Romance Language Family, (S) VO Language - Prodrop)					
Verb *hablar* (to speak)					
P1 P4	*(Yo) hablé* *(Nosotros) hablamos*	*(Yo) no hablé* *(Nosotrs) no hablamos*	*Hablaste (tu)?* *Hablamos?*	Generated [4]	All persons Past tense Positive form

Table 8.8 Languages Testing in the Verb Conjugation Component

Notes:

1. The Nawat orthography is that proposed by King (2003), rather than Lemus (1997) which was used in the original Nawat language learning courseware (Ward, 2001).

2. Uí Dhonnachagh's (2002) Irish Finite-State-Transducer Morphology Engine was used as the source of verb conjugation information for Irish.
3. The verb conjugation information for Nawat was generated for the two main types of Nawat verbs (i.e. those that drop the end vowel and those that do not).
4. The verb conjugation information for Spanish was generated for *ar/er/ir* and some irregular verbs. A summary of development and testing for the VCC is shown in Table 8.9.

Component	Information
Purpose	Provide animated verb display for Irish
CL Resources reused	Irish FST Morphology Engine (Uí Dhonnchadha, 2002)
Software tools	XML/Flash animator (Koller, 2004)
Testing	Manually tested all 11 irregular verbs Manually tested 1 slender verb (*bris* (to break)), 1 broad verb (*dún* (to close)), 1 special verb in the past tense (*ith* (to eat)), 1 unchanging verb in the past tense (*léigh* (to read))
Deployment Testing	Checked both static and animated forms in the target environment Checked that the specified (i.e. static or animated) verb page was correctly loaded on login
Difficulties	There were some difficulties parsing the information from the Irish FST Morphology engine due to the differences between the linguistic reasons and the learner's/developer's intuitions
Modular	Content developer can decide on: - tenses (past, present, future) - forms (positive, negative, question) - persons (singular, plural) - presentation (alone, embedded in general framework)
Reusable	Used to develop Nawat and Spanish verb animation resource

Table 8.9 Summary of Development and Testing for the Verb Conjugation Component

8.6 Writing Checker Module

The specification provided by the Design Phase was fairly comprehensive and the architecture is as shown in Chapter 8. The WCC was to put a wrapper around *Gramadóir* as well as develop local code to produce the required WCC. The overall system logic or pseudocode of the WCC is outlined in Figure 8.12, while Figure 8.13 shows an expanded version for Irish.

Require textcheckLocal.pl (i.e. use the local error checking routines)

Read and process learner text

Depending on configuration options ....

- If External error checking on ... check for external errors
- if local error check on ... check for local errors

Display user text with grammar and spelling messages (if any)

Figure 8.12 Overview of WCC Pseudocode

Depending on configuration options ....

- read in error message conversion file
- If Gramadóir error checking on ... check for general errors
    - check if valid error message
    - use error map configuration file to convert *Gramadóir* error message to more appropriate message
- if local error check on ... check for local errors
    - check verb errors
    - check person errors
    - check verb *bíonn* errors
    - check *isteach* errors
    - check *go dtí* errors
    - check *sa* errors
- check punctuation errors
- check for spelling errors
    - convert *Gramadóir* error message if required
    - use Levenshtein algorithm (Merriampark, 2005) to find suitable word local dictionary if none suggested by *Gramadóir*
        - if levenshtein distance = 1, show suggestion as is
        - else if levenshtein distance = 2, show suggestion with '?'
        - else do not display suggestion
- display user text with grammar and spelling messages (if any)

Figure 8.13 Writing Checker Component Pseudocode (Expanded)

`textcheckGeneral.pl` contains the main system logic, while the context specific error checking is specified in the `textcheckLocal.pl`. Appendix R Technical Manual shows details of the required routines and error message arrays used by these files. *Gramadóir* does

not distinguish between grammar errors and spelling errors. However, the prototype stage for the WCC (Chapter 6) revealed that it was important for the users to see the two different types of errors reported separately. An error configuration file was used to classify *Gramadóir* errors as either spelling or grammar errors based on the error message text reported by *Gramadóir*. As many of the *Gramadóir* error messages were not appropriate for the target user group, it was necessary to convert them to more appropriate error messages. Some of the original *Gramadóir* error messages and their CLICI equivalent are shown in Table 8.10 (a full listing is given in Appendix D Mapped Error Messages). This is to avoid any inappropriate (i.e. overly formal or linguistically orientated) error messages being shown. In the event that an unknown error message is received from *Gramadóir*, the message "Humm, there might be an error here" is reported to the user. This is to let the learner know that the system thinks there *may* be an error in the learner's input, but that the system is not perfect and there may not actually be an error. The intention is to draw attention to the input and encourage the learner to review it for errors. This error mapping information is also stored in the error configuration file. Although *Gramadóir* tries to suggest alternatives when a spelling error is detected, it sometimes failed to suggest any for the errors submitted by the students in the prototype phase. To deal with this problem, the Levenshtein algorithm (implement with code from Merriampark (2005)) was used to detect suitable words in the local dictionary. The local dictionary contained words from the language lessons. Analysis of the students' texts and the suggestions provided to the WCC indicated that words with a Levenshtein value of 1 were very probably the word the student intended, words with a value of 2 were probably suitable, while words with a value of 3 were probably not what the student intended to write.

***Gramadóir* Msg**	**CLICI Msg**
	Humm, there might be an error here
`Definite article required`	'an' required
`Eclipsis missing`	You need a letter at the start of the word
`Lenition missing`	You might be missing a 'h' here
`Prefix \/d'\/ missing`	You need a 'd' here
`The dependent form of the verb ...`	The verb is not correct
`The genitive case`	You need to add something here

Table 8.10 *Gramadóir* Error Messages and their CLICI Equivalent

The local error checking involved checking particular verbs as well as negation errors, checking for person agreement, special checks for the verb *bí* (to be), a check for person pronoun usage, a check when the words *isteach* (in), *go dtí* (to) and *sa* (into) are used. The prototype phase

identified that *Gramadóir* reported false negatives (i.e. did not detect the error) for some sentences with these key words.

The prototype stage of the Design Phase for the WCC indicated that the original screen design could be improved. Figure 8.14 shows a screen shot of the WCC component that the students and teachers found acceptable. (In the original design, the grammar and spelling errors were not distinguishable, and it was not possible to resubmit a text without manually retyping it in again). The user interface shows the user's text in the most prominent part of the screen, with grammar errors shown below the text and spelling errors shown on the right-hand side. The less prominent position of the feedback on spelling errors is based on the teachers' pedagogical philosophy that spelling errors are not as important as grammar errors (at least in this particular context). The students are used to reading a text and looking at information about the text under the text itself, and in keeping with this format, the grammar errors are shown under the student's text. Note that the menu panel of the left-hand side of the screen specified in the Design Phase was removed to reduce screen clutter (the system provides a link to return to the general CLICI pages). The content developer can also customise the User Interface labels and messages that are shown to the learner (see Appendix P Content Developer User Manual for details).

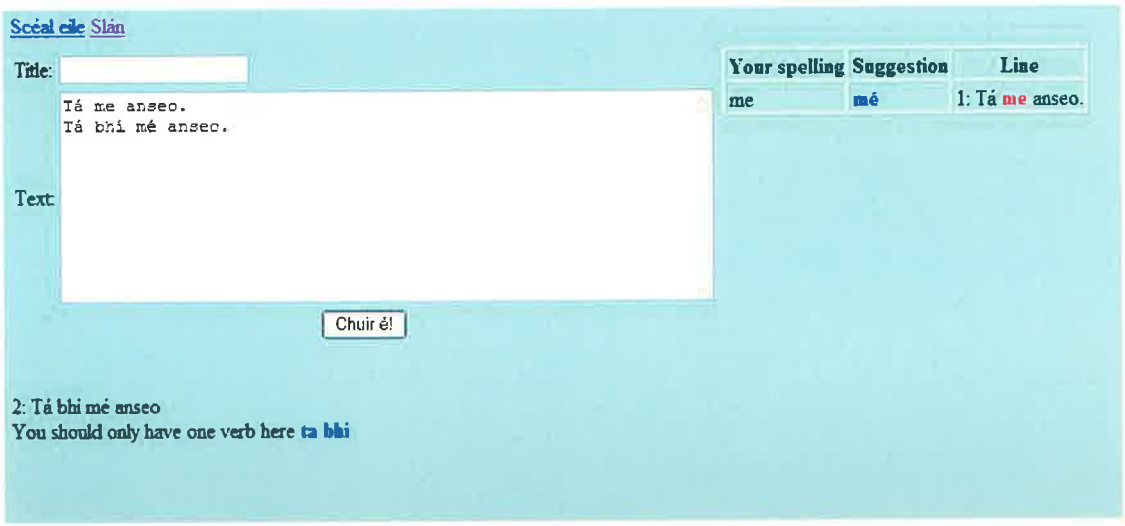

Figure 8.14 Screen Shot of the Writing Checker

Testing

The WCC was manually tested for each of the errors shown in Appendix E (Errors Tested). It was also tested with the sample sentences provided by Scannell (2005). Texts written by the students in the prototype stage of design were also manually tested. Grammar error testing involved checking to see if the error was detected and, where appropriate, that the correct error message was displayed. Spelling error checking meant testing to see if the error was detected and if the correction suggested was appropriate. The error activation configuration options (all

errors, system grammar errors, local grammar errors, spelling errors) were tested individually and in combination.

Deployment Testing

The WCC was tested in the target environment by the developer and by the students. Apart from a delay (~10 seconds) in reporting back to the students, no major problems were detected.

Software Engineering Testing

It was not feasible to develop a comprehensive grammar checker for another language for testing purposes. However, a mini-system was tested for Nawat, with just one rule in the grammar checker, one local rule and one spelling error. Information on this testing phase is shown in Table 8.11. Although only a toy system was tested for Nawat, it showed that the WCC was language independent and its structure was modular and reusable.

Component	Test
Grammar check rule	Verb conjugation check – use of *ni* (first person singular conjugation) when sentence contains *naja* (I)
Local rule	The letter 'j' should be used instead of the letter 'h'
Spelling error	'*nemy*' should be spelt '*nemi*'

Table 8.11 Testing for the Nawat Writing Checker

A summary of development and testing for the WCC is shown in Table 8.12.

Component	Information
Purpose	Provide grammar and spelling checking for Primary School learners of Irish
CL Resources reused	*Gramadóir* (Scannell, 2005)
Software tools	Levenshtien algorithm for spelling suggestions
Testing	Tested with *Gramadóir* test file, local test files, basic texts, random input; spelling error testing; configuration options testing
Deployment Testing	Tested the Writing Checker in the target environment
Difficulties	Determining the cause of an error (approach: under- rather than over-report)
Modular	Several options available: *Gramadóir*/punctuation/local errors
Reusable	Nawat specific errors

Table 8.12 Summary of Development and Testing for the Writing Checker Component

8.7 Concluding Comments

The specifications provided by the Design Phase gave clear directions for the Development Phase. The main issues for the Development Phase were to ensure that appropriate technologies were used and that the system was modular in structure and the architecture was reusable. Where appropriate, configuration options were provided to facilitate system flexibility and reusability. Testing is not usually considered an enjoyable task by developers. It often lacks the creative aspect of coding and can reveal unwelcome errors in the code. However, it is an essential component of any software development, and creativity can be used to test obscure cases. Obviously, it is important to test the software in the target environment and not just in the developer's hardware and software environment. CALL software is not just a pedagogical resource - it must also be tested as a piece of software. In this regard, the CLICI resources were tested for modularity, flexibility and reusability, as one of the key aims of the project was to develop software that could be used for other (Minority) languages, not just Irish. Reports about CALL projects in the literature rarely discuss how the software was tested (rather than evaluated). Finally, humans get special enjoyment out of activities when they experience what Csikszentmihalyi (pronounced 'cheeks sent me high') (1990) terms 'flow'. This can apply to athletes, artists and language learners. Even though the actual code is quite simple, there were moments of 'flow' experienced by the developer during the Development Phase of the project, when XML technologies and Perl code could be used to produce the required resources.

8.8 Summary

This chapter looks at the Development Phase of the CLICI project. Section 8.2 discusses the development philosophy adopted during the project and noted the importance of testing. Section 8.3 shows how the various parts of the CLICI project work together. Section 8.4 reviews the development of the Lesson Generation Component (LGC), which was the simplest component to develop. The Verb Conjugation Component's (VCC) development and testing is presented in Section 8.5, showing how automation of the verb information pages, as well as the related exercises, is achieved. The programming logic behind the Writing Checker Component (WCC) and the testing of the WCC software is given in Section 8.6. Section 8.7 provides some concluding comments that reflected on the development and testing processes.

Chapter 8 Development + Testing

8.1 Introduction

This chapter reviews the development and testing of the CLICI software. Section 8.2 looks at the development principles adopted during the project and highlights the importance of testing. The overall architecture is discussed in Section 8.3. Section 8.4 reviews the development of the Lesson Generator Component (LGC), while Section 8.5 explains how the Verb Conjugation Component (VCC) was developed and tested. The programming logic behind the Writing Checker Component (WCC) and the testing of the WCC software is presented in Section 8.6. Concluding comments are given in Section 8.7, while Section 8.8 provides a summary of the chapter.

8.2 Development Principles

The output of the Design Phase is a specification of the project requirements and the rationale behind these requirements. It does not specify how the requirements should be implemented at a technical level. Technical decisions are made in the Development Phase and are informed by the developers' experience and knowledge as well as insights gained with any project prototypes. Some of the basic development principles adopted during the CLICI project were those from the field of software engineering e.g. modularity, generality and anticipation of change.

Given the intended deployment setting, i.e. the primary schools that have their calendar fixed by the Department of Education, it was important that basic project management techniques were used to ensure that project deliverables were ready for the school year and terms. There is sometimes a tendency in CALL software to include features that are not strictly necessary, but are interesting and doable from a development point of view. These features have been avoided in the CLICI project. Development details of the three components are given in the Sections 8.3 to 8.5 below. In Colpaert's ADDIE model, this phase is called the Development Phase, but as he points out, it also includes testing. Colpaert outlines 8 stages of testing that the DIDIASCALIA team carry out and these are shown in Table 8.1. DIDIASCALIA produce market-ready CALL products and this is reflected in the level of testing it carries out. CLICI project testing involved routine checking, content implementation, beta-testing and research evaluation. Testing details for each component are provided in the relevant sections in this chapter. Many of the programme files are quite small. Some developers may consider them to be too small and that larger files with more functionality would be better. However, based on previous software engineering experience, smaller files are easier to modify and maintain, and usually produce loosely coupled code with tight cohesion (desirable software characteristics). Smaller files are also suitable for multi-person teams, and although only one developer was actually involved in the project, it is good practice to work with small independent units.

Testing Type	Summary
Pre-testing: specification checking	This is similar to prototyping, where developers can judge feasibility and can try to foresee conflicts between linguistic, didactic and technical specifications.
Testing 1: routine checking	Each individual routine is checked by the programmer.
Testing 2: content implementation testing	Combined elements of the system are tested together.
Testing 3: operational testing	This refers to debugging carried out by external users.
Testing 4: content testing	Native speakers check the linguistic content of the system.
Testing 5: beta-testing	The program is tested by real users in a real environment.
Testing 6: real world testing	The program is tested in the real world by buyers of the product.
Testing 7: research evaluation	Courseware evaluation can be used for research testing purposes

Table 8.1 DIDASCALIA's Testing Process (from Colpaert (2004))

8.3 Overall Architecture

The Design Phase specified that three components were to be developed: a Lesson Generator Component (LGC), a Verb Conjugation Component (VCG) and a Writing Checker Component (WCC). Each component is independent of the others, but ideally should be presented to the learner in an integrated fashion. Based on technical suitability, developer experience and knowledge, and existing resources, it was decided that XML (eXtensible Markup Language) technologies (XML, 2000) would be used in the CLICI project. They would be complemented by Perl to develop the required resources. XML technologies provide a clear separation between data, its processing and its presentation. This feature is very important and useful in software engineering in general and CALL artefacts in particular, where the ability to modify and adapt to individual learner needs may be required or desirable. XML technologies make it easy to structure data according to local needs. XML technologies are also non-proprietary – they are decided on by the World Wide Web Consorsium (W3C, 2006) which aims to get agreement of interested stakeholders while at the same time avoid the problems of proprietary standards. XML manages to combine the theoretical soundness of SGML without its complexity (XML, 2000). XML technologies are flexible and support Unicode (Unicode, 2007). XML technologies have become increasingly commonplace in recent years, including in the CALL domain (e.g. Ward, 2001; Cushion, 2003). Perl is a compact and powerful scripting language. It can be used for the data processing modules as well as the real-time engine behind the dynamic parts of the CALL resources.

The User Interface (UI) platform was not explicitly specified in the Design Phase, although basic outlines were provided. There are several issues to consider in UI design. These include consistency, the use of text, colour and font usage, information alignment and user control and freedom. The CLICI UI uses a common UI for most of the pages, with a menu panel in green on the left-hand side of the screen, a title clearly visible on the top of the page, puzzled-men for the games and sound icons where appropriate. It uses minimal, student-comprehensible text in Irish and 'error messages' to the students are framed positively. The system enables the students to navigate freely to avoid frustration. A web-interface was used for the CLICI project as it was a familiar one for the target users. A web page lends itself to the language learning process as it allows the incorporation of multimedia elements into a screen in an almost seamless manner. Thus, images and audio parts of language lessons can be easily made available to the learners. Links can be used to direct the learner to related information. Standard UI guidelines for web sites such as Nielsen (1996; 1999) and Bunday (2006) were followed. For example, Nielsen (1996; 1999) in his "Top Ten Mistakes" says that frames, scrolling text, long scrolling pages and non-standard link colours should be avoided. Bunday (2006) notes the need to conserve bandwidth, to keep graphics small and to make the site navigable. With these guidelines in mind, the CLICI UI avoided the Nielsen Mistakes and aimed to ensure easy navigation. In terms of the target audience, bright colours were used and clutter was kept to a minimum.

From a development point of view, the UI was easy to implement and fitted in with the XML technologies and Perl. The CLICI project runs on an Apache server (Apache, 2006) version 1.3.29, which hosts the static and dynamic web pages. The static pages are stored under the `htdocs` directory, while the dynamic pages are in the `cgi-bin` directory. The CLICI `tools` directory contains the Perl scripts for each of the components. The generated lessons and verb information are saved under the target language directory (i.e. Irish). Some run-time components of the VCC are stored in the `cgi-bin` directory, specifically those that relate to the run-time creation of web pages (e.g. the Championship exercise type – see Section 8.5). The WCC code and configuration files are stored under the `cgi-bin` directory. The tools directory contains some Perl libraries which contain code for common functions, as well as component specific code. There is a configuration directory which contains system configuration files as well as a global configuration file called `parameters.dat`. The overall project architecture is shown in Figure 8.1.

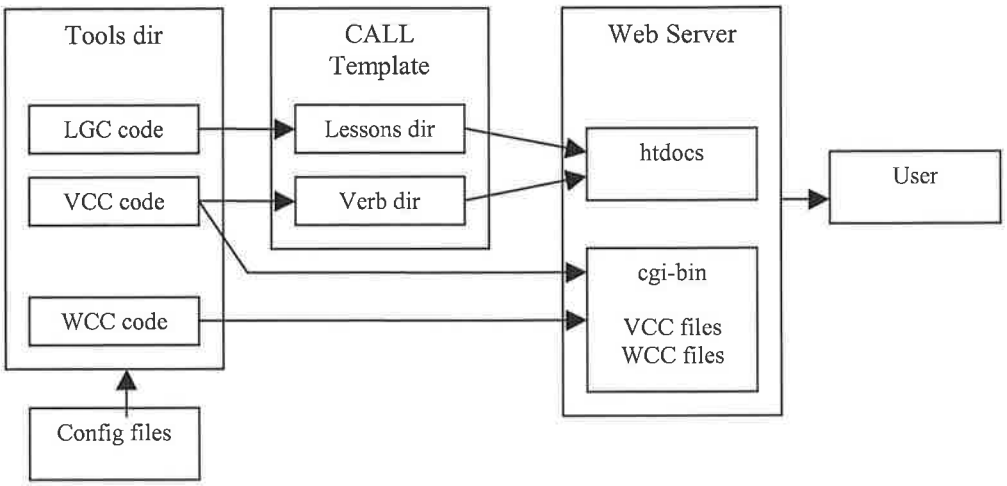

Figure 8.1 Overall CLICI Architecture

Documentation

There are three User Manuals provided with the CLICI system: the Learner User Manual (Appendix O), the Content Developer User Manual (Appendix P) and the Teacher User Manual (Appendix Q). Each of these manuals aims to provide the relevant usage information for a particular user group. The Technical Manual which provides technical information on the three components is shown in Appendix R. The CLICI system installation manual is given in Appendix S, while an overall introduction to the system is shown in Appendix T.

8.4 Lesson Generator Component

The overall aim of the Lesson Generator Component (LGC) was to provide a tool that would make it easier to develop CALL lessons and exercises using the CALL Template (Ward, 2001). The specification for the LGC was to put a wrapper around the CALL Template and provide the necessary code to create the required tool. No CL resources were used but the possibility of using NLP technologies to generate exercises might be explored at a later date. The CALL Template has four sub-directories for each lesson. The driver directory contains XML wrapper information, the generate directory contains the files to generate the html files, the source directory contains the data files (e.g. the lesson information) and the html directory contains the web pages. The LGC converts the flat data files into the required XML format for use in the CALL Template. The coding required was quite simple. Table 8.2 shows the LGC files and their function. Figure 8.2 shows the LGC architecture for the multiple-choice exercise. The other exercises (i.e. matching, mix-up sentence and gap-fill) follow a similar pattern.

Figure 8.3 shows a lesson that was generated using the LGC architecture. It uses the format of the CALL Template. The courseware menu is on the green panel on the left-hand side of the screen, the 'games' are on the top and the lesson content occupies the main part of the screen. There is a speech icon for the entire lesson, as well as one for each line of text.

File	Function
convertGen.bat	Calls createGen.pl
convertMatch.bat	Calls createMatch.pl
convertMix.bat	Calls createMix.pl
convertMulti.bat	Calls createMulti.pl
convertSection.pl	Calls createSection.pl
createGap.pl	Creates the gap-fill exercise XML file
createGen.pl	Creates the generate batch file
createMatch.pl	Creates the match exercise XML file
createMix.pl	Creates the mixed-up sentence XML file
createMulti.pl	Creates the multiple-choice exercise XML file
createSection.pl	Creates the lesson XML file
gap.pl	Extracts the gap exercise XML file data to a flat file format
match.pl	Extracts the match exercise XML file data to a flat file format
mix.pl	Extracts the mixed-up sentence XML file data to a flat file format
multi.pl	Extracts the multiple-choice XML file data to a flat file format
what.pl	Extracts the lesson XML data to a flat file format

Table 8.2 Lesson Generator Component Files

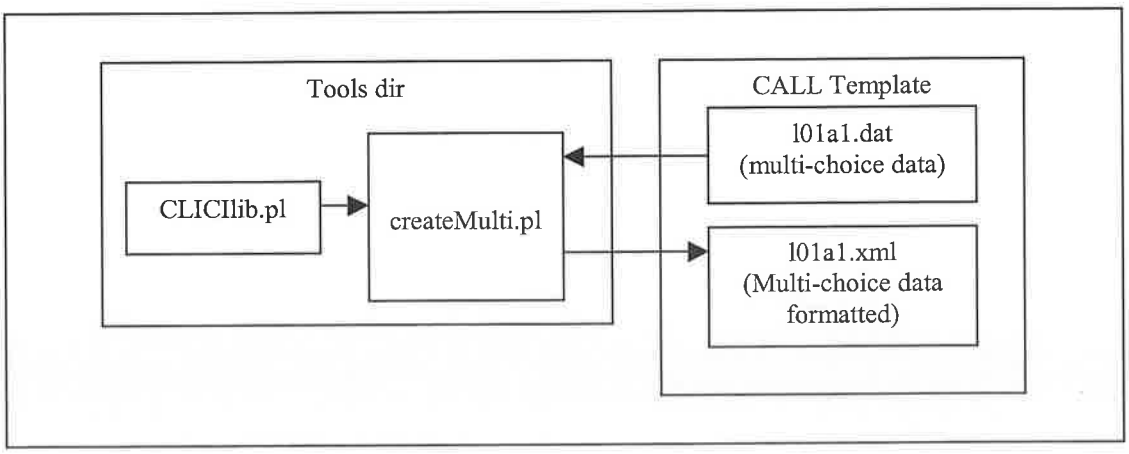

Figure 8.2 Lesson Generator Component Architecture for a Multiple-choice Exercise

Testing

A lesson and each exercise type (multi-choice, match, mix-up and gap-fill) were manually tested. The LGC source files were manually passed through *Gramadóir* to check for errors. The resources to create the flat files from existing XML files were also manually tested. To check

for reusability, tests were carried out on existing lessons and exercises from the Nawat CALL courseware (Ward, 2001). Table 8.3 shows a summary of development and testing for the LGC.

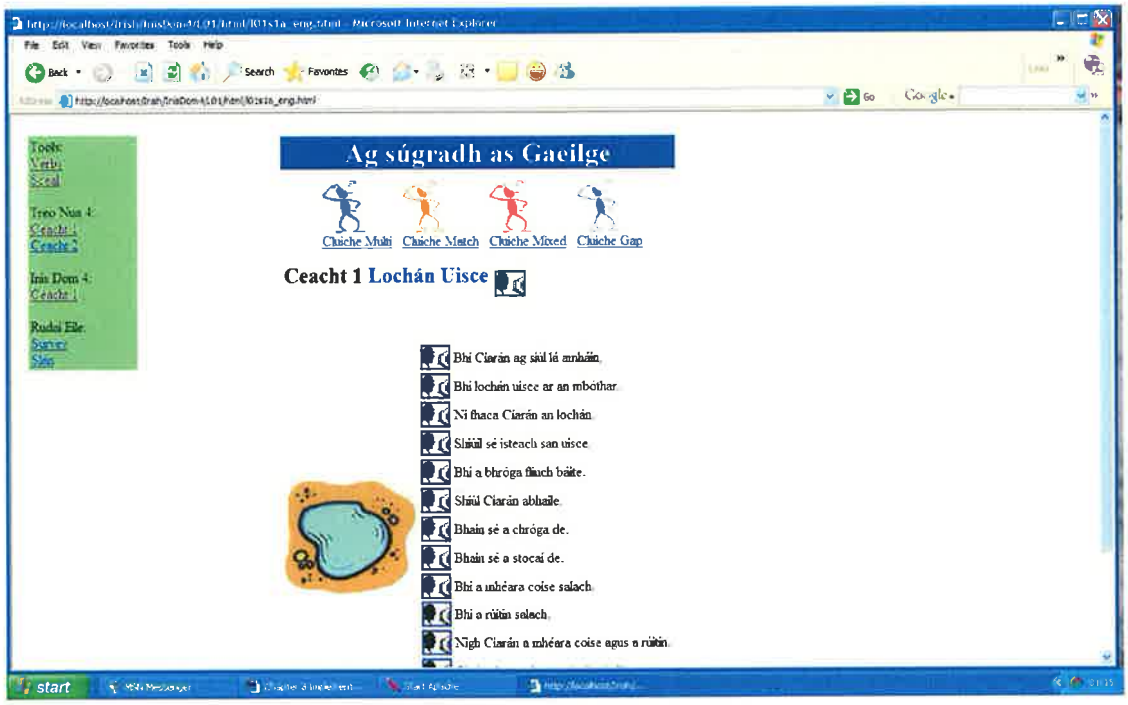

Figure 8.3 Screen Shot of CLICI Lesson

Component	Information
Purpose	Provide an authoring tool to aid the production of CALL resources
CL Resources reused	None
Software tools	CALL template (Ward, 2001)
Testing	Manually tested one lesson and each activity
Deployment Testing	Tested that the software worked as intended in the target environment
Difficulties	Deciding on the contents of the activities at a pedagogical level
Modular	Content developer can decide what components to include
Reusable	Used to develop Nawat material

Table 8.3 Summary of Development and Testing for the Lesson Generator Component

8.5 Verb Conjugation Component

The aim of the Verb Conjugation Component (VCC) was to display animated verb conjugation information and provide exercises, feedback and track student progress. The specification for the VCC from the Design Phase stated that the VCC should put a wrapper around three external resources (Irish FST Morphology Engine (Ui Dhonnchadha, 2002), animation code (Koller, 2004) and the CALL Template (Ward, 2001) to achieve this goal. In order to increase the prominence of the morphological changes required to the root form of the verb for a particular person/tense combination, it was decided to show the changes in red in the static viewing area

as well as showing them dynamically using Koller's (2004) animation code in the animation panel. Obviously, as the amount of information shown on the screen increases, the animation panel may not be aligned beside all the verb conjugation data and some scrolling may be required. A screen shot of the verb animation for *bris* (to break) is presented in Figure 8.4. The screen shot shows that a '*h*' is added to form the past tense of the verb. One part of the VCC was to convert an external data source (i.e. Uí Dhonnchadha's (2002) Irish Finite-State Morphological Analyser data) into the CLICI verb file format.

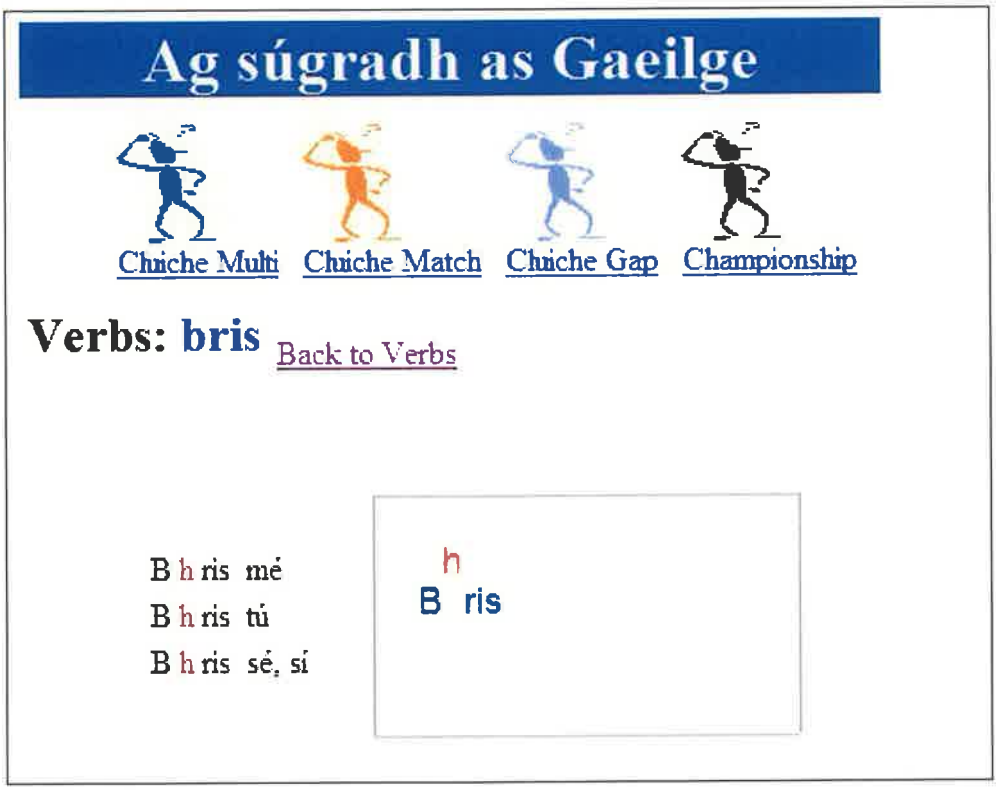

Figure 8.4 Screen Short of the Verb Conjugation Component

An overview of the programme logic is shown in Figure 8.5. Note that the VCC produces two files for each verb: one with xml formatted information and the other with flat file information. The principal part of the VCC was software to create verb display information automatically, as well as the associated exercises. These exercises are built upon Hot Potatoes (Holmes and Arneil, 1998) software (via the CALL Template) and consist of multiple-choice, matching, mixed-up sentence and gap-fill exercises. Figure 8.6 shows how the match exercise is automatically created.

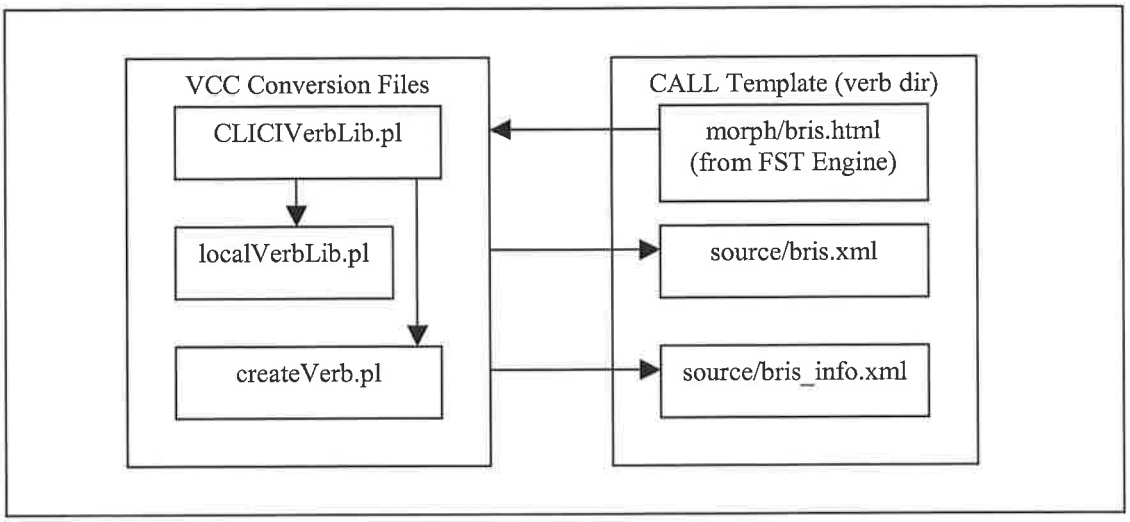

Figure 8.5 Verb Extraction Part of the Verb Conjugation Component

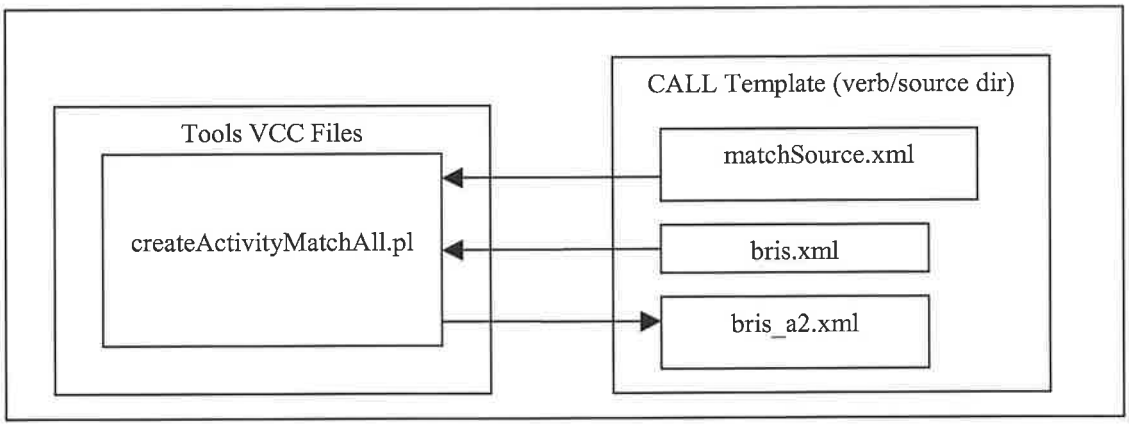

Figure 8.6 Automatic Creation of the Match Exercise File

A new exercise was added for the VCC. It uses a combination of multiple-choice and gap-fill questions. The html files for this new exercise type are dynamically generated and, in order to ensure flexibility and maintenance, the relevant section of header and other similar data is stored in the data files which are combined with the relevant verb data at run-time. The exercise reuses the questions from the multiple-choice files (e.g. `bris_a1_ans.txt`) and gap-fill files (`bris_a4_ans.txt`). In the context of the CLICI project, it is called the Championship (after the Championship competition for hurling and Gaelic football - two of Ireland's traditional and popular sports). Figure 8.7 shows a screen shot of the Championship exercise while Figure 8.8 shows a screen shot of the Championship answer page. The answer page shows the correct answer, alongside the student's answer. Figure 8.9 shows the architecture of the Championship part of the VCC. The students' responses are saved and the results are reported back to them, which shows their input together with the correct answers.

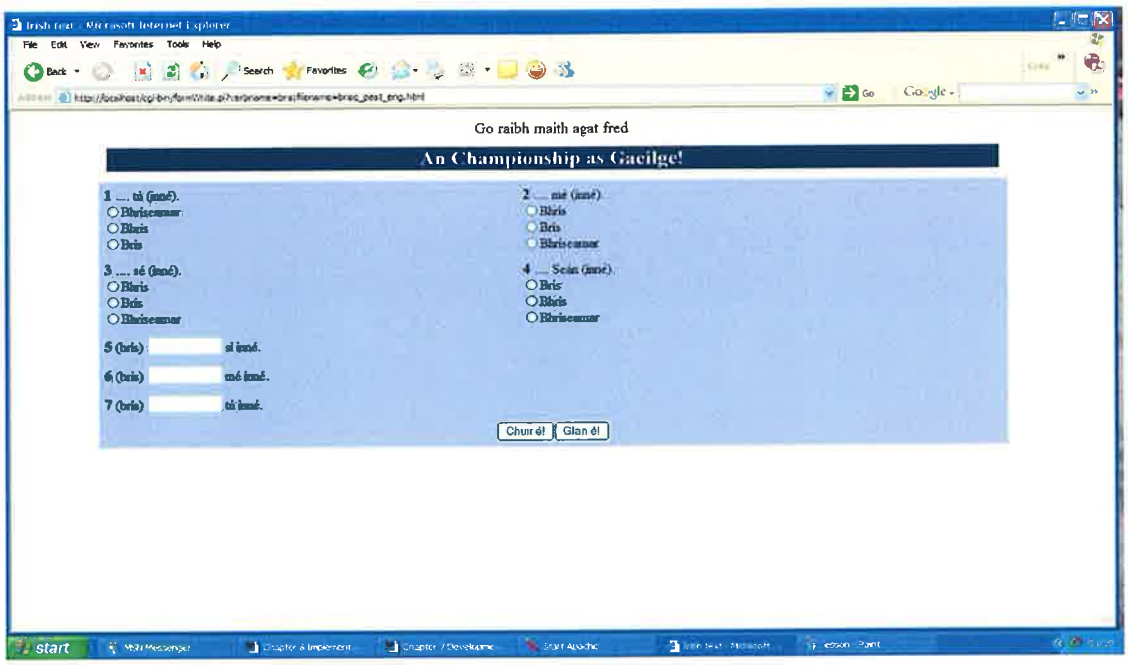

Figure 8.7 Screen Shot of the Championship Exercise Page

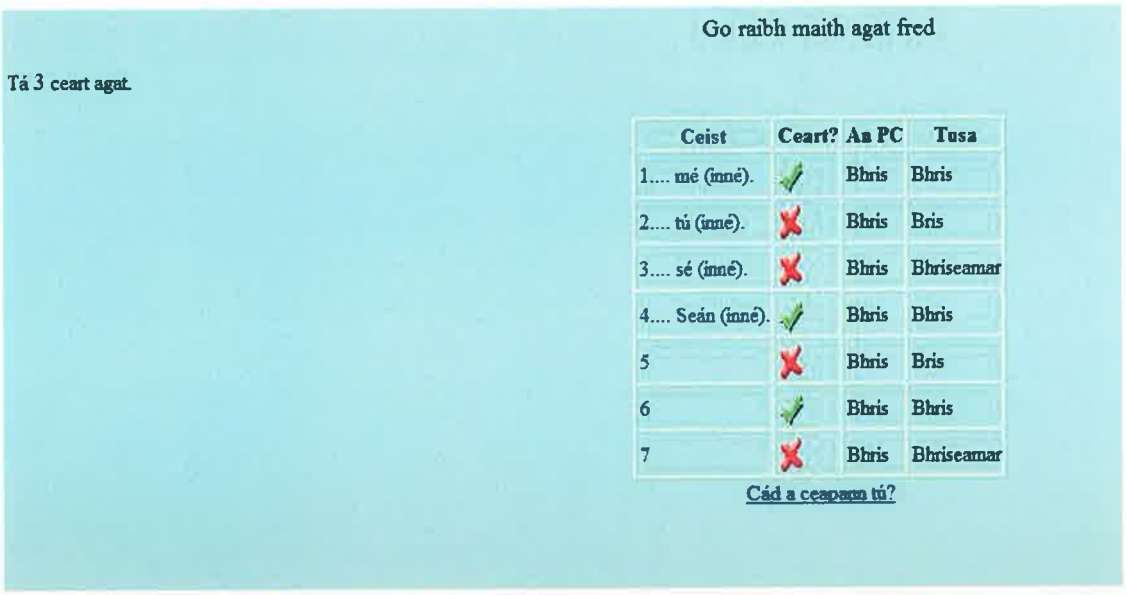

Figure 8.8 Screen Shot of Championship Answer Page

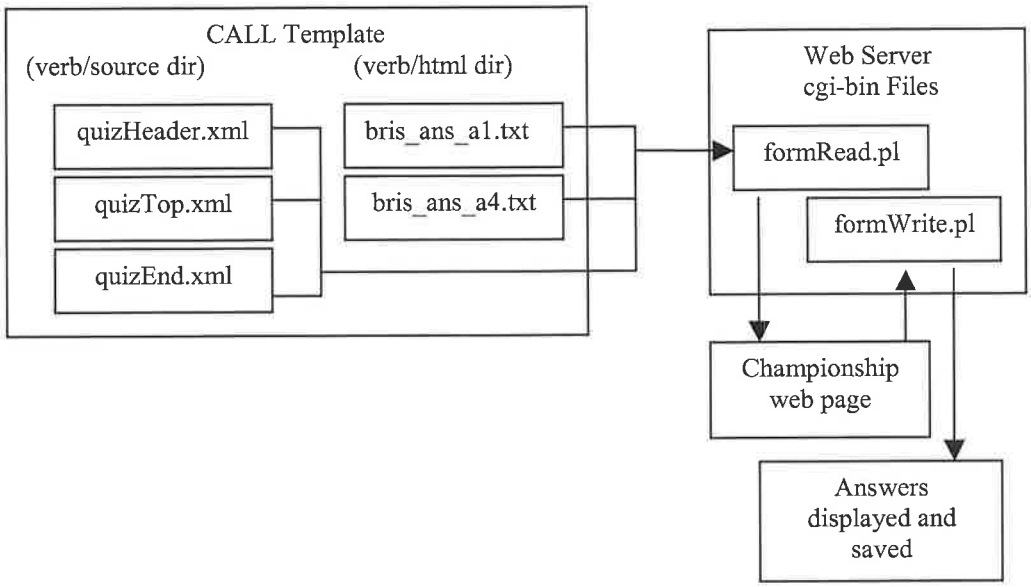

Figure 8.9 Automatic Creation of the Championship Exercise Page

The configuration directory contains three sub-directories: source, system and a language specific directory. The source directory contains `parameters.dat`, the global system configuration file. The system directory contains general header and wrapper information for the various VCC related files. The language specific directory (i.e. config/Irish) contains configuration files with language specific information. The contents of the three configuration sub directories are shown in Table 8.4. A list of VCC files and their functionality is shown in Table 8.5.

Several configuration files are used for flexibility. Each exercise type has its own configuration file (e.g. `matchSource` contains the configuration information for the gap-fill exercise). Figure 8.10 shows a portion of `matchSource.xml` which specifies the questions and answers to be automatically generated by the system.

Although one of the aims of the VCC was to animate the verb conjugation information, it was important to have the option to display only static information. This was accomplished by automatically producing a static and animated web page for each verb and allowing the teacher (or another person) to specify which format would be shown for the individual user. It should be noted that the animation was not automatically displayed when the learner opened the page. To activate the display, the learner had to place the cursor over the static information and click. The animation is then shown in the right-hand display panel. The animation feature used code developed by Koller (2004). He developed the `irish.swf` file which reads in the specified XML data at run-time to produce the animation. This means that once an XML file contains the

necessary data (i.e. Flash header code, the verb conjugation data in the required structure and code to call `irish.swf`), its information can be displayed dynamically. Figure 8.11 shows how this works. Previously, only precoded data could be used by flash code, which would not have been very desirable, and special thanks are due to Koller (2004) for researching the possibilities and developing the required code to dynamically generate Flash animations.

Directory	Filename	Purpose
source	parameters.dat	Global parameters for the system
language	parameters.dat	Local copy of parameters
	pronoun.dat	Pronoun information
	verbInfo.dat	Information on verbs (if required)
	verblist.dat	List of the verbs
	verbType.dat	Information on the verb type (if relevant)
system	end.dat	End text for xml wrapper file
	endDriver.xml	End text for xml driver file
	flashHeader.xml	Header text
	gapEnd.xml	End text for gap xml wrapper file
	gapHeader.xml	Header text for gap driver file
	gapSource.dat	Information for gap exercise
	gapTop.xml	Header text for gap xml wrapper file
	matchEnd.xml	End text for match xml wrapper file
	matchHeader.xml	Header text for match driver file
	matchSource.dat	Information for match exercise
	matchTop.xml	Header text for match xml wrapper file
	mixEnd.xml	End text for mix xml wrapper file
	mixHeader.xml	Header text for mix driver file
	mixSource.dat	Information for mix exercise
	mixTop.xml	Header text for mix xml wrapper file
	multiEnd.xml	End text for multi xml wrapper file
	multiHeader.xml	Header text for multi driver file
	multiSource.dat	Information for multi exercise
	multiTop.xml	Header text for multi xml wrapper file

Table 8.4 Files in the config Directories

The development of the VCC was not particularly difficult. However, an important feature of the development process was to avoid hard-coding data and to produce flexible, reusable software that was independent of any given verb structure and that was somewhat language

independent. The list of options available in the VCC is shown in Table 8.6. Also, there were some minor difficulties in parsing the verb information for irregular verbs from the morphological analyser (Uí Dhonnchadha, 2002) due to differences between the underlying linguistic reasons for the morphological changes required for conjugation and the learner/developer's intuitions.

File	Function
`createActivityGapAll.pl`	Creates the gap-fill exercise XML file
`createActivityMatchAll.pl`	Creates the match exercise XML file
`createActivityMixAll.pl`	Creates the mixed-up sentence XML file
`createActivityMultiAll.pl`	Creates the multiple-choice exercise XML file
`createDriver.pl`	Creates the XML wrapper file for the verbs
`createDriverGames.pl`	Creates the XML wrapper file for the games exercise
`createDrivers.pl`	Batch file to call each of the exercise driver creation files
`createGenGames.pl`	Creates the batch file for the games exercises
`createVerb.pl`	Main file for creating verb output files for the VCC
Libraries	
`CLICILib.pl`	Library of general functions
`myVerbLib.pl`	Library of Irish specific verb related functions
`CLICIVerbLib.pl`	Library of general verb related functions

Table 8.5 Verb Conjugation Component Files

```
quest|0|.... mé (inné).
ans|0|0|past_s1
ans|0|1|name
ans|0|2|past_p1
```

Figure 8.10 Portion of `matchSource.xml`

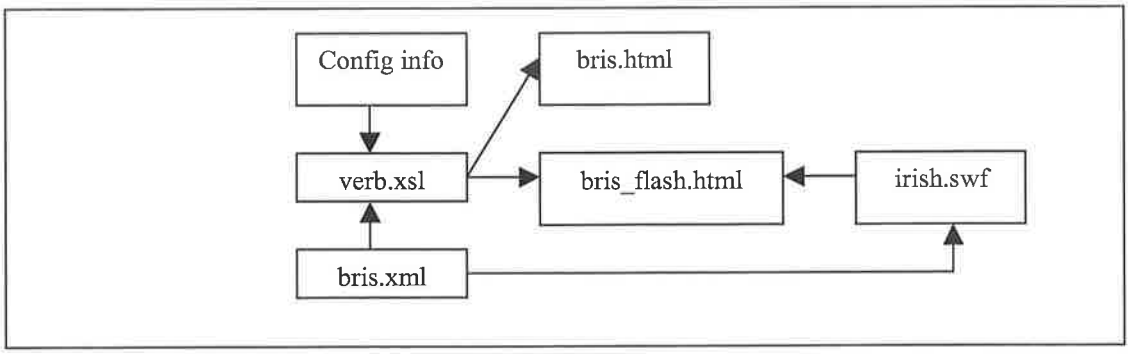

Figure 8.11 Static and Dynamic Verb Conjugation Architecture

Option	Explanation
Tense	Past, present and future
Person	1st, 2nd and 3rd person only or all persons
Language type	SVO (e.g. Nawat) or VSO (e.g. Irish)
Information	Positive, negative and question

Table 8.6 Options Available in the Verb Conjugation Component

Testing

Each part of the VCC was manually tested for a regular slender verb (*bris* (to break)) and a regular broad verb (*dún* (to close)). The fact that *dún* contains an accented character also enabled testing of accents. All 11 irregular verbs were manually tested for each part. A verb that does not change in the past tense was also manually tested (*leigh* (to read)). A summary of the components tested is shown in Table 8.7.

Component Testing	Testing
Verb extraction	To ensure the information was correctly extracted from the external source.
Verb page generation	To ensure that the web page was correctly generated.
Exercise generation	To ensure that each exercise was correctly generated based on options specified in the configuration files.
Static web page display	To ensure that the static web page was correctly displayed.
Dynamic web page display	To ensure that the dynamic web page correctly displayed the animation information.
Championship – display	To ensure that the correct questions were shown for the Championship exercise.
Championship – answers	To ensure that the correct answers were actually correct.
Championship – results display	To ensure that the results with the student's answers, the correct answers and the score were correctly displayed to the student.

Table 8.7 Testing for the Verb Conjugation Component

Deployment Testing

The static and dynamic verb html pages were checked in the target environment, i.e. on the machine that the students would actually use. A complete set of exercises (i.e. multi-choice, match, mix, gap-fill and Championship) were also tested for each verb type. One minor difference that emerged was that the screen size was smaller and the necessary changes were made to the software to accommodate this.

Software Engineering Testing

The software was also tested for configurability, modularity and reusability. Various combinations of tenses (past, present, future), forms (positive, negative, question), persons (singular, plural) and presentation modes (alone, within the CALL Template) were tested. In testing for reusability, the relevant verb pages were generated for Spanish verbs (a pro-drop language) and Nawat verbs (an Uto-Aztecan SVO Language). A summary of the features tested is shown in Table 8.8.

Person	Positive	Negative	Question	Source	Options
Irish (Celtic Language Family, VSO Language)					
Verb *bris* (to break)					
P1 P4	*Bhris mé* *Bhriseamar*	*Níor bhris mé* *Níor bhriseamar*	*Ar bhris tú?* *Ar bhriseamar?*	External [2]	P1, P2 and P3 only Past tense Positive, negative and question forms
Verb *téigh* (to go)					
P1 P4	*Chuaigh mé* *Chuamar*	*Ní dheachaigh mé* *Ní dheacamar*	*Ar dheachaigh tú?* *Ar dheacamar?*	External	(As above)
Nawat (Uto-Aztecan Language Family, SVO Language)					
Verb *chiwa* (to do)					
P1 P4	*Na chiwki* *Temet chiwket*	*Na tesu chiwki* *Temet tesu chiwket*	*Na chiwki ?* *Temet chiwket ?*	Generated [3]	All persons Past and present tense Positive and negative forms
Spanish (Romance Language Family, (S) VO Language - Prodrop)					
Verb *hablar* (to speak)					
P1 P4	*(Yo) hablé* *(Nosotros) hablamos*	*(Yo) no hablé* *(Nosotrs) no hablamos*	*Hablaste (tu)?* *Hablamos?*	Generated [4]	All persons Past tense Positive form

Table 8.8 Languages Testing in the Verb Conjugation Component

Notes:

1. The Nawat orthography is that proposed by King (2003), rather than Lemus (1997) which was used in the original Nawat language learning courseware (Ward, 2001).

2. Uí Dhonnachagh's (2002) Irish Finite-State-Transducer Morphology Engine was used as the source of verb conjugation information for Irish.
3. The verb conjugation information for Nawat was generated for the two main types of Nawat verbs (i.e. those that drop the end vowel and those that do not).
4. The verb conjugation information for Spanish was generated for *ar/er/ir* and some irregular verbs. A summary of development and testing for the VCC is shown in Table 8.9.

Component	Information
Purpose	Provide animated verb display for Irish
CL Resources reused	Irish FST Morphology Engine (Uí Dhonnchadha, 2002)
Software tools	XML/Flash animator (Koller, 2004)
Testing	Manually tested all 11 irregular verbs Manually tested 1 slender verb (*bris* (to break)), 1 broad verb (*dún* (to close)), 1 special verb in the past tense (*ith* (to eat)), 1 unchanging verb in the past tense (*léigh* (to read))
Deployment Testing	Checked both static and animated forms in the target environment Checked that the specified (i.e. static or animated) verb page was correctly loaded on login
Difficulties	There were some difficulties parsing the information from the Irish FST Morphology engine due to the differences between the linguistic reasons and the learner's/developer's intuitions
Modular	Content developer can decide on: - tenses (past, present, future) - forms (positive, negative, question) - persons (singular, plural) - presentation (alone, embedded in general framework)
Reusable	Used to develop Nawat and Spanish verb animation resource

Table 8.9 Summary of Development and Testing for the Verb Conjugation Component

8.6 Writing Checker Module

The specification provided by the Design Phase was fairly comprehensive and the architecture is as shown in Chapter 8. The WCC was to put a wrapper around *Gramadóir* as well as develop local code to produce the required WCC. The overall system logic or pseudocode of the WCC is outlined in Figure 8.12, while Figure 8.13 shows an expanded version for Irish.

Require textcheckLocal.pl (i.e. use the local error checking routines)

Read and process learner text

Depending on configuration options ....

- If External error checking on ... check for external errors
- if local error check on ... check for local errors

Display user text with grammar and spelling messages (if any)

Figure 8.12 Overview of WCC Pseudocode

Depending on configuration options ....

- read in error message conversion file
- If Gramadóir error checking on ... check for general errors
    - check if valid error message
    - use error map configuration file to convert *Gramadóir* error message to more appropriate message
- if local error check on ... check for local errors
    - check verb errors
    - check person errors
    - check verb *bíonn* errors
    - check *isteach* errors
    - check *go dtí* errors
    - check *sa* errors
- check punctuation errors
- check for spelling errors
    - convert *Gramadóir* error message if required
    - use Levenshtein algorithm (Merriampark, 2005) to find suitable word local dictionary if none suggested by *Gramadóir*
        - if levenshtein distance = 1, show suggestion as is
        - else if levenshtein distance = 2, show suggestion with '?'
        - else do not display suggestion
- display user text with grammar and spelling messages (if any)

Figure 8.13 Writing Checker Component Pseudocode (Expanded)

`textcheckGeneral.pl` contains the main system logic, while the context specific error checking is specified in the `textcheckLocal.pl`. Appendix R Technical Manual shows details of the required routines and error message arrays used by these files. *Gramadóir* does

not distinguish between grammar errors and spelling errors. However, the prototype stage for the WCC (Chapter 6) revealed that it was important for the users to see the two different types of errors reported separately. An error configuration file was used to classify *Gramadóir* errors as either spelling or grammar errors based on the error message text reported by *Gramadóir*. As many of the *Gramadóir* error messages were not appropriate for the target user group, it was necessary to convert them to more appropriate error messages. Some of the original *Gramadóir* error messages and their CLICI equivalent are shown in Table 8.10 (a full listing is given in Appendix D Mapped Error Messages). This is to avoid any inappropriate (i.e. overly formal or linguistically orientated) error messages being shown. In the event that an unknown error message is received from *Gramadóir*, the message "Humm, there might be an error here" is reported to the user. This is to let the learner know that the system thinks there *may* be an error in the learner's input, but that the system is not perfect and there may not actually be an error. The intention is to draw attention to the input and encourage the learner to review it for errors. This error mapping information is also stored in the error configuration file. Although *Gramadóir* tries to suggest alternatives when a spelling error is detected, it sometimes failed to suggest any for the errors submitted by the students in the prototype phase. To deal with this problem, the Levenshtein algorithm (implement with code from Merriampark (2005)) was used to detect suitable words in the local dictionary. The local dictionary contained words from the language lessons. Analysis of the students' texts and the suggestions provided to the WCC indicated that words with a Levenshtein value of 1 were very probably the word the student intended, words with a value of 2 were probably suitable, while words with a value of 3 were probably not what the student intended to write.

***Gramadóir* Msg**	**CLICI Msg**
	Humm, there might be an error here
`Definite article required`	'an' required
`Eclipsis missing`	You need a letter at the start of the word
`Lenition missing`	You might be missing a 'h' here
`Prefix \/d'\/ missing`	You need a 'd' here
`The dependent form of the verb ...`	The verb is not correct
`The genitive case`	You need to add something here

Table 8.10 *Gramadóir* Error Messages and their CLICI Equivalent

The local error checking involved checking particular verbs as well as negation errors, checking for person agreement, special checks for the verb *bí* (to be), a check for person pronoun usage, a check when the words *isteach* (in), *go dtí* (to) and *sa* (into) are used. The prototype phase

identified that *Gramadóir* reported false negatives (i.e. did not detect the error) for some sentences with these key words.

The prototype stage of the Design Phase for the WCC indicated that the original screen design could be improved. Figure 8.14 shows a screen shot of the WCC component that the students and teachers found acceptable. (In the original design, the grammar and spelling errors were not distinguishable, and it was not possible to resubmit a text without manually retyping it in again). The user interface shows the user's text in the most prominent part of the screen, with grammar errors shown below the text and spelling errors shown on the right-hand side. The less prominent position of the feedback on spelling errors is based on the teachers' pedagogical philosophy that spelling errors are not as important as grammar errors (at least in this particular context). The students are used to reading a text and looking at information about the text under the text itself, and in keeping with this format, the grammar errors are shown under the student's text. Note that the menu panel of the left-hand side of the screen specified in the Design Phase was removed to reduce screen clutter (the system provides a link to return to the general CLICI pages). The content developer can also customise the User Interface labels and messages that are shown to the learner (see Appendix P Content Developer User Manual for details).

Figure 8.14 Screen Shot of the Writing Checker

Testing

The WCC was manually tested for each of the errors shown in Appendix E (Errors Tested). It was also tested with the sample sentences provided by Scannell (2005). Texts written by the students in the prototype stage of design were also manually tested. Grammar error testing involved checking to see if the error was detected and, where appropriate, that the correct error message was displayed. Spelling error checking meant testing to see if the error was detected and if the correction suggested was appropriate. The error activation configuration options (all

errors, system grammar errors, local grammar errors, spelling errors) were tested individually and in combination.

Deployment Testing

The WCC was tested in the target environment by the developer and by the students. Apart from a delay (~10 seconds) in reporting back to the students, no major problems were detected.

Software Engineering Testing

It was not feasible to develop a comprehensive grammar checker for another language for testing purposes. However, a mini-system was tested for Nawat, with just one rule in the grammar checker, one local rule and one spelling error. Information on this testing phase is shown in Table 8.11. Although only a toy system was tested for Nawat, it showed that the WCC was language independent and its structure was modular and reusable.

Component	Test
Grammar check rule	Verb conjugation check – use of *ni* (first person singular conjugation) when sentence contains *naja* (I)
Local rule	The letter 'j' should be used instead of the letter 'h'
Spelling error	'*nemy*' should be spelt '*nemi*'

Table 8.11 Testing for the Nawat Writing Checker

A summary of development and testing for the WCC is shown in Table 8.12.

Component	Information
Purpose	Provide grammar and spelling checking for Primary School learners of Irish
CL Resources reused	*Gramadóir* (Scannell, 2005)
Software tools	Levenshtien algorithm for spelling suggestions
Testing	Tested with *Gramadóir* test file, local test files, basic texts, random input; spelling error testing; configuration options testing
Deployment Testing	Tested the Writing Checker in the target environment
Difficulties	Determining the cause of an error (approach: under- rather than over-report)
Modular	Several options available: *Gramadóir*/punctuation/local errors
Reusable	Nawat specific errors

Table 8.12 Summary of Development and Testing for the Writing Checker Component

8.7 Concluding Comments

The specifications provided by the Design Phase gave clear directions for the Development Phase. The main issues for the Development Phase were to ensure that appropriate technologies were used and that the system was modular in structure and the architecture was reusable. Where appropriate, configuration options were provided to facilitate system flexibility and reusability. Testing is not usually considered an enjoyable task by developers. It often lacks the creative aspect of coding and can reveal unwelcome errors in the code. However, it is an essential component of any software development, and creativity can be used to test obscure cases. Obviously, it is important to test the software in the target environment and not just in the developer's hardware and software environment. CALL software is not just a pedagogical resource - it must also be tested as a piece of software. In this regard, the CLICI resources were tested for modularity, flexibility and reusability, as one of the key aims of the project was to develop software that could be used for other (Minority) languages, not just Irish. Reports about CALL projects in the literature rarely discuss how the software was tested (rather than evaluated). Finally, humans get special enjoyment out of activities when they experience what Csikszentmihalyi (pronounced 'cheeks sent me high') (1990) terms 'flow'. This can apply to athletes, artists and language learners. Even though the actual code is quite simple, there were moments of 'flow' experienced by the developer during the Development Phase of the project, when XML technologies and Perl code could be used to produce the required resources.

8.8 Summary

This chapter looks at the Development Phase of the CLICI project. Section 8.2 discusses the development philosophy adopted during the project and noted the importance of testing. Section 8.3 shows how the various parts of the CLICI project work together. Section 8.4 reviews the development of the Lesson Generation Component (LGC), which was the simplest component to develop. The Verb Conjugation Component's (VCC) development and testing is presented in Section 8.5, showing how automation of the verb information pages, as well as the related exercises, is achieved. The programming logic behind the Writing Checker Component (WCC) and the testing of the WCC software is given in Section 8.6. Section 8.7 provides some concluding comments that reflected on the development and testing processes.

Chapter 9 Implementation

9.1 Introduction

This chapter looks at how the CLICI resources were actually used in the target environment. Strictly speaking, the Implementation Phase of the ADDIE model refers only to the deployment of the developed software. However, in order to provide a more complete picture of the learner interaction with the CLICI research project and to demonstrate the overall deployment history, this chapter discusses the interaction with both schools since the start of the CLICI project, including the pilot study (Chapter 6). Section 9.2 provides a brief summary of the schools and classes who participated in the CLICI project. Section 9.3 discusses CALL usage training in general and gives an overall overview of the CLICI training provided to the students. Section 9.4 gives a description of School 1 (S1) – the mainstream school. Section 9.5 provides an overview of Teacher 1 (T1) and her classes (Class 1 – C1 and Class 6 – C6) that were involved in the CLICI project. It also gives an implementation history of the CLICI resources in these classes and subsequent findings. Section 9.6 introduces Teacher 6 (T6) and her class (Class 7 – C7), her (limited) interaction with the CLICI project and the findings from this experience. Section 9.7 describes School 2 (S2) – the school in the disadvantaged area. Teacher 5 (T5) and her classes (Class 5 – C5, Class 8 – C8 and Class 9 – C9) involved with the CLICI project, the implementation history and findings for these classes are also discussed in Section 9.8. Some concluding comments are provided in Section 9.9. Section 9.10 gives a summary of the chapter.

9.2 Overview

Three schools were initially invited to take part in the CLICI project. One of these schools, a girls' primary school declined, citing teacher time pressures as to why they could not participate. The other two schools agreed to be involved in the project. Both of these schools were boys' schools. Contact was made with the first school directly, with the head teacher, who then discussed with his staff and an initial discussion session was held with the developer and interested teachers. Chapter 6 (Pilot Study, specifically Section 6.2) provides an overview of this initial contact. In School 1 (S1), one teacher (T1) decided to continue working on the project. She was the teacher of Class 1 (C1) in the pilot study and at that time she was a 2nd class teacher. When the CLICI software was ready for deployment with learners, the teacher had a new class. The students were 3rd class students (8 – 9 years of age) and are referred to as Class 6 (C6). Another teacher from S1 was contacted and agreed to take part in the VCC testing. This teacher (T6) had a group of 3rd class students (8 – 9 years of age), but unfortunately due to personal reasons, her class had only a limited exposure to the VCC software. In the other boys' school (S2), the teacher (T5) already had some CALL experience and she agreed to continue with the CLICI project after the pilot study. During the lifetime of the CLICI project (including the pilot study), she had three different classes. The first group was Class 5 (C5) in the pilot study (described in Chapter 6), the second group was a 5th year

class (10 – 11 years of age) – Class 8 (C8) and the third group was a 4th year group (9 – 10 years of age) – Class 9 (C9). Table 9.1 shows a list of the schools, teachers and their classes who were involved in the CLICI project (including the pilot study). Subsequent sections in this chapter discuss how the CLICI resources were actually used by the students. The findings from each stage of deployment are presented and discussed where appropriate.

School	Teacher	Class	Description	Comment
School 1 (S1)	T1	C1	2nd class (age 7 – 8)	Pilot study class
		C6	3rd class (age 8 – 9) 4th class (age 9 – 10)	Participated in project over 2 years
	T2	C2	5th class (age 10 – 11)	Pilot study class
	T3	C3	5th class (age 10 – 11)	Pilot study class
	T4	C4	6th class (age 11 – 12)	Pilot study class
	T6	C7	4th class (age 9 – 10)	VCC test class; limited participation
School 2 (S2)	T5	C5	3rd class (age 8 – 9)	Pilot study class
		C8	4th class (age 9 – 10)	WCC prototype testing class
		C9	4th class (age 9 -10)	WCC testing class

Table 9.1 Summary of Schools, Teachers and Classes in the CLICI Project

9.3 Training

Hubbard (2005) identifies two types of CALL training: technical training (i.e. computer usage) and pedagogical training (i.e. language learning use). In his analysis of published CALL research, he found that many CALL researchers failed to mention student training in their studies and, of those that did refer to it, the majority imparted technical training (22%). Very few (6%) of the studies reviewed by Hubbard provided additional training during the research period. The need for training was identified at the outset of the CLICI project. Before using any of the CLICI resources, the students were shown how to use the software in groups of three or four. As the students were already quite proficient in using the computer, only minimal technical training was required, so the training focus was on the pedagogical aspect of the software. In the case of the lessons, the students were shown how to read and listen to the lesson in its entirety, as well as each line individually. There were encouraged to listen and read at the same time. Often the students have reading difficulties in Irish due to the lack of correspondence (from their point of view) between the written and spoken forms. For example, *fhaca* (conjugated form of *feic* (to see) in the negative in the past tense) is pronounced 'ɔːk æ'. The students were shown how to do each exercise and told that they could refer back to the lesson for help. They were told that they could do the material in whatever order they wanted, but that it was a good idea to read and listen to the lesson first. As the students did not report

any particular difficulties with the lessons, no additional training was provided during the research period.

Training for the Verb Conjugation Component (VCC) involved showing the students how to use the software. For VCC evaluation purposes, C6 (from School 1) was split into two groups – one had access to static information only, while the other group could also see animated information. After a three week period, the groups were switched (see Chapter 10, Section 10.6 for details). Students were given a brief refresher training session for the VCC. If the students were in the animation group, there were shown how to view the animation information. For the Writing Checker Component (WCC), the students were shown how to enter a text, where the spelling errors and grammar errors were shown and how to resubmit a text, enter a new text or leave the WCC. As students reported some difficulties in using the WCC, they were given another training session that tried to address the issues raised. The CLICI training sessions were brief and to the point. The need to train the students had to be balanced by the fact that the instruction took place during class time. This was usually at a time when the teacher was giving a lesson to the class as a whole and possibly in a subject other than Irish. Students were free to ask questions and frequently did so. Occasionally, some students would be absent for a training session and they would be trained later.

9.4 School 1 – Description

In Dublin city, primary schools and secondary schools tend to be single-sex schools i.e. boys attend boys-only schools and girls attend girls-only schools. In other parts of the country, particularly in areas where the student population is small, children usually attend mixed schools. School 1 (S1) is a mainstream, English-medium primary school for boys in Dublin. There are around 28 – 30 students in each class. This would be fairy typical of a primary school in urban Dublin. There is a computer lab in the school with 15 PCs available for the students. The PCs are of a reasonable standard, but some of the headphones and mice are in need of repair. Students at the school are comfortable with using a computer and have had several years of computer experience. They are familiar with a web-style interface and are adept at using the mouse and keyboard (although none of them are touch-typists). A summary of the school is shown in Table 9.2.

Item	Description
School location	Dublin 7
School type	English-medium, mainstream boys school
Computer availability	15 PCs available in the computer lab, reasonable standard, some worn-out headphones and mice
Student computer experience	All students were comfortable with using a computer

Table 9.2 Description of School 1 (S1)

9.5 Teacher 1 and the CLICI Project

This section provides background information on Teacher 1 (T1) in School 1 (S1) and describes her interaction and that of her classes with the CLICI project.

9.5.1 Teacher 1 – Background Information

One teacher (T1) decided to continue with the CLICI project after the pilot study. During the lifetime of the CLICI project (including the pilot study) this teacher has two different classes. For the pilot study, T1 had a group of 2nd year students (7 – 8 years of age) and this is Class 1 (C1) in the pilot study. For the deployment phase of the CLICI system, there were 29 students in her class (Class 6 – C6), 26 of whom studied Irish. Three students were exempt from Irish due to learning difficulties. For the period September 2004 – June 2005, the class was a 3rd class, so the students were between 8 – 9 years of age and for the period September 2005 – June 2006, the teacher had the same group of students as a 4th class (9 – 11 years of age). Prior to participation in the CLICI project, neither the teacher not the students had any previous CALL experience. The students were competent computer users. The teacher has a very positive attitude toward Irish and the teaching of Irish. She believes that anything that would make Irish more interesting for the students would be welcome. She uses a range of teaching styles, including communicative techniques and a focus on form for grammar items. Although students studying Irish are not usually exposed to the grammar rules of the language until later on in their study, she feels that they are ready for them and that they can benefit for knowing at least some grammar rules. The teacher would like to spend more time on Irish, but this is not really possible due to the competing demands of other subjects. A description of Teacher 1 (T1) and Class 6 (C6) is provided in Table 9.3.

9.5.2 Teacher 1 – Implementation History

December 2002

The teacher (T1) started working with the CLICI project in December 2002. Initially the teacher was provided with an overview of CALL as she had no previous knowledge of CALL and had expressed an interest in using CALL for Irish.

January – April 2003

From January to April 2003, the C1 students' attitudes to Irish were investigated (via questionnaires) before and after usage of a CLICI prototype lesson in the pilot study (see Chapter 6). The pilot study aimed to find out whether it was feasible to develop CALL materials for Irish in the primary school context and to see if the students liked Irish CALL. The likelihood of the 'smile coefficient' – initial favourable reaction to CALL software by CALL novices (MacWhinney, 1995) was high, but it was still important to carry out this check. Also, it was an opportunity to determine what deployment difficulties existed in this particular

context. Note that this phase covers the pilot study reported on in Chapter 6 and involves other classes also.

Item	Description
Class size	29 students, 26 of whom studied Irish (3 exempt due to learning difficulties)
Class/student age	Sept 2004 – June 2005: 3rd class, students between 8-9 years of age Sept 2005 – June 2006: 4th class, students between 9-10 years of age
Teacher previous CALL experience	None (prior to the CLICI project)
Students previous CALL experience	None before Sept 2004, although were competent in using the computer
Teacher attitude to Irish	Very interested in Irish, anything that would make Irish more interesting to the students would be welcome
Teaching style	Use of communicative techniques, combined with focus on form (generally students do not learn grammar rules until later, but this teacher feels that they are ready and can benefit for knowing some rules). The teacher would like to spend more time on Irish.

Table 9.3 Description of Teacher 1 (T1) and Class 6 (C6)

September 2003 – June 2004

Based on both the teacher's and the students' positive feedback, a detailed needs analysis was carried out (see Chapter 5 and Chapter 6). Also, a PC was obtained and set up in the classroom to overcome the logistical difficulties of using the computer lab.

September 2004 – December 2004

The actual Implementation Phase of the CLICI project started in September 2004 with Class 6 (C6). From September 2004 – December 2004 the students worked with the lessons developed using the Lesson Generator Component (LGC). The lessons contained stories from the classroom textbook, along with audio files and language exercises. The aim of this phase was to familiarise students with CALL, so that they would be comfortable with using CALL and to try to minimise the initial over-positive reaction by novice CALL users (the 'smile coefficient'). When working with the teacher up to this point, it was obvious that the CALL resources would not be used by the students on a regular basis if students were not assigned specific computer time. Another aim of this phase was to regularise the use of the CALL software by the students by getting the teacher to assign them a 20 minute slot during the school week in which they could use the CLICI resources on the classroom PC.

January – April 2005

The period from January to April 2005 was used to continue the exposure to CLICI lessons, and to survey the students on their attitudes and obtain their feedback on the software.

May – June 2005

Initial testing of the Verb Conjugation Component (VCC) was carried out from May to June 2005. This was mainly to test the feasibility of the software and to make some initial evaluations.

September – December 2005

A more comprehensive evaluation of the VCC software was carried out from September to December 2005 with C6. The aim for this period was to test for learning difference between static and animated presentation of verb information and to investigate student preference for mode of presentation. In order to ensure that both groups had an equal distribution of good, medium and weak students, pupils were classified by their teachers and, where possible, equal numbers of each category were randomly assigned to each group. The students were trained in the use of the static VCC pages and used the software for three weeks. This was to try to minimise the effect of the "smile coefficient". Students from both groups continued to use the software for a further 3 weeks, with Group 1 (G1) only seeing the static version and Group 2 (G2) seeing the animated version. The two groups were then switched, with G1 seeing the dynamic version and G2 the static version. Software usage continued for a further three weeks. The students were also introduced to the Writing Checker Component (WCC) and asked to provide feedback on it.

January – March 2006

Finally, from January to March 2006, the C6 students continued to use the Writing Checker to produce texts in Irish.

June 2006

A questionnaire-based survey was administered to the C6 students in which they were asked to provide feedback on the WCC. The teacher (T1) also provided feedback on the CLICI system.

A summary of the implementation history with T1 is shown in Table 9.4.

Period	Class	Activity	Description	Aim
Dec 2002		Introduction to CALL	Provided an introduction to CALL to interested teachers in S1	• To provide an overview of CALL. These teachers had no previous knowledge of CALL but were interested in the possibilities.
Jan – Apr 2003	C1	Attitude testing and prototype development	Carried out a 'before and after' survey of students' attitudes to Irish and Irish CALL. Developed and deployed Irish CALL prototype (see Chapter 6 on the pilot study).	• To find out what the students' attitudes to Irish were. • To find out if it was feasible to develop CALL materials for Irish in the primary school context via the development of prototype materials • To see if the students liked Irish CALL • To find out the potential implementation difficulties in this particular context
Sept – Jun 2004		Needs analysis, PC installation	Carried out a needs analysis with stakeholders and procured classroom PC	• To find out what the learning needs were and to devise a plan of blended learning that would increase the chances of success • To procure a classroom PC for the class (to overcome the logistical difficulties of using the computer lab)
Sept – Dec 2004	C6	Installed CALL lessons	Installed Irish CALL lessons that were linked with the classroom activities	• To familiarise the students with Irish CALL • To regularise the use of CALL materials in the class

Table 9.4 Implementation History of the CLICI Project with Teacher 1 (T1) Part 1

Period	Class	Activity	Description	Aim
Jan – Apr 2005	C6	More CALL lessons, attitude survey	Install the relevant lessons on the PC and carried out an attitudinal survey with the students.	• To further embed the CALL materials in the classroom • To minimise the effect of the "smile factor"
May – Jun 2005	C6	Installed animated verbs	Installed the static and animated verbs on the PC, carried out student survey.	• To test for learning difference between static and dynamic presentation of verb information.
Sept – Dec 2005	C6	Continued animated verb testing, installed writing checker Questionnaire to students	Continued testing the effect of mode of presentation of verb information. Provided the students with the writing checker.	• To test for learning difference between static and dynamic presentation of verb information. • To investigate student preference for mode of presentation • To investigate the feasibility and student reaction to the writing checker
Jan – Mar 2006	C6	Use of writing checker	The students used the Writing Checker to produce texts in Irish	• To check the feasibility of using the writing checker • To determine the suitability and usefulness of the writing checker in this context
Jun 2006	C6	Questionnaire to students and teacher	A questionnaire-based survey was administered to the students The teacher filled out a feedback form	• To ascertain the students' opinion on the CLICI resources • To ascertain the teacher's opinion on the CLICI resources

Table 9.4 Implementation History of the CLICI Project with Teacher 1 (T1) Part 2

9.5.3 Teacher 1 - Implementation Findings

Each of the phases outlined above produced interesting findings. A recap of the findings reported in Chapter 6 on the pilot study is included here for completeness.

December 2002

The introduction to CALL phase resulted in one teacher being interested in continuing to experiment with CALL materials for Irish. This was essential for the success of the CLICI project, because a real deployment situation was required if the project was to avoid being just another "ivory tower" experiment.

January – April 2003

The findings from the pilot study revealed that the students' (C1) attitude to Irish was not positive, and that older students expressed more negative feelings towards the language (in all, 4 classes were involved in this pilot study phase of the project). As reported in Chapter 6, this phase demonstrated that it was feasible to develop CALL materials for this context and that the most useful scenario was the one where the CALL materials were linked with the class textbook. The students were comfortable using the computer and it was noted that bad equipment (e.g. worn headphones) reduced the quality of the CALL experience. The maximum attention span was around 15 to 20 minutes for this student group. It was easier and more realistic to work with non-final year classes, as final year classes were very focused on preparation for the entrance examination to secondary school and preparation for religious confirmation. The logistical difficulties associated with using the computer lab (e.g. student supervision) were apparent at this stage. Chapter 6 (Pilot Study) discusses this phase in greater detail.

September 2003 – June 2004

The Analysis Phase from September 2003 – June 2004 revealed that there are many learning needs in this context and any CALL materials that would focus on the four learning aims (reading, writing, listening, speaking) would be welcome (see Chapter 5 on the Analysis Phase). While blended learning (i.e. a mixture of classroom-based and computer-based learning) is often suggested as a working way of using CALL, the reality is that the implementation of a blended learning plan has to be carefully worked out. For example, the CALL materials that cover a particular topic or lesson must be available to the students when they need it. From a technical point of view, the problem of different versions of software on different computers manifested itself and resulted in some software release delays.

September – December 2004

When the CALL resources were made available to the students in Class 6 (C6) (September – December 2004) it became apparent that integrating the use of CALL materials into the classroom schedule is very important, as otherwise the students will not use them on a regular basis. Invariably, other classroom activities will impinge on CALL material usage, and unless

each student is assigned a particular slot in the week to use the CALL software, the computer will just become an unused piece of hardware occupying classroom space.

January – April 2005

The period from January – April 2005 showed that C6 students quickly adapt to CALL usage and that it soon ceases to be a novelty. This period also demonstrated that if the students are given an assigned timeslot on the computer for Irish CALL, they will use the software on a regular basis.

May – June 2005

A questionnaire-based survey was carried out in June 2005 with the C6 students. The objective of the survey was to find out the students' opinions on the CLICI lessons. 25 students responded and the overall reaction was favourable. A substantial minority (40%) do not like Irish, but all but 1 student enjoyed Irish on the computer. Most students found the LGC lesson at least somewhat helpful (68%) and most students (98%) listened to the recordings at least some of the time. An analysis of this data is provided in Chapter 10, Section 10.5, while Appendix I (Survey June 2005) provides more details.

The initial period of the VCC deployment revealed that clear instructions must be provided to students to make sure that they are doing what the teacher wants them to do. For example, if the teacher did not direct the students to work on a particular verb on the VCC, they would work on the lessons or verbs of their choice. This is not a problem in and of itself, but it is important to be aware that guidance is probably useful in this particular context. The students responded positively to the animated verb information, but due to external factors, they had only limited opportunities to test it out. Related to this, it was once again noted that external activities can decrease the use of CALL software by students.

September – December 2005

The period from September to December 2005 with C6 students revealed that it was difficult to test for learning difference between static and dynamic presentation of verb information. The number of students who took the Championship test for both static and animated verbs over the evaluation period for the same verb type/presentation combination was too low to be able to carry out proper hypothesis testing, although some interesting observations were made. The period from September to December 2005 provided some interesting insights into how the students perceived the CLICI resources. A questionnaire-based survey was carried out in November 2005 to ascertain the students' opinion of the CLICI materials. The questionnaire was administered to 20 students (see Chapter 10, Section 10.5 and Appendix J Survey November 2005 Part 1 for details). In general, the students liked Irish on the computer (85%)

and the majority found it at least somewhat helpful (75%). Just over half the students (55%) prefer learning Irish in class, with a sizeable minority (45%) preferring the computer and a small minority liking both (5%). Chapter 10, Section 10.5 discusses the results in detail. With regards to the VCC, the majority of the students (85%) enjoyed the verb part at least a little bit, with only 15% not enjoying it at all. A sizeable majority (80%) found it helpful at least some of the time, with only a minority (20%) did not find the VCC at least somewhat helpful. Chapter 10, Section 10.6 discusses the results and details are given in Appendix J (Survey November 2005, Part 2).

The students also provided feedback via an online questionnaire that was administered after they completed a Championship exercise (in November 2005). There were 23 completed surveys after the students had seen the static presentation, 20 for the animated presentation giving a total of 43 surveys in total. A minority of the students (17%) did not find the verb lessons helpful, while a majority (84%) found them (at least) somewhat helpful. The findings are discussed in Chapter 10, Section 10.6 (see Appendix K (VCC Online Feedback) for details).

Static-Animated Verb Conjugation Component

There was also empirical data collected on the students during their interaction with the VCC during the period November – December 2005. This data related to their test score results and the aim of this data collection and analysis was to determine if a particular presentation mode resulted in higher test scores. Chapter 10, Section 10.6 discusses the results, while Appendix L (VCC Empirical Data) has more details. Although not statistically significant, there are some indications that the static presentation is better for medium and weaker learners studying regular verbs, while the animated presentation is better for good students studying regular verbs.

Writing Checker Component

The students also provided feedback on the writing checker in November 2005 (See Chapter 10, Section 10.7 and Appendix J Survey November 2005 Part 4). The majority at least somewhat enjoyed the writing checker (70%) but a sizeable minority (40%) did not find it helpful.

January – March 2006

The period from January to March 2006 was used to continue testing the WCC with C6. Weak, medium and good level student texts are shown in Figure 9.1, Figure 9.2 and Figure 9.3 respectively. Appendix M C6 Learner Corpus Examples shows more examples of student texts. Note that there are many punctuation errors and a lack of full stops. The first text probably is an attempt at a piece of memorised text. The second text is an attempt at an original text, while the third text is probably copied from a textbook. The student's text is shown in the 'Original Text' column, a corrected version is offered in the 'Corrected Text' column, the spelling and grammar

errors are highlighted in the 'Errors' column, while the 'Translation' column provides a translation on what the researcher believes the student was trying to say.

Original Text	Corrected Text	Errors	Translation
[Name] is ainm dom agus ta me ar laethanta saoire. chonaic mé an trá agús chonaic mé an fear ghunatr rother agús ar an ghuatr agus chuaigh mé sá bhuailh .	*[Name]* is ainm dom agus tá mé ar laethanta saoire. Chonaic mé an trá agus chonaic mé an fear ghunatr rother agus ar an ghuatr agus chuaigh mé abhaile.	Spelling Errors: *ta (ta), me (mé), agús (agus), ghunatr (???), rother (rothar), ghuatr (???) bhuailh (abhaile)* Grammar Errors: Mixed tenses.	My name is [Name] and I'm on holidays. I saw the beach and I saw the ??? man and on the ??? and I went home.

Figure 9.1 Sample Text from Student 119 (weak)

Original Text	Corrected Text	Errors	Translation
bhí mé sá síopa inne. chuir mé an mílsean agus an ull bhí mé ag shiul sá tech. chuir mé an telifís an spórt agus an cátun. díth mé an diner. bhi mé an laba.	Bhí mé sa siopa inné. Chuir (put) (Cheannaigh?) mé an milseán agus an úll. Bhí mé ag súil sa teach. chuir mé an teilifís an spórt agus an cartún. D'íth mé an dinnéar. Bhí mé sa leaba.	Spelling Errors: *sá (sa), inne (inne), mílsean (milseán), ull (úll), shiul (súil), tech (teach),telifís(teilifís), cátun (cartún), diner (dinnéar), laba (leaba)* Grammar Errors: Incorrect choice of verb (*chuir* (put)/*cheannaigh* (buy)); (*chuir* (put)/*chonaic* (saw))	I was in a shop yesterday. I put (bought?) sweets and an apple. I was walking in the house. I watched sport and cartoons on the television. I ate my dinner. I was in bed.

Figure 9.2 Sample Text from Student 118 (medium)

Original Text	Corrected Text	Errors	Translation
Chuaigh Eoin sa phairc inné. Bhí faínleog agus sionnach ag troíd. Chonaic Eoin iora rua ar an cránn. Bhí Eoin ag imírt péle. Chuaigh Eoin sa abhaile areír.	Chuaigh Eoin isteach sa pháirc inné. Bhí fáinleog agus sionnach ag troid. Chonaic Eoin iora rua ar an gcránn. Bhí Eoin ag imirt peile. Chuaigh Eoin abhaile aréir.	Spelling Errors: *phairc (pháirc), faínleog (fáinleog), troíd (troid), imírt (imirt), péle (peile), areír (aréir)* Grammar Errors: Missing *isteach* (in), missing letter before *cránn* (*gcrann*) (eclipsis)	Eoin went to the part yesterday. A swallow and a fox were fighting. Eoin saw a red squirrel on the tree. Eoin played football. Eoin went home yesterday.

Figure 9.3 Sample Text from Student 117 (good)

June 2006

In June 2006, a questionnaire-based survey was carried out with C6. The object of the survey was to learn about the students' opinion on the WCC and writing in Irish. Chapter 10, Section 10.7 discusses the results in detail (see also Appendix N Survey June 2006). Broadly speaking the good students tended to understand the error messages better than the other students. They also found the WCC more enjoyable and helpful than the other levels (see Appendix N C1 Learner Corpus for more examples). A few suggestions for changes to the WCC included making the error messages more understandable and improvements to the feedback on spellings.

The empirical data on the texts (obtained from the session logs) produced by the students is quite interesting. Only 1 (weak) student failed to produce a text, all the other students managed at least one text. The students in general had many more spelling errors per text than grammar errors. In some sense, this vindicates the decision to separate out the spelling errors from the grammar errors, as in theory, it allows the students to focus on the (more important) grammar errors (see Chapter 10, Section 10.7 and Appendix O WCC Empirical Data for more details).

The teacher was happy with the WCC as she felt that it gave the students an opportunity to practise Irish through different media. More research on WCC usage would be required to see how the WCC could be improved. Full details are discussed in Chapter 10 on evaluation.

A summary of the implementation findings of the CLICI project with T1 is shown in Table 9.5.

Period	Class	Activity	Findings
Dec 2002		Introduction to CALL	• The teachers were interested in experimenting with CALL materials for Irish
Jan – Apr 2003	C1	Attitude testing and prototype development	• Students' attitudes to Irish were not positive, and were more negative amongst the older students • It was feasible to develop CALL materials for this situation • The most useful scenario was where the CALL materials were linked with the class textbook • Students were comfortable with using PCs • Students' attention span was 15 – 20 minutes • Bad equipment (e.g. old headphones) can have a negative impact on student attitude • It is easier to work with teachers in non-final year classes • Logistical issues with using the computer lab
Sept 2003 – Jun 2004		Needs analysis, PC installation	• There are many learning needs and any CALL materials that would focus on the four learning skills would be welcome • The implementation of a blended learning plan has to be carefully worked out • Different versions of software on different computers can delay software releases
Sept – Dec 2004	C6	Installed CALL lessons	• Integrating the use of CALL materials into the classroom schedule is very important • Other classroom activities will impinge on CALL material usage
Jan – Apr 2005	C6	More CALL lessons, attitude survey	• Students quickly adapt to CALL usage. • Given an assigned timeslot on the computer for Irish CALL, the students will use the software on a regular basis

Table 9.5 Implementation Findings of the CLICI Project with Teacher 1 (T1) Part 1

Period	Class	Activity	Findings
May – Jun 2005	C6	Installed animated verbs	• Clear instructions must be provided to students to make sure that they are doing what the teacher wants them to do • Students responded positively to the animated verb information, but due to external factors, they had only limited opportunities to test it out • External activities can decrease the use of CALL software by students
Sept – Dec 2005	C6	Continued animated verb testing, installed Writing Checker Questionnaire to students	• Difficult to test for learning difference between static and dynamic presentation of verb information. • Students preferred animated mode of presentation • Initial favourable reaction to WCC
Jan – Mar 2006	C6	Use of writing checker	• Students could use the WCC to produce Irish texts
Jun 2006	C6	Questionnaire to students and teacher	• Students do not like writing in Irish, found the WCC somewhat enjoyable but had problems with the error messages • Teacher was happy with the WCC • More research on WCC usage would be required

Table 9.5 Implementation Findings of the CLICI Project with Teacher 1 (T1) Part 2

9.6 Teacher 6 and the CLICI Project

This section provides background information on Teacher 6 (T6) in School 1 (S1) and her class (C7) and their (limited) interaction with the CLICI project.

9.6.1 Teacher 6 – Background Information

Due to the difficulties that arose with empirically testing the VCC with C6 (i.e. small sample in each student level/presentation mode category and non-uniform usage), another class at the same level, but with a different teacher (T6) (Class 7 – C7) was contacted and agreed to use the VCC software. The teacher was interested in Irish and combined the class text book, with grammar instruction and communicative techniques. The students had no previous CALL experience but where computer-literate. Table 9.6 provides a brief description of Teacher 6 (T6) and Class 7 (C7).

Item	Description
Class size	28, 26 of whom studied Irish (2 exempt due to learning difficulties)
Class/student age	4th class, students between 9-10 years of age
Teacher previous CALL experience	None (prior to the CLICI project)
Students previous CALL experience	None, although were competent in using the computer
Teacher attitude to Irish	Interested in Irish, anything that would make Irish more interesting to the students would be welcome
Teaching style	"Traditional style", mix of class book, grammar instruction and communicative techniques

Table 9.6 Description of Teacher 6 (T6) and Class 7 (C7)

9.6.2 Teacher 6 – Implementation History

The aim of working with Teacher 6 (T6) and Class 7 (C7) was to see if the students with access to the animation format would perform better than those who did not. As with C6, the class was divided up into two groups with roughly equal numbers of students from the good, medium and weak categories as decided by the teacher and the appropriate training was provided. Table 9.7 shows the implementation history of the CLICI project with Teacher 6 (T6) and Class 7 (C7).

Period	Class	Activity	Description	Aim
Dec 2005	C7	Contact with teacher, provided overview of CLICI	Provided an overview of the VCC to Teacher 6	• To see if T6 was interested and willing to participate in CLICI project
Jan 2006	C7	VCC Checking with C7 class	The VCC software was tested by students in Class C7	• To see if there were any performance differences between students who had access to animation and those who did not

Table 9.7 Implementation History of the CLICI Project with Teacher 6 (T6)

9.6.3 Teacher 6 – Implementation Findings

January 2006

Class 7 (C7 was divided into two groups to test the VCC. Unfortunately, the class teacher had to take leave of absence for personal reasons so the VCC testing was not as comprehensive as

initially hoped. 18 of the 26 students had a chance to use the VCC. Their scores were all very high (perhaps due to the two verbs studied). The static presentation produced much better scores for both regular and irregular verbs but the small data set produces skewed results. The limited data makes meaningful analysis impossible (see Chapter 10, Section 10.6 for more information). Table 9.8 shows a summary of the implementation findings with C7.

Period	Class	Activity	Findings
Jan 2006	C7	VCC Checking with C7 class	• For personal reasons, the teacher was given leave of absence during the research period, and therefore the testing was not as comprehensive as initially hoped for

Table 9.8 Implementation Findings of the CLICI Project with Teacher 6 (T6)

9.7 School 2 - Description

School 2 (S2) is an English-medium primary school that is located in a designated disadvantaged area. The level of academic attainment is lower than the rest of the country. Students come from disadvantaged backgrounds and the State aims to supply extra resources to the school. There are usually a higher proportion of students with learning difficulties and support teachers are available for students with English and mathematics learning difficulties. Class sizes range from 17 – 26 pupils. S2 is located in Dublin 11. There is a computer laboratory in the school but it was not available to the students at the start of the project. All students are comfortable with using a computer. A summary of the school is shown in Table 9.9.

9.8 Teacher 5 and the CLICI Project

This section provides information on Teacher 5 (T5) in S2 and her classes' interaction with the CLICI project.

Item	Description
School location	Dublin 11
School type	English-medium boys school, in a designated disadvantaged area
Computer availability	15 PCs available in the computer laboratory but at the start of the project it was not available
Student computer experience	All students were comfortable with using a computer

Table 9.9 Description of School 2 (S2)

9.8.1 Teacher 5 – Background Information

The teacher (T5) in S2 had previous CALL experience with two final year undergraduate B.Sc. in Applied Computational Linguistics students in Dublin City University (DCU). They produced CALL resources for French and German for a previous class (Keogh and Green, 2004). The teacher had a positive experience and was interested in helping out with the CLICI project. She tries to make Irish as enjoyable as possible for the students, using drama and poems to teach Irish. The teacher also recognises the value of teaching some language rules and teaches these to her students where appropriate. She had three different classes during the CLICI project (including the pilot study). C5 is her class from the pilot study (3rd class, 8 – 10 year olds – see Chapter 6). Class 8 (C8) is the class that participated in the CLICI project from September 2004 – June 2006. C8 was a 4th class with 26 students. Class 9 (C9) refers to the group that the teacher taught from September 2005 – June 2006. C9 had 17 students and only three of these were classified by the teacher as being of normal standard. In general in S2, due to high number of students with learning difficulties, the class is usually one year behind in its study of Irish e.g. even though the C7 students were a 4th class, they used textbooks for 3rd class students. In both classes (C8 and C9), most of the students had a learning difficulty of some sort (from mild to very dyslexic). The students had no previous CALL experience. A description of these classes (C8 and C9) and some teacher information is shown in Table 9.10 (C5 is described in Chapter 6 on the pilot study).

Item	Description
Class size	C8: 26 students, many with learning difficulties C9: 17 students, 13 of whom receive extra help for learning difficulties (students have different degrees of difficulties)
Class/student age	C8: 4th class, students between 9 – 11 years of age C9: 4th class, students between 9 – 11 years of age
Teacher previous CALL experience	One year for French and German CALL (with a different class)
Students previous CALL experience	C8: None, although all were competent in using the computer C9: None, although all were competent in using the computer
Teacher attitude to Irish	Very interested in Irish (all her teacher-training was in Irish) and tries to impart this to her students.
Teaching style	Uses drama and poems to make Irish more interesting for the students. She also teachers some points of grammar.

Table 9.10 Description of Teacher 5 (T5), Class 8 (C8) and Class 9 (C9)

9.8.2 Teacher 5 – Implementation History

December 2002

The teacher (T5) started working on the CLICI project in December 2002. As she had previous CALL experience, the aim of this phase was to discuss ideas for the project.

January – April 2003

The teacher and her class (C5) took part in the pilot study from January to April 2003. The aim of this phase was as stated above for School 1.

September 2003 – June 2004

The period from September 2003 to June 2004 was used to carry out the needs analysis. The aim was to find out what resources were required in this particular context.

September - December 2004

Basic CALL lessons were installed at the start of the new academic year in September 2004 to test the feasibility of using CALL in this classroom. Class 8 (C8) participated in this phase of the CLICI project.

January – April 2005

The focus of the CLICI project in this school was on the Writing Checker Component (WCC), therefore the C8 students did not have access to the VCC. During the January – April 2005 period, the teacher was consulted for her input on various aspects of the WCC.

May – June 2005

The aim of the WCC prototype phase was to see if the C8 students could use the WCC and to find out what problems existed. As part of their training in the use of the WCC, they were told that the WCC was also 'learning' Irish and would not always know the correct answer. If the WCC reported something that they thought was not right, they could check with their teacher. This was to prevent them assuming that the WCC was always right (as recommended by Jacobs and Rodgers (1999)). The aim of the WCC testing phase was to see if the WCC was a feasible and usable option for the students in this context.

September 2005 – March 2006

Class 9 (C9) students had access to the WCC from September 2005 to March 2006.

A summary of the implementation history with Teacher 5 (T5) is shown in Table 9.11.

Period	Class	Activity	Description	Aim
Dec 2002		Discussion of CLICI project	Discussed the aims of the CLICI project with the teacher	• To discuss the CLICI project with the teacher and ask for her input.
Jan – Apr 2003	C5	Attitude testing and prototype development	Carried out a before and after questionnaire-based survey of students' attitudes to Irish and Irish CALL (see Chapter 6 on the pilot study for more details). Developed and deployed Irish CALL prototype.	• To find out what the students' attitudes to Irish were. • To find out if it was feasible to develop CALL materials for Irish in the primary school context via the development of prototype materials • To see if the students liked Irish CALL • To find out the potential implementation difficulties in this particular context
Sept 2003 – Jun 2004		Needs analysis, PC installation	Carried out a needs analysis with stakeholders and procured classroom PC	• To find out what the learning needs were and to design CALL resources that would fit in with the teacher's teaching style • To procure a classroom PC for the class (to overcome the logistical difficulties of using the computer lab)
Sept – Dec 2004	C8	Installed CALL lessons	Installed Irish CALL lessons that were linked with the classroom activities	• To familiarise the students with Irish CALL • To regularise the use of CALL materials in the class

Table 9.11 Implementation History of the CLICI Project with Teacher 5 (T5) Part 1

Period	Class	Activity	Description	Aim
Jan – Apr 2005	C8	Discussed ideas for Writing Checker	Discussed possibilities and options for the Writing Checker	• To get input from the teacher on what her ideas were for the WC
May – Jun 2005	C8	Installed the Writing Checker prototype	Installed the Writing Checker prototype on the classroom computer	• To test to see if the students could use the Writing Checker and what problems they encountered
Sept 2005 – Mar 2006	C9	Use of Writing Checker	The students used the Writing Checker to produce texts in Irish	• To check the feasibility of using the writing checker • To determine the suitability and usefulness of the writing checker in this context
Jun 2006		Questionnaire to teacher	Teacher provided feedback on WCC	• To ascertain teacher's opinion on WCC

Table 9.11 Implementation History of the CLICI Project with Teacher 5 (T5) Part 2

9.8.3 Teacher 5 – Implementation Findings

The deployment of the CLICI resources with Teacher 5 (T5) in S2 was very different from Teacher 1 (T1) in S1. In C6 each student was assigned a regular timeslot of 20 minutes per week for Irish CALL usage and students were exposed to LGC lessons, the VCC and the WCC. However, in C8 and C9, the students principally worked with the WCC. The T5 teacher planned that only a few students (i.e. the better students) would use the software after the prototype stage. The students were trained on the use of the WCC. These students were not assigned particular timeslots, but were assigned time by the teacher when she considered it appropriate. The classroom ambiance in these classes (C8 and C9) and in the school (S2) in general places greater demands on the teacher than in a mainstream school. It is probably hard to maintain control as the pupils would tend to be more disruptive. Also, given the number of students who require assistance, there are students constantly coming and going during the school day, as students attend sessions with special needs teachers for reading or mathematics. In summary, there are more disruptions and this makes it more difficult to establish CALL as a regular activity. Therefore, an organic approach was adopted to the deployment of the CLICI resources in this context – in other words, its usage was left up to the teacher without prodding

from the researcher. This meant that only limited use was made of the CALL resources. However, CALL researchers must respect classroom teachers and accept that their software will not always be used or be as wonderful to others as they might wish. Technology transfer (e.g. getting the technology used outside the coverage of the original research project) is an issue in CALL. In general, CALL has not yet been normalised (Bax, 2003) in the classroom i.e. it is not considered one of the standard resources available like a pen and paper. Many CALL research projects involve limited interaction with the participants only for the period of the project and interaction between the researchers and the participants ends when the project ends. Furthermore, the participants may receive help and support during the period of the research project that would not be feasible with wider deployment of the CALL materials. As the resources developed during the CLICI project have received favourable feedback from teachers and students, the aim is to continue to use the resources (in S1 with a new teacher at least, and possibly a new school with teacher T1, who has since changed schools) and to refine the deployment plan so that it could be rolled out to other classes and other schools.

As several of the findings from the pilot study were similar to C6 (above), only the salient findings will be discussed here. The teacher was interested in working with the CLICI project and was willing to try out new CALL resources for Irish. The results of the pilot study for C5 were discussed in detail in Chapter 6 and were broadly similar to C1. However, the computer lab in the school was unavailable during the pilot study and the students had to come to DCU to use the CALL resources. This was acceptable on a one-off basis, but not for regular usage. Therefore, a classroom PC would be required for this class. The CALL resources are unlikely to be used unless they are scheduled for each student or the teacher directs the students to use them at a suitable time during the school week.

The T5 teacher was keen on using a WCC for Irish and she was not particularly interested in the VCC. During the WCC prototype development phase, the teacher provided useful input as to what errors were important with this target group of students. The teacher identified the need to separate the grammar errors and the spelling errors, so that the students could focus on the grammar errors. She was not particularly concerned with spelling errors per se, as they were not a priority for her. The need to adapt the *Gramadóir* error messages was also apparent. The prototype deployment phase of the WCC was very useful. Problems with the screen design were quickly identified by the students and after several iterations a suitable layout was agreed with the students. They wanted to see the spelling errors and grammar errors displayed separately as otherwise they found it hard to distinguish them. They also wanted to be able to resubmit a (corrected) text to the WCC. In general, they liked using the WCC. They particularly liked trying out (strange) sentences to see what the WCC would say. A summary of these findings is shown in Table 9.12.

Figure 9.4 shows a representative sample text from Student 001, one of the students in C8 (see Appendix P T5 Learner Corpus Examples for other examples of student texts). The student wrote that he bought (*cheannaigh*) eight items. This text shows that the student is being adventurous as textbooks would usually only list three or four items at a time. Note that there are several punctuation errors in this text. Note the complete lack of any accent (*fáda*) in the text.

Pedagogical Findings (teacher and CALL developer)
• Need to localise the *Gramdóir* error messages • Need to separate the grammar and the spelling error messages
User Interface Findings (students)
• Need to display the spelling errors on one part of the screen, and the grammar errors on another part • Need to be able to resubmit a text
General Feedback (students)
• Liked using the WCC • Liked trying out sentences to see what the WCC would say

Table 9.12 Findings from the Writing Checker Prototype Phase

The C9 students had access to the WCC during the school year September 2005 – March 2006. Only four students used the writing checker as these were the students that the teacher decided would benefit most from, or at least be able to use, the WCC to produce texts in Irish. However, given other demands on the students' and teachers time, they only got to use it in February 2006. Therefore the data is extremely small (see Chapter 10, Section 10.7 and Appendix P T5 Learner Corpus for more information). Note that there were no surveys administered to C9 due to the limited number of students and their limited usage of the system. This deployment context was probably quite realistic in the sense that the organisation and enthusiasm required to integrate CALL resources into the teaching schedule might wane with even the most committed teacher. Therefore, if the CLICI resources were to be deployed in other schools, the actual usage and the frequency of usage would probably be closer to the C9 experience rather than the C6 experience. The WCC would simply be a tool (in the non-CALL sense) to be used by the students on an ad-hoc basis as directed by the teacher. A summary of the implementation findings of the CLICI project with T5 is given in Table 9.13.

9.9 Concluding Comments

Although the two schools involved in the project are both English-medium primary schools based in Dublin, there are some significant differences between them. For example, in School 1

(S1), the mainstream school, the students use the recommended textbook for their class, whereas in School 2 (S2), the school in the disadvantaged area, the students use a textbook recommended for a more junior year. More students are exempt from studying Irish in S2 and there are fewer above-average students. These observations highlight the fact that what may initially appear to be a fairly standardised deployment context is in fact not so homogenous. This has implications for CALL design, development and implementation, as a 'one size fits all' approach would limit potential usage.

Original Text	Corrected Text	Errors	Translation
La amhain,Bhi me ag an siopa agus cheannaigh me milsean,oraisti,piorrai,ulla,bananai,cnonna,fionnchaora agus brioscai. Ta an mala trom. Ta an pion i mo cheann. Bhuigh me dul go dti an toir.	Lá amháin, bhí mé ag an siopa agus cheannaigh mé milseán, oráistí, piorraí, úlla, bananaí, cnónna, fíonchaora agus brioscaí. Tá an mhala throm. Tá pian i mo cheann. Chuaigh mé go dtí an stór.	Spelling Errors: *La (Lá)* amhain (amháin), *me (mé), siopa (siopa), milsean (milséan), oraisti (oráistí), piorrai (piorraí), ulla (úlla),bananai (bananí), cnonna (cnónna), fionnchaora (fionchaora), brioscai (brioscaí) ta (tá), pion (pian), Bhuigh (Chuaigh), dti (dtí), toir (stóir)* Grammar Errors: Missing '*h*' in *mala* (bag) and *trom* (heavy) (aspiration)	One day, I was (in) the shop and I bought sweets,oranges, pears, apples, bananas, nuts, raisins and biscuits. The bag is heavy. I have a headache. I went (?) to the shop.

Figure 9.4 Sample Text form Student 001 (good)

One of the problems for CALL researchers is the difficulty in evaluating CALL resources longitudinally (Felix, 2005; see also Chapter 10 on evaluation). Many CALL artefacts are tested with students, usually on a voluntary basis, and some only for one treatment (i.e. CALL usage session). This is because it is often difficult to have access to the students over time. Researchers who have (direct) access to third level students (e.g. Heift, 2001) are able to carry

out longitudinal evaluation. The primary school context where the student population tends to be stable for at least one school year may appear to offer a positive environment for longitudinal evaluation. However, there are some difficulties that must be mentioned in this regard. In Ireland, the primary school year runs from the beginning of September to the end of June. There are breaks for Christmas and Easter, as well as mid-term breaks in October and February.

Period	Class	Activity	Findings
Dec 2002		Discussion of CLICI project	• The teacher was interested in experimenting with CALL materials for Irish
Jan – Apr 2003	C5	Attitude testing and prototype development	• It was feasible to develop CALL materials for this situation • Students were comfortable working with the computer • Students' attention span was 15 – 20 mins • Bringing the students to DCU to use the CLICI software would not be feasible in the long term
Sept 2003 – Jun 2004		Needs analysis, PC installation	• The teacher was principally interested in using a Writing Checker Component (WCC) – she felt it might be a useful tool for the brighter students who needed to be challenged in Irish
Sept – Dec 2004	C8	Installed CALL lessons	• Integrating the use of CALL materials into the classroom schedule is very important • Other classroom activities will impinge on CALL material usage
Jan – Apr 2005	C8	Discussed ideas for Writing Checker	• The teacher felt that the WCC as outlined, had potential
May – Jun 2005	C8	Installed the Writing Checker prototype	• The students were able to use the WCC and provided feedback on improvements to the presentation
Sept 2005 –Mar 2006	C9	Use of Writing Checker	• Students could use the WCC to produce Irish texts • Very limited use
Jun 2006		Questionnaire to teacher	• Teacher saw potential of WCC, although it was not a priority for her

Table 9.13 Implementation Findings of the CLICI Project with Teacher 5 (T5)

It is hard to find a window of 6 weeks continuous schooling. Experience on the CLICI project has shown that the beginning of September (start of school year), the end of October (Halloween), beginning of November, most of December (Christmas), the beginning of January (start of second term), mid February (mid-term break), mid-March (St Patrick's Day is March 17th – National holiday), parts of April (Easter), some time in May (communion or confirmation preparation/music) and most of June (end of year exams) are unsuitable for CALL evaluation. Also, preparation for school inspection, visiting EU delegations and preparation for external events can divert time away from CALL usage. This does not take into account teacher absence due to illness or other reasons, which can also have an impact on CALL usage. Finally, unless the CALL researcher is actually the class teacher, the researcher is dependent on the teacher for the actual usage of the CALL resources.

9.10 Summary

This chapter discusses how the CLICI resources were actually used in the target environment. It reviews the general area of CALL deployment in this context as well as the importance of training. Two schools were involved in this phase of the research and the rest of the chapter describes the usage of the CLICI resources in the two schools. Section 9.2 summarises the Schools, teachers and classes that participated in the CLICI project. CALL usage training and the CLICI training in particular are reviewed in Section 9.3. Section 9.4 gives a description of School 1 (S1), which is a mainstream school. Teacher 1 (T1), her CLICI participation classes (C1 and C6) and related implementation history and findings of the CLICI resources are presented in Section 9.5. It discusses the involvement of the teacher from the initial conception of the CLICI project and through the usage of the three CLICI resources (LGC lessons, VCC and WCC). Section 9.6 provides information on Teacher 6 (T6), Class 7 (C7) and their CLICI implementation history and findings. Section 9.7 describes School 2 (S2), which is a school in a disadvantaged area. Teacher 5 (T5) and her CLICI participation classes (C5, C8 and C9) and related implementation history and findings are discussed in Sections 9.8. Although both teachers (T1 and T5) are primary school teachers, it was interesting to see that there were also different findings due to the inherent differences between the classroom contexts. Some concluding comments are given in Section 9.9, including the fact that the school year is actually quite fractured and not as continuous as might initially be presumed.

Chapter 10 Evaluation

10.1 Introduction

This chapter discusses the evaluation of the project. Section 10.2 provides a general overview of evaluation in CALL and looks at issues around quantitative and qualitative data. A more detailed review of the CALL literature on evaluation is given in Section 10.3, which reviews Chapelle's (2001), ICT4LT (2005) and Colpaert's (2004) evaluation criteria. Section 10.4 outlines how the CLICI project was evaluated using Bradin's (1999) CALL software evaluation criteria. The Lesson Generator Component (LGC) is evaluated in Section 10.5. Section 10.6 contains the evaluation for the Verb Conjugation Component (VCC), while Section 10.7 describes the evaluation for the Writing Checker Component (WCC). An evaluation of the project from a software engineering point of view is given in Section 10.8, while Section 10.9 carries out an evaluation from a CL/CALL integration perspective. The typical pitfalls that surround CALL evaluation (Felix, 2005) and the actions taken to try to avoid them are discussed in Section 10.10. The limitations of the research findings are identified in Section 10.11. Section 10.12 provides some concluding comments, while Section 10.13 gives a summary of the chapter.

10.2 General Overview of Evaluation

Overview

Evaluation in CALL has always been complex. Regarding *how* to evaluate, does qualitative evaluation give a better evaluation or does quantitative evaluation provide a more realistic approach for CALL? If both approaches are used, how should they be combined? Regarding *what* to evaluate, the debate in CALL has moved on from the "Is CALL better than non-CALL?" to "What aspects of CALL are effective in which settings and for what type of learner?". In recent years, there has been increasing focus on evaluation in CALL. Felix (2005) reviews evaluation in CALL and provides suggestions and examples of projects that have carried out good evaluations. Hubbard (2005) reviews what types of evaluation are carried out and reports that both subjective (opinion-based or judgemental) and objective (data-based or empirical) evaluations are used. The issue of quantitative and qualitative evaluation in CALL and the need for, and the value of both are outlined below. In order for CALL research to be of value, it is essential that evaluations are carried out. However, it is equally important that evaluation is considered at the start of a project and not just as an afterthought. Levy (1999) states that evaluation should be considered at the design stage. Chapter 7 (Design) provided a brief outline for each of the three components of the CLICI project. This chapter reports on qualitative and quantitative evaluations of these components from various viewpoints, as well as project-wide evaluations.

Goodfellow (1999) advocates a phenomenographic approach to CALL evaluation, which includes descriptive recordings of the learner's experience. He lists different types of data that are relevant to CALL evaluation, including quantitative performance data, qualitative performance data, learner insights, introspective quantitative data and introspective qualitative data. While it would be desirable to have all five types of phenomenographic data, often the reality is that it is not possible to obtain them all. Felix's (2005) research on CALL evaluation is recent and provides a good overview of the subject. She outlines the pressing need for good CALL effectiveness research. She identifies two problems, namely the fact that evaluation research is relatively scarce and lacks scholarly rigor. Felix refers to shortcomings reported by Chapelle and Jamieson (1991) and states that they are still relevant today. Researchers do not control for extraneous variables and therefore they cannot show cause and effect. Subjects are not randomly selected and the measuring instruments are questionable. Also, researchers do not control for the 'reactive effect', where the attitudes and feelings of students, teachers and organisations impinge on the outcome. One way of overcoming these shortcomings is to focus on the process of learning rather than on outcomes alone.

Other common problems include misleading titles of research reports, providing a poor description of the research design, a failure to investigate previous research, poor choice of variables to be investigated and over-ambitious reporting of results. Researchers should state procedures, materials, technologies, tests and statistical analysis used. Felix (2005) cites Nutta et al. (2002) as a good example of CALL effectiveness design and reporting. Researchers should discuss limitations and potential threats to their findings (Chapelle and Jamieson, 1991). Felix outlines various research categories, variables and research designs that can be used. Research categories include the number of participants, the research design used, technology, setting and language skill. Variables include conversation, grammar, learning styles, listening and time. Research design considers the use of pre- and post-tests, the use of a control group and the selection of random subjects. There are various types of research design including pre-experimental, quasi-experimental and non-experimental. The reader is referred to Felix (2005) for details. In summary, Felix states that there should be a match between the design, the research question, the context, the time-frame available, the variables, the statistical analysis capacity and the ability to control for confounding elements. Various collection measures should be used and researchers are encouraged to consider the use of time-series analysis with switching and delayed tests. Hubbard (2005) identifies some CALL research weaknesses. He cites the small number of subjects as one potential shortcoming, but notes that the numbers involved are commensurate with research from similar areas. Often the research is based on just one session, with novice CALL users, who sometimes receive no training before using the software.

Quantitative and Qualitative Evaluation

Quantitative (QT) and Qualitative (QL) evaluation are both important components of CALL evaluation. QT provides the hard facts while QL can often provide deeper insight into what happens when a learner avails of a CALL artefact. However, given that CALL has both a science and a humanities heritage, there is sometimes conflict over what is the desired, accepted or preferred mode of evaluation. Researchers from a scientific background argue that QT evaluation is the only one that produces measurable data and therefore the only type that enables researchers to stand over their findings. According to those in the science camp, data produced by QL analysis is by its nature subjective and does not meet the rigorous objective criteria accepted in the sciences. People from the humanities often hold the opposite viewpoint. They argue that mere objective numbers do not tell the real story behind what is going on. It can be difficult to change such deeply ingrained cultural stances, but, both modes of evaluation provide useful information and, where possible, both modes should be used.

Brandt (2005) reports on the benefits of carrying out both QL and QT evaluations. He has investigated the difference in learning outcome and learning experience between a Spanish module delivered in the traditional mode and in blended mode (i.e. a combination of face-to-face classes and online sessions). No significant difference was found between student performance in the two groups. However, QL analysis revealed that there was a difference between high achieving and low achieving learners in terms of effort, interest and motivation. This difference could not be detected by the QT analysis alone. On the other hand, QT data was able to dispel a long held supposition by language teachers in the university in question that blended learning students have a higher drop-out rate than regular students. The data showed that the retention rates were the same for both groups.

In recent years there has been a re-awakening with CALL researchers of the value of QT research (e.g. Jamieson and Chapelle, 2004). It may take slightly longer for some of those in the sciences to accept the value and validity of QL data. Both QL and QT evaluations are used in this project. Note that the terms judgemental and subjective are used to cover qualitative data, while empirical and objective are used for quantitative data.

Formative and Summative Evaluation

Formative and summative evaluations are also used in CALL projects. Formative evaluation takes place in parallel with software development, i.e. the users evaluate the software and their feedback is taken into account during software design and development. Summative evaluation on the other hand, takes place after the software has been developed. Formative evaluation often occurs when prototypes are used, whereas summative evaluation is more common when an ADDIE approach is adopted. In the context of this project, formative evaluation was used

when the prototypes of the Verb Conjugation Component (VCC) and the Writing Checker Component (WCC) were developed, while summative evaluation was used once the software was fully developed.

10.3 CALL Evaluation

Evaluating CALL

This section provides a brief overview of Chapelle's (2001), ICT4LT and Colpaert's CALL evaluation criteria. Combined these criteria are quite comprehensive and the combination is used to evaluate the CLICI CALL artefacts. Results are shown in the relevant sections below.

10.3.1 Chapelle's Evaluation Criteria

Chapelle (2001) identifies evaluation principles as well as judgemental and empirical evaluation for CALL tasks. She states that evaluation of CALL should take into account the deployment context and that both judgemental and empirical analysis should be carried out. SLA theory and research should inform the criteria used to check for CALL task quality and these criteria should be applied, based on the purpose of the task. Chapelle states that the language learning potential should be the main evaluation criterion. A summary of these principles and their implications are shown in Table 10.1. Chapelle outlines three levels of analysis for CALL evaluation: CALL software (judgemental), teacher-planned CALL activities (judgemental) and learner performance (empirical) (see Table 10.2).

Principle	Implication
Evaluation of CALL is a situation-specific argument.	CALL developers need to be familiar with criteria for evaluation which should be applied relative to a particular context.
CALL should be evaluated through two perspectives: judgemental analysis of software and planned tasks, and empirical analysis of learners' performance.	Methodologies for both types of analyses are needed.
Criteria for CALL task quality should come from theory and research on instructed SLA.	CALL evaluators need to keep up with and make links to research on instructed SLA.
Criteria should be applied in view of the purpose of the task.	CALL tasks should have a clearly articulated purpose.
Language learning potential should be the central criterion in evaluation of CALL.	Language learning should be one aspect of the purpose of CALL tasks.

Table 10.1 Chapelle's (2001) Principles and the Implications for CALL Evaluation

Level	Object of evaluation	Example question	Method of evaluation
1	CALL software	Does the software provide learners the opportunity for interactional modifications to negotiate meaning?	Judgemental
2	Teacher-planned CALL activities	Does the CALL activity designed by the teacher provide learners the opportunity to modify interaction for negotiation of meaning?	Judgemental
3	Learners' performance during CALL activities	Do learners actually interact and negotiate meaning while they are working in a chat room?	Empirical

Table 10.2 Chapelle's (2001) Levels of Analysis for CALL Evaluation

Chapelle specifies six criteria for evaluation: language learning potential, learner fit, meaning focus, authenticity, positive impact and practicality. An explanation of each of these terms is given in Table 10.3. She provides example questions for both judgemental and empirical evaluations and these are shown in Table 10.4 and Table 10.5, respectively.

Criteria	Explanation
Language learning potential	The degree of opportunity present for beneficial focus on form.
Learner fit	The amount of opportunity for engagement with language under appropriate conditions given learner characteristics.
Meaning focus	The extent to which learners' attention is directed toward the meaning of the language.
Authenticity	The degree of correspondence between the CALL activity and target language activities of interest to learners out of the classroom.
Positive impact	The positive effects of the CALL activity on those who participate in it.
Practicality	The adequacy of resources to support the use of the CALL activity.

Table 10.3 Chapelle's (2001) Criteria for Evaluation CALL Task Appropriateness

Qualities	Questions
Language learning potential	Do task conditions present sufficient opportunity for beneficial focus on form?
Learner fit	Is the difficulty level of the targeted linguistic forms appropriate for the learners to increase their language ability? Is the task appropriate for learners with the characteristics of the intended learners?
Meaning focus	Is learners' attention directed primarily toward the meaning of the language?
Authenticity	Is there a strong correspondence between the CALL task and second language tasks of interest to learners outside the classroom? Will learners be able to see the connection between the CALL task and tasks outside the classroom?
Impact	Will learners learn more about the target language and about strategies for language learning through the use of the task? Will instructors observe sound second language pedagogical practices by using the task? Will both learners and teachers have a positive learning experience with technology through the use of the task?
Practicality	Are hardware, software, and personnel resources sufficient to allow the CALL task to succeed?

Table 10.4 Chapelle's (2001) Questions for Judgemental Analysis of CALL Task Appropriateness

10.3.2 ICT4LT Evaluation

The ICT4LT (Information and Communications Technology For Language Teachers) is a web site that provides a wide range of information on CALL. It is based on a project originally funded by the European Commission. The ICT4LT web site provides a CALL software evaluation checklist. It covers some of the areas considered by Chapelle, but places slightly more emphasis on the software side. For example, it explicitly considers sound, pictures and video. The ICT4LT evaluation criteria are shown in Table 10.6.

10.3.3 Colpaert's Usefulness Criteria

Colpaert's usefulness criteria were discussed in Chapter 7 on Design. His criteria are usability, usage, user satisfaction and didactic efficiency. Table 10.7 shows a summary of these criteria.

Qualities	Questions
Language learning potential	What evidence suggests that the learner has acquired the target forms that were focused on during the CALL task? What evidence indicates that learners focused on form during the CALL tasks?
Learner fit	What evidence suggests that the targeted forms are at an appropriate level of difficulty for the learners? What evidence suggests that the task is appropriate to learners' individual characteristics (e.g. age, learning style, computer experience)?
Meaning focus	What evidence suggests that learners' construction of linguistic meaning aids language learning? What evidence suggests that learners use the language during the task of constructing and interpreting meaning?
Authenticity	What evidence suggests the learners' performance in the CALL task corresponds to what one would expect to see outside the CALL task? What evidence suggests the learners see the connection between the CALL task and tasks outside the classroom?
Impact	What evidence suggests that learners learn more about the target language and about strategies for language learning through the use of the task? What evidence suggests that instructors engage in sound second language pedagogical practices by using the task? What evidence suggests that learners and teachers had a positive experience with technology through the use of the task?
Practicality	What evidence suggests that hardware, software, and personnel resources prove sufficient to allow the CALL task to succeed?

Table 10.5 Chapelle's (2001) Questions for Empirical Analysis of CALL Task Appropriateness

10.3.4 Recommendations - Felix and Hubbard

Both Felix (2005) and Hubbard (2005) recommend providing context and evaluation information in detail. They suggest stating the number of students, the measures taken, the number of sessions, when the students were studied, their CALL experience and their 'traditional' experience. It is also important to describe what training was given to the students (both pedagogical and technical) and if CALL research intervention took place or not. Other necessary data are the research design, the technology, the setting, the language, the skill and what variables were studied. While it might seem obvious to state the above items when reporting on CALL research, Levy (1999) notes that often these details are not clearly stated by the researcher.

Question
Is the level of language that the program offers clearly indicated?
Is the user interface easy to understand? For example, are there ambiguous icons that cause confusion?
Is it easy to navigate through the program? Is it clear what point the learner has reached?
What kind of feedback is the learner offered if he/she gets something wrong? Is the feedback intrinsic or extrinsic?
If the learner gets something right without understanding why, can he/she seek an explanation?
Can the learner seek help, e.g. on grammar, vocabulary, pronunciation, cultural content?
Does the program branch to remedial routines?
Can the learner easily quit something that is beyond his/her ability?
Does the learner have to *mentally process* the language that he/she sees and hears? Or does the program offer a range of point-and-click activities that can be worked through with the minimum of understanding?
If the program includes pictures, are they (a) relevant, (b) an aid to understanding?
If the program includes sound recordings, are they of an adequate standard? Are they (a) relevant, (b) an aid to understanding? Is there a good mix of male and female voices and regional variations?
Can the learner record his/her own voice? Can the learner hear the playback clearly? Does the program make use of Automatic Speech Recognition (ASR)? Is it effective?
If the program includes video sequences, are they of an adequate standard? Are they (a) relevant, (b) an aid to understanding?
Does the program include scoring? Does the scoring system make sense? Does it encourage the learner?

Table 10.6 ICT4LT (2005) CALL Software Evaluation Criteria

Criteria	Summary
Usability	Is it usable by the target audience?
Usage	Does actual use correspond with intended use?
User satisfaction	Will the user continue to use the program and is s/he as satisfied as possible?
Didactic efficiency	Does it increase the efficiency and effectiveness of the teaching and learning process? (e.g. Chapelle's (2001) criteria)

Table 10.7 Colpaert's (2004) Usefulness Criteria

10.4 CLICI Evaluation

Evaluation for the CLICI project had to be carried out at several levels. The resources produced had to be evaluated as CALL artefacts. Chapelle's criteria (2001), the ICT4LT questions (2005) and Colpaert's usefulness criteria (2004) were used for this purpose. Their evaluation criteria consider the pedagogical aspects of the resources as well as the software from a CALL point of view. The union of these criteria contains some overlaps and this is a disadvantage as it causes some repetition. However, using the three criteria supports a broad evaluation. Chapelle's criteria provides a structure and separates judgemental and empirical data, the ICL4LT criteria focuses more on the software and Colpaert's usefulness criteria aids more general evaluation. Sections 10.5 to 10.7 cover the CALL evaluation of the LGC, the VCC and the WCC. Another level of evaluation was that of a software product, regardless of the CALL dimension. This meant evaluating the software using standard software engineering criteria such as maintainability and usability. Section 10.8 covers this topic. The third level of evaluation was the overall project evaluation. This meant evaluating the project against the original project goals. This evaluation is described in Section 10.10.

Evaluation was carried out by the teacher, the students and the developer where appropriate. Subjective evaluations were provided by the teacher via questionnaires and interviews. The learners also provided subjective evaluation via questionnaires. Although there is probably an element of responding in a positive manner (especially in the case of these young learners), it was emphasised to the students that their honest opinion was required. MacWhinney (1995) has warned against the possibility of the 'smile coefficient' when working with first-time CALL users. This is when they tend to view CALL very positively, in the first flush of excitement and novelty when using something different. MacWhinney suggests that more mature CALL users would probably not experience the same 'euphoria' with the same product and would provide more critical feedback. In order to militate against the euphoric effect, the students were asked to evaluate the CLICI resources after several months of usage. The questionnaires given to the students were drawn up following Fowler's (1995) guidelines and the lessons learnt during the pilot project (see Chapter 6) were used to avoid potential problems. Objective evaluation, where appropriate, was carried out by analysing data produced by the learners.

Another issue to be aware of in comparative evaluation is the Hawthorne effect. This occurs when users of a particular session (not necessarily CALL related) do better on tests or have improved learning outcomes because they get a boost from the fact that they have been selected to participate in the study. In terms of the CLICI project, the students were obviously aware that they were chosen to participate (via their teacher) and that they were the only ones to do so. However, their usage was framed in the context of evaluating the CLICI resources to see if they were useful, not whether or not the CLICI students did better than other students. Besides, in

the case of School 1 (S1), all the students in the class (except Irish -exempt students) were using the computer, so the 'specially selected' factor was minimised, especially as students at primary level tend not to discuss pedagogical practices in their class with students from other classes.

The issue of authenticity is somewhat complex for Irish. When considering authenticity, Chapelle (2001) asks if there is a strong connection between the CALL task and the task outside the classroom. In the case of Irish for primary school students, there are no outside classroom tasks. For CLICI evaluation purposes, authenticity is interpreted somewhat differently – it is viewed as a reflection of what tasks the students normally perform with the language (i.e. tasks that they would normally perform in Irish class).

Evaluation Methodology

In the Design Phase of the project, consideration was given to evaluation and in particular, how to carry out empirical evaluations. A simple empirical evaluation of the LGC could be carried out without the need for student participation (see Section 10.5). In order to carry out an empirical evaluation of the VCC, it was decided that a control group and a experimental group would be established. This would enable their results to be compared and hypotheses to be tested. The need for a control group was recognised, but difficulties with establishing one were also identified. Using one class as a control group and another as the experimental group was not really feasible as there were too many potential differences e.g. teaching style, pedagogical content and student ability. It was considered that intra-class comparison might be feasible. This would involve splitting the class in two groups, with equal numbers of good, medium and weak students and comparing the test scores of each group over several sessions. The evaluation would also involve switching – Group 1 would be the control group for the first phase and then be exposed to the session for the second phase, while Group 2 would initially be the experimental group and then the control group. As the students were in the same class, with the same teacher and the same textbook, it meant that many potential distorting factors would be minimised. There may have been lingering effects from switching, but this is always a possibility in this type of experiment design and in this case it was decided that the potential benefits from switching (more rounded view of student usage and fairness to students), outweighed the potential costs (lingering effects from first phase of CALL exposure). The difficulties encountered in the Implementation Phase are discussed in Chapter 9. The VCC evaluation is discussed in Section 10.6. The empirical evaluation of the WCC would be slightly more problematic, as it would not be feasible for some students to have access to the software and to deny access to others (at least in School 1 where all students were to have access to the WCC). Therefore, it would not be possible to establish a control group that was not exposed to the CALL resource (i.e. use of the WCC) as switching was judged to be not practical by the

classroom teacher (T1 in S1) and thus other empirical evaluation criteria would have to be used. This is discussed in Section 10.7.

Bradin's CALL Software Evaluation Criteria

Bradin (1999) provides a checklist for CALL software evaluation. Her criteria are complementary to the union of Chapelle's, ICT4LT's and Colpaert's criteria advocated above to evaluate CLICI. It is intended mainly for potential purchasers of CALL software but is also useful in the context of the CLICI project. It first considers the feasibility of the software (e.g. will it run on your computer). It then asks the potential purchaser to consider the quality of the software in terms of content, format and operation. A summary of her criteria and an evaluation of the CLICI software using these criteria are shown in Table 10.8. The CLICI software meets most of the criteria, with room for improvement in some areas (e.g. use of motivational devices and feedback).

Checklist for Software Evaluation	CLICI Evaluation
Step 1: Feasibility	
- Will the software run on your computer?	Yes
- What platform (computer type) does the software require?	Basic PC with Microsoft standard software installed (although other standard environments would probably also be OK)
- Will the software run on your network?	Stand alone application
- Can the software be made available to many students?	In theory, yes; in practice, only one student will use at a time.
- Does the software require Internet access?	No
- Can you afford the software?	Yes (free)
Step 2: Quality	
Content	
- What is the goal of the software? Is it consistent with yours and that of our students?	Make learning Irish more enjoyable for the students. This is consistent with teacher goals.
- Is the level appropriate	Yes
- Is the content accurate	Yes – although more testing may be required
- Is the material culturally appropriate	Yes

Table 10.8 Bradin's (1999) CALL Software Evaluation Criteria Part 1

Checklist for Software Evaluation	CLICI Evaluation
Step 2: Quality (cont.)	
Content (cont.)	
- Does the software accommodate the students' learning styles and preferences	The software does not automatically accommodate the students' learning styles and preferences.
- Is the software interesting	Relatively interesting for the students.
- How flexible is the software	New lessons can be added, new verbs can be added (with various options), writing checker is fairly flexible
Format	
- Is the interface consistent	Yes
- Is the screen display effective	Yes
- in drill software, are the motivational devices effective	Few motivational devices used
Operation	
- Is the software easy to use? Are the tasks and directions clear?	Yes, the students were able to use the software without any operational problems
- Does the software allow text and graphics to be printed	No
- How much control are the learners allowed	Limited
- How interactive is the software	Some interactivity, especially in the writing checker component
- Are the quality and degree of feedback adequate	Lesson and verb feedback is very limited, writing checker feedback is fine
- What kinds of records does the software keep	Quiz data for the verbs, text files and some analysis data for the writing component

Table 10.8 Bradin's (1999) CALL Software Evaluation Criteria Part 2

10.5 Lesson Generator Component Evaluation

The Lesson Generator Component (LGC) provides a wrapper around the CALL Template (Ward, 2001). It is not intended to be used by the language learner. However, the CALL resources produced by the combination of the LGC (via the CALL Template) were evaluated by the students. Thus, Chapelle's (2001) evaluation criteria and the ICT4LT checklist are used to

evaluate the lessons, while Colpaert's usefulness criteria are used to evaluate the LGC from a content producer's point of view.

10.5.1 Lesson Generator Component - Chapelle's Evaluation Criteria

A questionnaire-based survey was administered to the Class 6 (C6) students in S1 in June 2005 (n = 25). The aim of the survey was to find out the students' opinions on the LGC lessons. Table 10.9 provides a summary of the findings (see Appendix I Survey June 2005 for details).

The majority of the students reported that they listened to the whole story (92%) and each line of the story individually (76%) at least sometimes. Most students listened (60%) and read (56%) the story before doing the exercises. The students did the language exercises (games) at least some of the time (multiple-choice 76%, match 92%, mix 96% and gap-fill 72%). They enjoyed listening to the texts (64%). In order of preference, they enjoyed (yes or sometimes) the match and mixed-up games most (88%), then the multiple-choice game (76%) and least of all the gap-fill game (44%). This is not surprising as the gap-fill exercise involves language production, which students generally find more challenging. Overall though, a significant minority of the students who responded to the question reported that they did not find the lessons helpful. In summary, it appears that the students used the LGC lessons more or less as intended by the teacher.

Another questionnaire-based survey was administered to the C6 class in November 2005 (n = 20). The 3 part survey sought feedback from the students on the three CLICI components as seen by the learner: Part 1 on the LGC lessons and Irish on the computer in general, Part 2 on the Verb Conjugation Component (VCC) and Part 3 on the Writing Checker Component (WCC). 20 students completed the questionnaire. The data reported here comes from Part 1. Sections 10.6 and 10.7 report the Part 2 (VCC) and Part 3 (WCC), respectively. Appendix J (Survey November 2005) provides more detailed data.

In general, the C6 students liked Irish on the computer (85%) and the majority found it at least somewhat helpful (75%). Just over half the students (55%) prefer learning Irish in class, with a sizeable minority (45%) preferring the computer and a small minority liking both (5%). Those who preferred learning in class cited the need to learn new things ("the need to know different things, check improvement"), they got more help in class ("more help") and the fact that the computer was boring ("computer is boring"; "more of a challenge"). Those who preferred the computer said that it was easier ("easier work"), more enjoyable ("more fun"), faster, better and not having to suffer weak students ("if the rest of the class is doing bad stuff, you do not like it"). The majority (75%) found the LGC lesson resources at least somewhat helpful. Those who said it was helpful cited that they could see an improvement ("see improvement"), makes

learning enjoyable ("tells you Irish, have fun"), and that it facilitates revision. Those who did not find it helpful said that they already know the information ("no new stuff") and that they had sufficient Irish in class ("learn enough in class").

Question	Finding
Part 1	
Do you like Irish?	A substantial minority (40%) do not.
Do you enjoy Irish on the computer?	Only 1 student did not like it at all, the rest (96%) at least enjoyed it a little.
Would you prefer to learn Irish on the computer or in class?	The vast majority said the computer (84%). Some for not so good reasons (e.g. they could miss out on a subject they do not like), and others for sound pedagogical reasons.
Do you find the computer helpful?	The minority said no (32%), but the rest (68%) found it somewhat helpful at least.
Part 2	
Did you listen to the text as a whole?	The majority (92%) did at least some of the time.
Did you listen to each individual line?	The majority (76%) did at least some of the time.
Did you do the exercises?	The majority did, with the majority doing the multiple-choice (76%), match (92%), mixed-up sentence (96%) and gap-fill (72%) at least some of the time.
Did you enjoy listening to the text as a whole?	The majority (64%) at least enjoyed it a bit.
Did you enjoy listening to each line individually?	The majority (64%) at least enjoyed it a bit.
Did you enjoy the exercises?	Yes or sometimes: multiple-choice (76%), match (88%), mixed-up sentence (88%), gap-fill (44%)
Part 3	
Did you find the lessons helpful?	36% did not answer the question, while 24% did not find it helpful.

Table 10.9 C6 Student Feedback on the LGC Lessons (June 2005)

Half the students (50%) did not enjoy Irish on the computer. (Note that although the majority (85%) *liked* Irish on the computer *in general*, only a minority (35%) *actually enjoyed* it – the difference being that even though they liked using Irish on the computer, it was not particularly enjoyable for them). Their lack of enjoyment mainly stemmed from having to write in Irish

("very hard to write in Irish"; "I don't like writing stories") and that it was boring. Those that enjoyed Irish on the computer cited that it was helpful for writing stories ("In future, I need to know how to do Irish stories"). When asked which was better for learning (the computer or the class), a minority (25%) said the class as it is more enjoyable and they learn more ("class is more fun and learn more"; "because the work in class is harder than the computer"). They also cited access to the meaning of the words ("we get the word's meaning in class"). For those that thought the computer was better (40%), some said that it helped them get to know Irish and that it was easier. The remainder (35%) felt there was no difference ("it is the same as learning"). Table 10.10 shows a brief summary (see Appendix J Survey November 2005 Part 1 and Part 2).

Question	Yes	No	A Little/Both
Did you like Irish on the computer?	85%	15%	
Did you find it helpful?	55%	25%	20%
Did you prefer learning on the computer over the class?	45%	50%	5%
Did you enjoy Irish on the computer?	35%	50%	15%

Table 10.10 C6 Students' Attitudes to Irish on the Computer and LGC Lessons (November 2005)

The T1 teacher reported (Dec 2005, personal communication) that the lessons were appropriate for the students and a useful learning resource for them. She particularly liked the addition of the spoken language recordings to the lessons and welcomed the fact that the students could hear and read the text at the same time.

The feedback from the teacher and the students provides the basis for the evaluations shown below. The information in the tables should be self-explanatory and a brief summary will be given here. The T1 teacher provided feedback on the CLICI resources using Chapelle's judgemental criteria. She said that the listening element of the lessons improved the students' comprehension skills. The feedback from the students indicates that the CALL task facilitated language learning and was suitable for the target learners. It was of benefit to the students to hear and read Irish at the same time. There were no practicality issues with the CALL lessons.

Drawing on these findings and the feedback from the teacher, Chapelle's judgemental evaluation criteria can be answered as shown in Table 10.11. The information source is specified in the table, with T indicating input from the T1 teacher and S indicating input from the C6 students.

community and special interest groups in EUROCALL and CALICO will continue to promote the area. Some of the NLP/CALL books published to date mainly have a NLP/CALL readership in mind, but Chambers and Davies (2001), which was aimed at a wider audience, included two chapters relating to NLP/CALL (Jager (2001) and Schulze (2001)). From a learner point of view, the NLP/CALL community has learnt that it is important to make sure that user expectations are realistic and to provide the necessary information and training to learners. The fact that NLP/CALL systems may not be always correct can paradoxically be pedagogically useful. If learners are aware of the fact that they must make a value judgement on the information reported by the system, this forces them to take more responsibility for their learning, rather than just accepting the advice without reflection. The combination of increased know-how for NLP/CALL researchers and the fact that CALL is ready for new technologies means that there are plenty of opportunities for NLP/CALL in the future.

Holland (1995) argues that it is short-sighted not to use NLP resources in ICALL, given the resources provided by the private sector, the intelligence community and ARPA. Universities provide a unique ground for the development of NLP/CALL resources, as they have experts in instruction, pedagogy and technology (Jager et al., 1998) and this may offer an opportunity for NLP/CALL in the future. Jager (2001) states that NLP can make an impact on CALL as it can offer useful technologies for CALL applications and it can also address some language learning needs. He suggests that NLP should target applications where other techniques are unavailable or undesirable, e.g. for open-ended activities such as reading and writing tasks (Jager, 2001).

3.6.4 Threats

Although there are many opportunities for NLP/CALL, there are still some remaining difficulties. NLP tools are difficult for non-NLP specialists to use, although authoring tools are sometimes provided (Holland, 1995). NLP/CALL applications lack the glitz of multimedia projects and even though they may provide better coverage than them, the initial high investment is perceived negatively outside the NLP/CALL community. These difficulties discourage potential users (Murray, 1995; Sams, 1995). The external perception is that NLP/CALL systems appear to be removed from communicative teaching (Oxford, 1995) because they focus on form.

The interaction between theory and technology is sometimes at cross-purposes (Holland, 1995) and this can be problematic both within and outside the NLP/CALL community. MacWhinney (1995) reminds us that theory alone is not enough, while Holland (1995) cites funding as a problem area still. NLP/CALL needs to integrate theories from different sources at different levels, including linguistic, cognitive and pedagogical (Holland, 1995) and this implies the need for a multidisciplinary team that is aware of the limitations and possibilities of NLP/CALL.

Jager et al., (1998) speak of the need to convince teachers of the benefits of NLP/CALL and this has not really been addressed to date. More generally, the lack of knowledge of the effect of NLP usage in CALL, the integration difficulties and the user expectations will all continue to be threats in the near future at least.

A summary of this SWOT analysis is shown in Table 3.2.

3.7 Future Directions

The continued developments in computer technology in general will provide new opportunities for NLP/CALL going forward. L'Haire and Faltin (2003) note the need for error diagnosis and intelligent and real-time feedback in CALL and the potential of NLP to provide these facilities. Heift and Schulze (2003) state that NLP technologies can be used to point out obvious linguistic errors and to provide individualised feedback, correction and remediation. Heift and Schulze (2005) suggest that NLP's contribution to CALL could be maximised by focusing on error correction, by providing e-tutoring and by observing the learning process. They stress the need to give adequate consideration to evaluation of NLP/CALL systems. What is success? How should it be measured? How can it be measured? This echoes an emerging theme within the wider CALL community (e.g. Felix, 2005). It is important for NLP/CALL researchers to document their work and make it more widely known. They should make their resources available for others to use and try to reuse existing resources where possible. Heift and Schulze (2005) suggest that researchers have to learn from previous research and they should have more realistic expectations.

Despite the relative lack of success of NLP/CALL, Hamburger et al. (1999) are still optimistic and have some suggestions for the future. They accept that NLP/CALL systems will not be available for all languages in the near future and, even within a given language, it may be necessary for NLP/CALL to concentrate on sublanguages. They recognise that false positives and false negatives will still occur, although they can be minimised by applying certain constraints. They accept that NLP/CALL lacks the glitz of multimedia projects and that the initial investment is high, but state that it needs better marketing to become successful. They suggest that NLP/CALL projects should work with tolerant user groups at the beginning and that they should receive sufficient training to ensure some initial success. Cawsey (1992) and Moore (1994) suggest that NLP technology can be used in interface support by providing a more natural language interface to learners. There is still a need for greater collaboration between linguistics, SLA researchers, cognitive modelling specialists and computer scientists and future systems should try to be as multidisciplinary as possible. Future systems can be strengthened by gaining linguistic knowledge through exposure to large bodies of text. Semantics and discourse phenomena will also play an increasing role in NLP/CALL.

Strengths	Opportunities
Develop otherwise impossible resources	Computing technology improving
Ability to automate CALL development	Previous hurdles being overcome
Develop flexible systems	More resources available, more reuse
Form-focused instruction	Some mature NLP technologies and tools exist
Tracking users	NLP technology becoming more acceptable
Encourages learner autonomy	NLP/CALL becoming better known
	Better handling of learner expectations
	CALL is ready for NLP
	Universities provide a unique environment
	Focus on specific applications
Weaknesses	**Threats**
Inherently difficult	Initial high investment and difficulty discourages potential users
Prototype systems only	
User expectations	Perception that NLP/CALL is removed from communicative teaching
Lack of internal awareness	
Lack of proper evaluation	Sometimes conflicting interaction between theory and technology
Poor User Interface	
Lack of full language coverage	Need to integrate theories from different areas
Lack or limited use of pedagogy	
Funding difficulties	Need for multidisciplinary team
	Need to convince teachers
	Funding difficulties

Table 3.2 SWOT Analysis of NLP/CALL

Several researchers have emphasised the need to balance form-focused feedback with communicative teaching (Doughty, 1993; Lightbown and Spada, 1990; Poole, 2005) and this will continue. Russell Valezy and Spada (2006) report that although the empirical evidence on the effectiveness of corrective feedback is limited, the assumption that corrective feedback works appears to be correct. Jager et al. (1998) recommend that NLP/CALL researchers should not be tied to one pedagogical approach and that they should be aware of different approaches. Within the NLP/CALL community there is still a need to investigate properly the effect of NLP technology usage in CALL. On a more general level, lack of funds to develop a mature product rather than a prototype (Holland, 1995) and the need to convince teachers are problems that will continue in the future (Jager et al., 1998). The integration difficulties outlined in this chapter will continue to exist.

3.8 Conclusions

Although NLP/CALL systems continue to improve, they have yet to make an impact on the world of CALL. In theory, the combination of NLP and CALL seems very appealing and would appear to have a lot of potential. However, the internal and external difficulties continue to thwart the development of useful, large-scale systems. It seems that NLP/CALL researchers ought to concentrate on developing materials that reuse existing resources where possible, avail of insights from the field of language pedagogy and to design and develop them in conjunction with others (e.g. teachers, content developers). Evaluation should be considered from the start and the researchers should have a clear understanding as to why they are developing the resources and what they intend to find out when they carry out their investigations. When resources are limited, a pragmatic approach should be adopted. Researchers should try to develop feasible and potentially useful resources for real users if NLP/CALL is to have any chance of changing the external perception of the field.

3.9 Summary

This chapter reports on the field of NLP and CALL. Section 3.1 provides an introduction to the chapter while Section 3.2 provides definitions of some terms relative to the NLP/CALL field. Section 3.3 gives a brief overview of the CL field and Section 3.4 looks at the how NLP has been used in CALL to date. One of the major problems associated with the NLP/CALL field is the integration difficulties that exist and these are reviewed in Section 3.5. Section 3.6 provides a SWOT analysis of the use of NLP technologies in CALL. Section 3.7 looks at the future of NLP/CALL while some brief concluding remarks are outlined in Section 3.8.

Chapter 4 Irish

4.1 Introduction

This chapter provides important cultural, political and linguistic content for the research presented in this thesis. Section 4.2 clarifies some terms relating to Irish. Section 4.3 looks at the history of Irish from three millennia ago to the present day. The current situation of Irish is reviewed in Section 4.4, which looks at the number of speakers and the complex socio-cultural issues surrounding the language. Section 4.5 outlines some general points about the language. Irish language education is discussed in Section 4.6, with a particular focus on the primary school sector and related pedagogical issues. Section 4.7 considers CALL and Irish, both in general terms and specifically in the primary school context. The (few) computational linguistics resources that are available for Irish are outlined in Section 4.8, including the Irish Finite-State Morphology Engine (Uí Dhonnchadha, 2002) used in the CLICI system. Some concluding comments are made in Section 4.9. Finally, Section 4.10 provides a summary of the chapter.

4.2 Clarification of terms

This section clarifies the use of terms used in this dissertation that relate to Irish or are Irish words used in English in Ireland. In the context of this dissertation, "Irish" refers to Gaelic, the native language of Ireland. It is sometimes referred to as "Irish Gaelic", but generally only by those outside of Ireland. Irish is one of the two official languages of Ireland[1]. The word "Ireland" is used as shorthand for the Republic of Ireland. While there is a shared history of the language throughout the whole island, different trajectories have been taken by the Republic of Ireland and Northern Ireland since partition in 1921. This dissertation focuses on Irish in the Republic of Ireland. Maguire (1991) and O'Reilly (1999) are useful sources of information on Irish in Northern Ireland.

An Irish speaking region is called a "*Gaeltacht*" (literally: an Irish speaking area). The plural form is *Gaeltachtaí* but the phrase "*Gaeltacht* areas" will be used for clarity (this is how they are commonly referred to in Ireland amongst English speakers). There are *Gaeltacht* areas in Cork, Donegal, Galway, Kerry, Mayo, Meath and Waterford. *Gaeltacht* areas receive special funding from the government and there are several statutory bodies responsible for looking after *Gaeltacht* affairs. As there are financial incentives available, *Gaeltacht* areas are keen to maintain their official status, even when they technically fail to meet the criteria of a *Gaeltacht* (80% of the community must be Irish speakers). Section 4.4 provides an overview of the current speaker numbers, but a rough figure of 20,000 would be a conservative yet realistic estimate of active speaker numbers (Ó hÉallaithe (2005)) out of a population of 4 million,

[1] The other is English.

although other sources report around 45,000 active speakers (CSO, 2004). "*Gaelscoil*" is a school in which the medium of instruction is Irish - the plural is "*gaelscoileanna*".

Unless otherwise stated, opinions and attitudes towards Irish are presented from the viewpoint of the majority community i.e. those who do not have Irish as their first language. "Irish speakers" refers to those who can (and are willing to) speak Irish. "Native speakers" refers to those whose first language (or mother tongue) is Irish. Table 4.1 provides a summary of the terms used.

Term	Meaning
Irish	Gaelic, the autochthonous language of the Republic of Ireland
Ireland	Republic of Ireland
Gaeltacht	Irish speaking region of the country
Gaeltacht areas	Formally "*Gaeltachtaí*", the plural of *Gaeltacht*
Gaelscoil	An Irish-medium school
Gaelscoileanna	Irish-medium schools
Irish speaker	Someone who can and is willing to speak Irish
Native speaker	Someone whose first language is Irish

Table 4.1 Clarification of Terms

4.3. History of Irish

Irish is an Indo-European language. It is a member of the Celtic language family, more specifically the Insular Celtic family and Goidelic branch. The Goidelic branch also includes Scottish Gaelic and Manx. The other branch of the Insular Celtic family is called the Brythonic branch that includes Breton, Cornish, Cumbric and Welsh. This section provides a brief history of the Irish.

4.3.1 Up to Independence 1921

Five Phases

It is estimated that Irish has been spoken in Ireland for around 2300 years (Greene, 1996). The history of Irish can be divided-up into 5 phases, from ancient times to the present day (Purdon, 1999). The Ogham Irish phase refers to Irish from the 5th to 7th centuries AD (note that the spelling Ogam is also used). There are very few records of Ogham Irish, except a few stones with engravings scattered throughout the country. McManus (1991) provides a guide to Ogham. Old Irish refers to the Irish spoken from the 7th to the 9th centuries. Middle Irish covers 900 to 1200, while Classical Irish spans from 1200 to 1600. Finally, Modern Irish refers to Irish from 1600 up to the present. The state of Irish can be divided up into three periods:

Establishment and Consolidation; Decline; Revival. A summary of these periods is provided below.

Establishment and Consolidation

The language was firmly established and in almost universal use until 1169, when the Norman invasion commenced. However, the language was in a strong state up till the early 1600s, when it was the language of communication for almost everyone on the island (Blaney, 1996; O' Donnaile, 1997). The Statutes of Kilkenny (1366) stated that the Normans should not speak Irish nor aim to integrate themselves into Irish society, and thus they were to use English as their language of communication. This meant that English became enshrined as the language of administration, removing Irish from this important sphere of usage (Goldenberg, 2002). Furthermore, the traditional structures of society were also changing, which further weakened the language.

Decline

The language was in a period of decline from 1600 to the late 1800's. After the Battle of Kinsale (1601) between the Irish army, supported by Spanish troops, and the (victorious) English army, most of the Irish-speaking nobility fled to Europe (O'Reilly, 1999) and English-speakers came to dominate positions of power. By 1800 English was seen as essential by those seeking to improve or simply maintain their social and economic position in society. During the 19th century, English was viewed by the majority as essential in Irish society in all aspects of life. Purdon (1999) cites the following factors that contributed to the decline of Irish: increased urbanisation; improvements in communication and exposure to outside influences on previously self-sufficient Irish-speaking communities; improvement in middle-class prosperity and increased Anglicisation of some native speakers; the decision to opt for Anglicisation in the Catholic seminary in Maynooth (1796); the attentions of those who wished to preserve Irish as a fascinating relic; the association of spoken Irish with drunkenness and a lack of respectability for those with knowledge of the language; the necessity of English for legal matters; the lack of solidarity of a shared and exclusive language; the need for English in public sector employment; and the idea that the lack of English was an impediment to political progress.

Revival

The late 19th century saw a revival of the language. Several cultural institutions were formed around this period including the Gaelic Athletic Association (1884), the Irish Literary Theatre (1899) and the Gaelic League (1893). The Gaelic League was founded with the optimistic goals of reviving Irish as the language of the majority and the creation of new Irish literature (Ó hAilín, 1969). Initially, it was apolitical and secular and was successful in training teachers and learners of the language. However, political events in the country meant that it was difficult for

the League to maintain its apolitical stance (i.e. neither supporting nor condoning nationalism) and by 1915 it was no longer a politically neutral organisation.

4.3.2 Since Independence 1921

Irish was made an official language of the newly-independent Ireland. All aspects of government administration were required to be bilingual. Part of the philosophy was to provide conditions so that Irish people could reconnect with their cultural heritage.

Compulsory Irish

Irish has been a compulsory school subject since Independence in 1921. It was made mandatory for the Intermediate Certificate 1928 (a state exam that students sat, usually after 3 years of second-level schooling). It was made compulsory for the Leaving Certificate (a state exam that students sit, usually after 5 years of second-level schooling) in 1934 until 1973 (Purdon, 1999). The ability to speak Irish was compulsory for entrance to the Civil Service until 1974 and it was also a university entrance requirement. Irish language competence is still compulsory to be a primary school teacher (a judgement upheld in the Irish High Court in 1999 (Ó'Murchú, 2001)). The then Minister for Justice, Michael Mac Dowell, announced a review of compulsory Irish for entrance to the Garda Síochana (the Irish Police) in August 2005. His motivation was to encourage members of Ireland's newly arrived immigrant communities (e.g. Chinese, Nigerian and Polish) to become members of the police force.

4.4 Current Situation

This section presents an overview of the current situation of Irish in Ireland. It reviews the census data and focuses particularly on the language related questions on the census form (Section 4.4.1). The complex socio-cultural position of the language is discussed in Section 4.4.2.

4.4.1 Census Figures

A census of the population is normally taken in Ireland every 5 years. There has been a question (or questions) pertaining to Irish on the census since 1861. These questions aim to ascertain the number of speakers of Irish in the country. The original question asked respondents to answer "Irish only", "Irish and English", "Read but cannot speak" or to leave blank. The language related questions were modified in 1996 in order to get a more accurate profile of the Irish speakers (but there is still room for improvement). The 1996 and 2002 census questions read "Can the person speak Irish?" and it also includes a question on frequency of speaking Irish. In 1996, there were 1.4 million (44%) people with speaking competence (CSO, 2004), with approximately 354,000 who reported they used the language on a regular basis. Most of these people would be in the educational system. Broadly speaking, the picture

that emerges is one of continued decline until 1946, and a maintenance or slight increase since then. Table 4.2 shows the census data of speaker numbers since 1861 while Figure 4.1 shows a graph of speaker numbers over time.

Year	Speakers	Non-Speakers	
1861	1,077,087	3,325,024	
1871	804,547	3,248,640	
1881	924,781	2,945,239	
1891	664,387	2,804,307	
1901	619,710	2,602,113	
1911	553,717	2,585,971	
1926	543,511	2,428,481	
1926	540,802	2,261,650	(>= 3 years)
1936	666,601	2,140,324	
1946	588,725	2,182,932	
1961	716,420	1,919,398	
1971	789,429	1,998,019	
1981	1,018,413	2,208,054	
1986	1,043,701	2,310,931	
1991	1,095,830	2,271,176	
1996	1,430,205	2,049,443	
2002	1,570,894	2,180,101	

Table 4.2 Census Data of Speaker Numbers since 1861

While the figures may seem high, it must be borne in mind that all school-going students (with some minor exceptions – see Section 4.7.3) speak Irish each school day. Furthermore, as most adults in Ireland (with the exception of adult immigrants) have studied Irish during their school-going years, it could be argued that the number is actually quite low. Another factor to consider is the fact that all primary school teachers and a small percentage of secondary school teachers speak Irish on a daily basis as part of their work. Therefore, some would argue that the real number of speakers who use Irish as their L1 is actually around 20,000 (Ó hÉallaithe, 2005). However, it is very difficult to measure accurately the number of speakers of a language and speaker numbers is only one component of the Irish language debate. Figure 4.1 shows a graph of Irish speakers and non-speakers from 1861 – 2002.

4.4.2 Socio-cultural Position

The socio-cultural position of Irish is complex and there are many factors that influence attitudes towards it. This subsection looks at the favourable and unfavourable factors that can

contribute to the decline or otherwise of the language. Some of them are common to Minority Languages (MLs) worldwide, while others are specific to Irish. Irish is one of the few MLs that is an official language. While this official status could be considered as a force for the good of the language, some (e.g. Ruddock, 2005) have argued that it is actually to its detriment. Table 4.3 shows a summary of these factors.

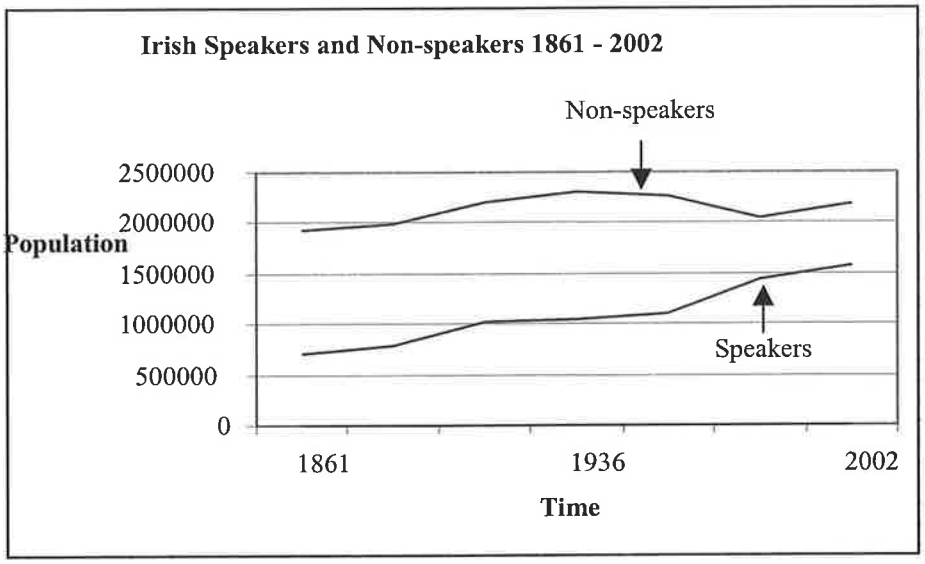

Figure 4.1 Graph of Irish Speakers and Non-Speakers 1861 - 2002

Unfavourable Factors	Favourable Factors
Historical baggage	Official status
Lack of utilitarian value	Socio-cultural importance
Official status	Improved positive image
	Improved teaching and more Irish-medium education
	Political situation

Table 4.3 Favourable and Unfavourable Socio-Cultural Issues for Irish

4.4.2.1 Unfavourable Factors

Historical Baggage

One of the unfavourable factors towards the language is the historical baggage that comes with Irish. While in theory, it could be viewed as the native language of the oppressed majority (e.g. like Welsh in Wales), almost the opposite viewpoint is held. It is true that until Independence in 1921, Irish was an oppressed language. However, since then it has been granted official status and the initial government of the Republic of Ireland was very keen on protecting and promoting the use of the language. From the point of view of the majority English-speaking community, over the years the pendulum swung the other way. Irish speakers were perceived to have a superior attitude over their English-speaking counterparts. Irish was a prerequisite to get

a job in the Civil Service until 1972. The language was seen as something foisted upon the people, rather than something they were clamouring for. Enthusiasts were often arrogant, exclusivist. Purdon (1999) notes that each new initiative to further the language was greeted with intemperate enthusiasm by language activists and often virulent opposition by others. While this viewpoint may have softened in recent times, there is still an element of this sentiment throughout the country. Ó Riagáin (1997) reports that although people support Irish, there is no strong commitment to its actual use and no government policies which aim to improve its position.

Lack of Utilitarian Value

All Irish speakers are bilingual (Ní Chartúir, 2002) and there is no absolute necessity to learn the language in order to be able to communicate with Irish speakers, even those in the *Gaeltacht* areas. Some parents would prefer their children to learn a "useful" language (e.g. French, German or Spanish) instead of Irish and they resent the compulsory nature of Irish. This perception of the futility of learning Irish owing to its lack of utilitarian value is to the detriment of the language. The Reform Movement (Reform, 2003) has argued that Irish should be dropped as a compulsory subject, arguing that it is not of value to the nation to have all students studying Irish, especially given the low levels of attainment. Ruddock (2005) has argued that dropping the compulsory nature of Irish and instead making it optional would actually be better for the language. Fewer students would study it, but those who chose to study it would be more motivated and furthermore the other students would perhaps avoid acquiring negative attitudes towards the language. Although it may initially appear paradoxical, this seems like a good approach, especially if it was modified so that students have some minimal exposure to the language at some stage during their time in compulsory state education.

Official Status

The Official Languages Act 2003 (OLA, 2003) is a factor that may or may not be positive. The aim of the Act is to ensure that government bodies and semi-state institutions (initially) will be able to provide their services in both English and Irish (OLA, 2003). A pragmatic approach is being adopted and the government is allowing organisations a period of grace in which to prepare for the implementation of the Act. It is anticipated that Irish speakers will be understanding and have realistic expectations regarding the implementation of the Act also. The Act is viewed positively by Irish speakers, but less so by others. Organisations point out the extra costs they will incur in translation and related services. Some perceive it as a job creation exercise for Irish speakers but the Act has mainly passed unnoticed by the general public. In 2001, Ó'Murchú stated that the Act could psychologically strengthen the efforts of Irish speakers but could perhaps weaken the general good will towards Irish through alienation (Ó' Murchú, 2001) – this may yet turn out to be the case.

In July 2005, Irish was made an official language of the European Union (EU) (effective from 1st January 2007). Up till then, it was the only official member state language of the pre-expansion EU (i.e. pre May 2004) that was not an official language of the EU. Official status means that Irish Members of the European Parliament (MEPs) can address the parliament in Irish and that official documents will be translated into Irish. All Irish MEPs speak English and most do not speak Irish fluently, so its official status is largely symbolic. Critics argue again that it is "jobs for the boys" as it will create several well-paid jobs for Irish speakers in the EU as translators. Although it was reported in the media, the new status of Irish in the EU has been largely ignored by the people of Ireland (though it has not gone unnoticed by some Minority Language speakers, especially Catalan speakers).

4.4.2.2 Favourable Factors

Socio-cultural Importance

Although opponents of the language have listed many objections to Irish language initiatives (e.g. financial considerations, elitism, minority interest, bad educational practice, rising international importance of English (Purdon, 1999)), there is still a desire amongst the population that the language survives. Cultural values are inherited by means of language and most people have an emotional feeling towards language (Goldenberg, 2002). The symbolic role of Irish in ethnic identity and its cultural value was considered important (Sweeney, 1988) and this continues to the present day (Ó Murchú, 2001). Although people may not speak the language, they do not want to see it disappear altogether – they realise that something important will be lost if it disappears forever.

Improved Positive Image

On a positive note, there have been several cultural developments in recent years that have made Irish less "uncool". These include the Riverdance effect, TG4 (Irish language television station) and Irish radio stations. The Riverdance effect refers to the shift in public perception of Irish dancing after seeing the Riverdance Production's 5 minute dance routine during the Eurovision song contest hosted in Ireland in 1996. It totally revolutionised Irish dancing, with dancers wearing sexy clothes and using their arms (neither are a feature of traditional Irish dancing). Irish people were proud of the production and it was the first time in a long time that the general population (excluding traditional music and dance aficionados) could delight in Irish culture.

TG4 is an Irish language television station. It provides news, sport, documentaries and general entertainment programmes in Irish. Many programmes provide English subtitles, which make the programmes accessible to non-Irish or latent-Irish speakers. Although part of the national television network, it has a relatively free-hand when producing its programmes and provides

dynamic output of interest to speakers, semi-speakers and non-speakers alike. Many contributors are young and talented (Ní Chartúir, 2002), which is positive for the language and the image of the language. The introduction of new radio licences has meant that there are new local radio stations catering for urban Irish speakers (e.g. Radió na Life (Liffey Radio)). Also, Radio na Gaeltachta has overturned a long-held position that banned the use of songs in English and decided to play such songs on its late-night music slot. This should be a positive move for young Irish speakers. Like many modern, minority languages, Irish also has an internet presence (see Ní Chartúir, 2002 for a list of Irish-medium sites and sites pertaining to Irish language matters).

Teaching and Education

Bad educational practice (Purdon, 1999) has given way to improved teaching methods which have had a positive impact on the language. The previous audio-lingual method (prevailing until the early 1980s and perhaps longer) was not interesting for the students and probably not for teachers either (Harris and Murtagh, 1999). Although it will take some time to roll-out the new communicative curriculum and teaching methods, it is a positive step. However, the Irish Language Officer, a role established under the Official Languages Act, said in his Annual Report 2004-2005 (ILO, 2005) that the teaching of Irish was still inefficient and that new approaches should be considered. Around 500 million Euro is spent each year on Irish language education. Students study the language for approximately 13 years and spend 1500 hours studying in class, yet the level of attainment is not very high. On the other hand, there has been an increase in students receiving their education through Irish (see Section 4.6 on education) and this has fostered an increase in the number of speakers outside of the traditional *Gaeltacht* areas, especially in Dublin. Although linguistic attitudes alone may not be the driving force behind this move to Irish-medium education, this is a positive sign for the language.

Political Situation

The political situation in Northern Ireland is not always something that Irish people openly discuss. There was an unstated feeling in some quarters that the Republican movement (e.g. Sinn Féin, IRA) hijacked the Irish language (O'Reilly, 1999) and people were reluctant to be seen as speakers lest they be associated in people's minds with the negative aspects of Republicanism. However, recent developments in the Peace Process, most noticeably the Good Friday Agreement in 1998, have led to a de-coupling of the language and the Republican movement and has enabled people to identify themselves as speakers without the fear of being incorrectly labelled. In summary, the language still occupies an ambiguous position in Irish society but there are some positive signs for the future.

4.5 General Orthographic and Linguistic Features of Irish

This section highlights some general linguistic and orthographic points of interest about Irish. A more detailed overview of the specific linguistic properties of the language is provided in Appendix G Irish. Table 4.4 shows a summary of the points discussed in this section. Irish is a Celtic language of the Indo-European language family. It has been spoken in Ireland for the last three millennia. Irish is one of the oldest continuously written languages in the world. There are examples of Irish use on Ogham inscriptions from around the 4th century. Its writing system has gone through several changes and the current system dates from 1958 (Ní Chartúir, 2002). 18 letters (both upper and lower case) of the Roman alphabet are used for Irish words (*a, b, c, d, e, f, g, h, i, k, l, m, n, o, p, r, s, t* and *u*), while the remaining letters are used for foreign words (*j, k, q, v, w, x, y* and *z*). Vowels can be accented, to produce a longer sound. Irish is a verb-initial or Verb-Subject-Object (VSO) language (i.e. the verb comes first, followed by the subject and then the object of the sentence). Figure 4.2 displays an example of a simple Irish sentence, showing the VSO order of the sentence components. The VSO structure is common among Celtic languages, but relatively rare among languages of the Indo-European family. Other languages which have VSO order include Zapotec (an Oto-Manguean language), Berber (a Berbero-Libyan language) and Chamorro (an Oceanic language).

Point	Description
Celtic language	Member of the Indo-European language family.
Writing system	Irish is one of the oldest continuously used written languages in the world.
18 letters	Only 18 letters are used for words of Irish origin.
Verb initial language	The order in an Irish sentence is: Verb-Subject-Object.
11 irregular verbs	11 of the most commonly used verbs are highly irregular, the rest are very regular.
Complex morphology	Letters can be inserted at the beginning (eclipses) or as the second letter in a word (lenition).
No "yes" or "no"	There are no words which equate to "yes" and "no" in English.
"To be"	There are two verbs for "to be" in Irish.
Orthographic vowel harmony	Orthographic vowel harmony is important. When adding a suffix to a stem, the stem is adjusted to match the board or slender character of the suffix or a broad or slender suffix is used.
3 dialects	There are three dialects of the language: Munster, Connaught and Ulster.
Standard Irish	Standard Irish is taught in schools but is not spoken by native speakers
Hiberno-English	Irish has had a strong influence on the variety of English spoken in Ireland.

Table 4.4 Points of Interest About Irish

Chuaigh	*mé*	*go dtí*	*an*	*siopa.*
Went	I	to	the	shop.
Verb	Subject			Object

Figure 4.2 Example of VSO Order in Irish

Irish has 5 tenses and 4 moods (see Appendix G, Section G.10 for details) and apart from the 11 of the most commonly used verbs (see Appendix G, Section G.10.3), the verbs are regular and their conjugation is predictable. The morphology of Irish is quite complex and two types of mutation are possible. Lenition involves a change at the beginning or within a word (see Appendix G, Section G.4), while eclipses refers to the change that occurs at the beginning of a word (see Appendix G, Section G.5 for details). There is no single words for "yes" or "no" used on their own (and not forming part of a larger phrase) in the language (Purdon, 1999), which is relatively rare amongst Indo-European languages. In order to reply to a question with a "no", the speaker replies with the negative marker and the verb in the negative form. Figure 4.3 shows an example. Likewise, there is no single word for "yes" in Irish.

Ar	*cheannaigh*	*tú*	*aon*	*Rud?*
Question-marker	Bought	you	any	thing?
Did you buy anything?				
Níor	*cheannaigh*	*mé*	*aon*	*Rud.*
Negative-marker	bought	I	any	thing.
I didn't buy anything.				

Figure 4.3 Example of a Negative Response Without Using "No"

The copula in Irish is used to describe what or who someone is (vaguely similar to *ser* in Spanish), as opposed to how and where (similar to *estar* in Spanish). Figure 4.4 shows an example. Vowel agreement is important in Irish and verb conjugation, plural formation and other language features are based on ensuring that broad vowels and slender vowel harmony is maintained (see Appendix G, Section G.10).

Is	*fear*	*é.*		
Copula	man	he		
He is a man.				
Tá	*sé*	*isteach*	*sa*	*teach.*
Copula	he	in	the	house
He is in the house.				

Figure 4.4 Example of Translating "to be" in Irish

There are three main dialects of Irish – Munster, Connaught and Ulster. There are pronunciation and vocabulary differences between the dialects. For example, even the simple greeting of "How are you?" is very different in each dialect: *Cad é mar atá tu?* (Ulster), *Cén chaoi a bhfuil tú?* (Connaught) and *Conas taoí?* (Munster). Munster and Connaught dialects have more in common with each other than the Ulster dialect. One difference between Munster and Connaught Irish is the location of stress in a word. In Connaught the stress falls on the first syllable of the word, while in Munster the stress falls on another syllable if there is a long vowel sound in the word. For example, the word *cailín* (girl) is pronounced '***cailín***' in Connaught and '*cail**ín***' in Munster (Ni Chartúir, 2002). Thomas Davis (1814 – 45), an Irish writer and politician, summarised the differences between the dialects by remarking that Munster Irish was tuneful but inaccurate, Ulster Irish was accurate but tuneless, Leinster Irish was inaccurate and tuneless while Connaught Irish was both accurate and tuneful (Purdon, 1999).

The Irish that is taught in schools in Ireland is called Standard Irish which combines features from each dialect. In 1958, an Irish grammar and spelling book was produced (*Gramadach na Gaeilge agus Litriú na Gaeilge : An Caighdeán Oifigiúil* - Irish Grammar and Irish Spelling: The Official Standard (OS, 1958)). It became accepted as the definitive version of the language and formed the basis of what is now known as Standard Irish. The English-Irish Dictionary (de Bhaldraithe, 1959) also contributed to language standardisation (Ní Chartúir, 2002). The Irish that school children learn is not actually spoken by any native speakers of the language, with some exceptions. Students in different parts of the country may learn the version of Irish that is closest to them. Also, some school children outside of the traditional Irish speaking areas now receive all their education through the medium of Irish (see Section 4.6 for details) and while not strictly native speakers, they often attain native-like fluency.

One final point to mention is the influence Irish has had on Hiberno-English. Hiberno-English refers to the variety of English spoken by Irish people. Many of the expressions and even the syntax of some Hiberno-English sentences can be traced directly to Irish. For example, "I do be reading while watching the television." may sound odd or incorrect to speakers of other varieties of English, but Hiberno-English speakers will naturally produce this sentence structure. This comes from "*Bíonn mé ag leamh nuair a bíonn mé ag féachaint ar an teilifís*". Figure 4.5 shows the link between the Hiberno-English and the Irish versions of this sentence. See Dolan (1998) and Ó Muirithe (2000) for more information on Hiberno-English. Of course, Irish not only influenced Hiberno-English, but also many of the place-names in Ireland are simply anglicised versions of the original Irish name, or to a lesser extent translations of the Irish name (see Flanagan and Flanagan, 2002 for more details on this topic). It should also be noted that English has also had an affect on Irish, mainly in terms of lexical borrowing.

Bíonn	*mé*	*ag*	*leamh*	*nuair*	*a*	*bíonn*	*mé*	*ag*	*féachaint*	*ar*	*an*	*teilifís*
Do	I	reading		when		do	I		watching		the	television
I do be reading while watching the television												

Figure 4.5 Irish and English Version of a Sentence

4.6 Education

4.6.1 Education Before Independence

In 1831, the National Education Act made the teaching of English compulsory. In the late 1890's and early part of the 20th century, the Gaelic League gave classes in Irish and tried to make the learning of the language more palatable with music, dance and festivals. They held an annual *Oireachtas* (festival) where prizes were given for Irish writing. The League was conscious of the need for a new method to teach the language since most potential learners were adults who left school at fourteen or younger. John MacNeill (one of the founders of the Gaelic League) doubted that Irish could be restored by teaching in the schools. The League used the *modh díreach* (direct method), a modified form of Berlitz, where classes were held through Irish. Purdon (1999) reports that the method worked, mainly due to the motivation of the learners. In 1908, Irish was compulsory for matriculation (entrance) in the National University of Ireland.

4.6.2 Education Since Independence

Since 1921, Irish has been a core component in the primary and secondary curriculum. The first government of the newly independent Ireland recognised the key role the education system could play in preserving, but more importantly, promoting and increasing the use of Irish. Irish was to be the medium of instruction for Infant classes (i.e. 4-6 year olds) and this was extended to other classes in the 1940s. As most of the teachers at that time could not speak the language, it was decided that native speakers would teach Irish in schools. Although it provided a solution, there were three basic problems with this approach. Firstly, the speakers were rarely literate in either English or Irish. Secondly, they had no pedagogical training and limited, if any, first-hand experience of classroom language learning. Thirdly, there were relocated from their communities to English speaking parts of the country, which was not always a comfortable experience for them. In parallel, the government ensured that Irish was taught in teacher training colleges, so that future teachers could teach the language when they qualified. This has continued up to the present and Irish is still a prerequisite to becoming a primary teacher in Ireland. Negative feedback from parents and teachers along with a research report in 1967 led to Irish being reduced from the medium of instruction to being a subject only. This continues to be the case for most schools (see Section 4.6.3 for more details).

Irish was originally taught using a rote-learning approach. Not surprisingly, this was not very successful. From 1971, an audio-oral or audio-visual approach was adopted (Ó' Murchú, 2001).

While this was an improvement on the previous approach, it was not particularly successful either. Irish was considered "different" from Modern Foreign Languages (MFLs) such as French and German, and more up-to-date teaching practices were slow to find their way into the teaching of Irish. However, by the late 1990s a communicative approach was adopted for Irish in primary schools. Harris and Murtagh (1999) found that the communicative approach produced better attitudes and competence, especially with lower levels of ability. The relevant language materials were developed and teachers received updated pedagogical training. The new approach was rolled-out in a phased manner, starting with the younger learners all the way up to 5th and 6th class learners (i.e. the final two years in Irish primary schools). Pedagogical practices have also changed in secondary schools, but the focus to date has been on primary schools.

Schools were not the only medium of teaching Irish. There were several radio programmes in the 1930s and 1940s which aimed to teach the language to the masses. Accompanying printed materials were published and sold-out quickly. Despite initial enthusiasm on the part of learners and teachers, the approach was not very successful. In the 1970s, An Gúm, a government agency focusing on Irish, produced a series of books and tapes called *Buntús Cainte* (Ó Domhnalláin, 1967). These were to teach adult ab-initio learners in self-study mode. Since then, various books, tapes and more recently CDs have been released. One of the more recent additions is *Gaeilge agus Fáilte* (Byrne, 2002). This book is aimed at adults, particularly false-beginners (i.e. those who have some understanding of the language but who cannot use it very well) and overseas learners (mainly in the USA). Other welcome additions include the BBC series Blás (BBC, 2005), which involves a combination of television programmes, books and web materials.

4.6.3 Schools

Schooling is compulsory from age 6 to 15 and 50% of 4 year olds and almost all 5 year olds attend primary school (Ó'Murchú, 2001). There are three types of schools in Ireland. The first type of school, which is attended by the vast majority of students, is the English-medium school. Although the ethos and focus of the schools may vary, all of these schools use English as the language of instruction. The second type of school is the all-Irish school, which uses Irish as the language of instruction. These schools are located outside of the *Gaeltacht* areas and the students are generally not L1 speakers of Irish. They are relatively new and increasingly popular. All-Irish schools are looked at more closely below. The third type of school is the school located in the *Gaeltacht* areas. These schools also teach through the medium of Irish and it is assumed that the students are L1 Irish speakers. Some of these schools struggled to teach all of the subjects at second level through Irish due to the difficulty in finding

suitably qualified teachers. Also, Ó'Murchú reports that these schools are becoming more bilingual as the linguistic background of pupils is now more varied.

The all-Irish schools are a relatively new phenomenon on the Irish education scene. There have always been some such schools, the most famous being Scoil Éanna for boys which was founded in 1908 by Padraig Pearse (one of the leaders of the 1916 Rising) and Scoil Bhríde for girls founded in 1917. However, in recent years, there has been an explosion in their popularity. In 1972, there were 11 primary and 5 secondary Irish-medium schools in Ireland and by 1998, there were 124 primary and 26 secondary schools. The reasons for this are not entirely clear, but they include parental interest in Irish, smaller class sizes, good educational achievement (Greaney, 1977), more motivated teachers and parents wanting something different from the traditional English medium education for their children. Most children come from a middle-class background (Purdon, 1999) where parental interest in education tends to be quite high (this is similar to the French immersion situation in Canada, where French immersion schools are sometimes referred to as "the poor man's private school" (Johnson, 2007). Ó Riagáin and Ó Gliasáin (1994) report that more parents would opt for Irish-medium education if it was available to them.

Gaelscoileanna (Irish language schools) face many obstacles. They are usually set-up by a group of interested parents who have to start the school from scratch. Very often, they have no suitable building at their disposal, and end up using buildings designated for other purposes (e.g. sports changing rooms and converted churches). They have to lobby the government for years to get funding for a proper school. There are also other issues to be faced. The selection of textbooks is very limited as the market in very small (this is a common problem in minority language education). The issue of textbooks becomes more acute at second level, where the subjects are more technical and specialised. As mentioned above, there are also problems finding sufficiently qualified teachers for the schools.

There are three voluntary organisations for Irish education. They are *Gaelscoileann* (for Irish medium education), *An Comhchoiste Réamhscolaíochta* (joint committee on pre-schooling which includes the voluntary body *Na Naíonraí Gaelacha*) and *Comhar na Múinteoirí Gaelige* (the organisaiton for teachers of Irish). These organisations are grant aided by Foras na Gaeilge (the all-Ireland statutory agency for Irish). The issue of students not speaking Irish when they start school is addressed by the use of *naíonraí*. These are Irish language nurseries (or language nests) – a type of pre-school or kindergarden where only Irish is used. Hickey (1999) reports that children make significant advances in Irish during their period in the Naíonra and this leads to greater use of Irish at home as well. Despite the obstacles, the popularity of gaelschools continues to rise, with most schools having waiting lists.

Primary Schools and Irish

The Revised Curriculum advises at least 4.5 hours of teaching per week for Irish where it is being taught as a second language (Ó Murchú, 2001). However, both the quality and quantity of Irish teaching in primary schools varies greatly. Some students are exempt from studying Irish, including those who have lived abroad, foreign children and those with attested learning difficulties. In 1999-2000, there were 1,234 such exemptions.

4.6.4 Pedagogical Issues for Irish

There are several pedagogical issues to be considered when discussing the teaching of Irish, particularly in the primary school context. These can be broken down into linguistic, socio-cultural and general issues. Table 4.5 shows a list of these issues. The linguistics issues include pronunciation difficulties, irregular verbs and complex morphology. Although Lado's (1957) work on the role of transfer from the L1 to the L2 (also known as contrastive analysis hypothesis or cross-linguistic influence) has been described as being too simplistic (Gass and Selinker, 1990; Kasper and Kellerman, 1997) and Selinker and Lakshmanan (1993) argue that native language influence is not significant with young learners, Odlin (1989) states that children aged 4-10 tend to stick to one syntactic pattern. Interestingly, Cenoz (2001) reports that older children show more language transfer than younger children, possibly due to their higher metalinguistic awareness (albeit in the context of third language acquisition). The VSO word order in Irish does not seem to cause the students too many difficulties, although they sometimes appear to be confused about verbs and use two main verbs in a sentence (which is incorrect). The complex morphology does cause problems as the rules are difficult to grasp, especially for younger learners. Although care is taken to avoid introducing some aspects of morphology early in the learning process, it has to be tackled at some stage. As the vast majority of learners are L1 English speakers, they have little or no exposure to morphological changes that can occur, as English is a morphologically relatively simple language. The 11 irregular verbs do present a challenge for students, especially as many of these are verbs that beginners need to know to be able to talk about basic things. It would be easier for the students if these verbs were encountered later in their study of the language, when their grasp of the general pattern of verb conjugations was established. However, the early, necessary exposure to these verbs can cause confusion for students. Finally, the relationship between the written form and spoken form of words can cause difficulties for students. Once the learner is aware of the rules, the pronunciation system is not difficult, but it is one extra learning burden for beginning students. For example, *Tá sé láidir* (He is strong) can be pronounced tɔ: ʃeɪ lɔɪ dʒə (taw shay law-jer). Primary school students learn how to pronounce words by repeated reading, rather than being taught the rules formally.

Issue	Explanation
Linguistic	
Verb-initial language	Some confusion about verbs and when they appear in a sentence
Complex morphology	Very different from English, even challenging for mature learners
Irregular verbs	The 11 irregular verbs are among the most common verbs
Pronunciation	The pronunciation is not intuitive
General	
Starting age	Students start to learn at the age of 4
Lack of communicative need	All Irish speakers are bilingual
Socio-cultural	
Socio-cultural issues	Not all stakeholders value learning of the language

Table 4.5 Pedagogical Issues for Irish

The early starting age can be considered as a positive or negative feature. Chapter 5, Section 5.4.1 looks at the advantages and disadvantages of starting to learn a language at an early age. Under certain conditions, it is probably advantageous to start early. However, special care must be taken with such young learners who are still only getting to grips with their first language and the pedagogical implications are by no means trivial. Little (2005) highlights the lack of communicative need as a key difficulty in teaching Irish. All Irish speakers are bilingual (Ní Chartúir, 2002), so there is no real need for people to be able to speak Irish in order to communicate with native Irish speakers. Coady (2001) carried out an interesting survey which indicated that students in *Gaelscoileanna* perceived there was a communicative need for Irish, while those in English-medium schools did not see such a need. This contrasts with the situation in Wales. Rednap (2006) notes the increasing communicative need for Welsh in Wales and, although Welsh is not compulsory for government employees, the increasing number of speakers and their growing confidence in using the language, means that they are beginning to expect to be able to conduct more of their interactions with public bodies in Welsh.

The stakeholders in the teaching of Irish in schools include teachers, students, their parents and Irish language bodies. Teachers in general and Irish language bodies by definition value the language and the teaching and learning of the language, but the situation for the other stakeholders is not always as positive. Parents have different opinions regarding the language and these opinions are quickly absorbed by their children. If the parents have a positive attitude towards the language, their children are more likely to be favourably disposed towards it and vice-versa. Teachers can also influence students' attitudes, but by the end of primary school, peers play a bigger role and students tend to be more negative about the language. Attitude

towards the language is very important as it influences motivation which in turn is one of the key factors in successful language learning. If students do not value learning the language, then the actual learning of the language will be difficult for them.

4.7 CALL and Irish

The previous section looked at the role of Irish in the Education system in general. This section reviews what CALL resources are available for Irish. It first looks at those resources that are aimed at adult learners of Irish. Following this, the situation with regard to CALL and Primary Schools in general (i.e. not just specifically Ireland) is outlined before focusing on CALL resources for Irish for the primary school sector.

4.7.1 CALL for Adult Learners of Irish

Most of the CALL resources that are available for Irish are aimed at adults. There are many sites available on the Internet for learning Irish. Some of them are provided by Irish language enthusiasts, while others are attached to particular schools. Internet resources are constantly on the increase, a full listing will not be provided here. A good starting pint is Ní Chartúir (2002) which lists most of the main sites, but they are not always of good quality and often only cover the needs of beginners. Intermediate and advanced learners, as with many other Less Commonly Taught Languages (LCTLs) have fewer resources available to them. There are several electronic bilingual dictionaries available, including Irish Dictionary Online (IDO, nd) and Focail (Focail, 2006), which is an Irish terminology dictionary. One of the more comprehensive sites for adults is EasyReader (Ó Donnabháin, 2005). It caters for beginners right through to advanced learners. Students can find out the meaning and grammatical properties of a word by simply clicking on the word. Aural versions of texts are available in the three dialects and learners can also record their own voice. Users can supply their own text, which is useful for teachers who would like to tailor the course for their particular user group. EasyReader is supported by Foras na Gaeilge, the Irish Language Board, and this provides a certain level of reassurance for students with regard to the quality and authenticity of the language used. However, that fact that EasyReader seems so good also serves to underline the lack of good quality materials available elsewhere.

4.7.2. CALL and Primary Schools in General

CALL is mainly deployed in tertiary education contexts, although there is now greater use of CALL in secondary schools as well. However, to date the implementation of CALL in primary schools is rather limited. This is not surprising, especially if we consider that the uptake of CALL in universities is modest. Cuban (2001) reports that computer-based technology is under- utilised in primary school classrooms, while Lewis (2004) points out that there are very few didactic proposals for internet-based CALL in primary schools. The British Educational

Communications and Technology Agency (BECTA, 2001) investigated the successful conditions for the use of ICT in primary schools, which include level and type of pupil and teacher ICT training and skills, pedagogical awareness among staff, classroom integration, planning, technical support and the establishment of pedagogical objectives. There are many possible reasons for the lack of deployment of CALL in primary schools including lack of teacher awareness and knowledge of CALL, lack of available resources, lack of pedagogical awareness, lack of integration with the curriculum and logistical issues. These reasons are expanded in Chapter 5, Section 5.4.

4.7.3 CALL, Irish and Primary Schools in Ireland

One of the essential elements of CALL is access to a computer. Interest in ICT in schools has increased in recent years. Pelgrum and Anderson (1999) report that ICT can facilitate the adoption of a new paradigm of education that is more learner-centred, team-based and exploratory. According to the Irish Department of Education and Science (DES), ICT can have a catalytic effect in schools (DES, 1997), although Pelgrum and Anderson (1999) report that the change is not universal. There are two main reasons why the government is concerned about the teaching and use of ICT in Schools. The first is economic, i.e. to provide training and skills for future employment and to address the needs of the economy. The second is social concerns, i.e. the need to ensure equality of access to ICT. In 1997, the Irish government launched IT2000 with the aim of supporting the development of ICT in Irish schools. The Department of Education and Science stated that all students should have access to new technology regardless of their social or economic background (DES, 1977).

Although the student-computer ratio has improved in recent years, the actual use of ICT is patchy (Mulkeen, 2001). Some schools use a computer lab while others have a computer in the classroom. Some schools have timetabled slots while others encouraged students to use the computer during breaks. Some schools have curricular software but report little use of it. The main educational use of the computer was the Internet with very little use of other applications. The variation in use seems to depend more on teacher interest rather than school policy. There are two main obstacles to the actual use of ICT in schools. The lack of teacher skills has been identified by the OECD (1999), the Information Society Commission (ISC, 1999) and teachers themselves (Mulkeen, 2001) as a major issue. Teachers are comfortable using word processors but have much lower levels of skills with other applications. Another area of concern is the need for curricular guidelines. Teachers felt that they were given resources to buy equipment but were not provided with information about how to use them. The Information Society Commission also highlighted the need for more resources for curricular development (ISC, 1999). Given the difficulties in using ICT in primary schools in general, it is not surprising that there is very little (if any) CALL usage in Irish primary schools.

CALL Materials for Irish in the Primary School

There are very few CALL materials available for Irish that are aimed specifically at primary school students. Most of the CALL materials available for Irish are targeted at adults. The few resources available for children are developed by Fios Feasa (2003). They have produced CDs with cartoon-like, animated images and audio. These are professionally produced and attractive. However, for reasons of flexibility, they are stand-alone products and are not tied to any particular textbook. While this is sometimes an advantage, in the context of the tight time limits in the curriculum, it is not an attractive option for many teachers.

Mac Uidhilin and Hetherington (2000) review the existing products and future requirements for teaching Irish as a subject. They distinguish between content-rich software (i.e. software that is designed to fulfil a specific function that comes with content) and content-free software (i.e. software which allows the users to input their own contents – authoring tools). The majority of content-rich software packages for Irish are aimed at adults, although there are some exceptions (e.g. Multimedia Flashcards (Heinenamm/Eurotalk) and Talk Now Irish)). Mac Uidhilin and Hetherington (op. cit.) suggest that content-free software is widely used as an aid to teaching Irish. They cite examples such as multimedia projects and creating signs in Irish. However, it is not the case that all schools can and do avail of the possibilities offered by authoring tools. Hetherington (2000) provides a list of CALL resources for teaching Irish in primary and secondary schools. She is particularly impressed by "The Children of Lir", which provides an example of good practice and demonstrates how CALL can be used in the classroom. However, none of the resources mentioned are specifically linked to the curriculum, which hampers their implementation on a wide-spread scale. Decoo and Colpaert (1999) show that blended CALL materials (i.e. CALL materials that are integrated with the classroom curriculum) are most successful. Teachers need to plan the integration of these types of materials (i.e. resources that are not linked to the curriculum) into their classroom plans and the time and effort required to do this militate against their usage. Furthermore, parents may be reluctant to pay for "non-essential" resources.

Mac Uidhilin and Hetherington (2000) surveyed teachers and they found that Irish teachers want:

- more resources to make learning Irish more enjoyable for children,
- use of interactive material/games with strong educational themes,
- new curriculum-specific, content-rich resources to support the teaching of Irish,
- new resources, developed using content-free software, to be created and shared on the Internet.

There are some resources available but they are often unsuitable due to poor design quality, adult-orientation, fee-based or they contain inaccurate content (e.g. spelling mistakes). The Scoilnet site (Scoilnet, 2003) provides CALL resources for teachers for the subjects taught in primary and secondary schools, and there are some good resources for Irish. Mac Uidhilin and Hetherington (2000) suggest that the addition of new materials should include graded reading, grammar and aural exercises and language games. They suggest that teachers with a special interest in CALL for Irish should be encouraged to produce materials. Furthermore, they believe that the site should be published on a regular basis on CD-ROM for easier access. Harris (1991) points out that one of the most valuable features of the Irish programme in primary school is its second-language character, whereby Irish is usually taught through the medium of Irish. This is something that should be borne in mind when developing CALL materials for Irish. For example, the user interface could use Irish as the primary language of interaction with the instructions and have labels shown in Irish (depending on student ability). CALL materials do have the ability to provide graded reading, grammar and oral (if not aural) exercises as well as language games and this is indeed an area in which CALL can make a contribution to the teaching of Irish in the schools context. Although publishing the Scoilnet site (Scoilnet, 2003) on CD-ROM may seen a bit antiquated, the reality is that many Irish primary school classrooms still do not have access to the internet and a CD-ROM is an acceptable alternative in this situation.

4.8 Computational Linguistics Resources for Irish

There are relatively few CL resources for Irish. This is not particularly surprising, given the low number of speakers and the lack of economic importance of the language. Although Chapter 3 reported that there are CL tools for a variety of languages outside the traditional CL heavyweights (especially English), these tools are mainly available for languages with a large speaker base (e.g. Arabic). However, it is quality not quantity and the availability of resources that is important, and although the number of CL resources available for Irish is small, they are of a high quality and (mostly) freely available (at least for educational purposes). Table 4.6 lists some of these CL resources for Irish.

Two of the most important resources in the context of this project are the Irish Finite-State (FS) Morphology Engine (Uí Dhonnchadha, 2002) and *Gramadóir* (Scannell, 2005). The Irish FS Morphology Engine allows the user to input a text, sentence or phrase in Irish and it returns morphological information about each word in the input. It can also generate all the valid morphological forms of a word. It was developed using Xerox Finite-State Tools (Beesley and Karttunen, 2003; Xerox, 2006). The lexicon includes 15,000 headwords from "*An Foclóir Póca*" (O'Donaill, 2002), an Irish-English dictionary. The system also provides intermediate transformation information and this feature is particularly important for this project as it

provides the engine for the Verb Conjugation (VC) Component, which is discussed in detail in Chapter 7, Section 7.7.

Resource	Description	Source
FST Morphology Engine	Finite State Technology Morphology Engine for Irish. It uses the Xerox FST toolset to provide morphological information on Irish. Given the morphological complexity of the language,	Ui Dhonnchadha, E – ITE and DCU.
Gramadóir	A grammar checker for Irish. This resource checks for grammar and spelling errors and is available on the web or for download.	Scannell, K, Saint Louis University
SpellChecker	This is a spell checker for Irish. It was developed by researchers in Trinity College Dublin for Microsoft. Although the spell checker itself is proprietary, the underlying algorithm is not.	Microsoft Corporation
Dictionaries	There are various dictionaries available for Irish, some of them online. The most scholarly perhaps is *An Foclóir Beag* (FB, 2005), developed by the University of Limerick.	University of Limerick
Irish Language Corpus	Although not strictly a CL resource, this electronic corpus of 30 million words provides a wealth of reference material on Irish (NCI, 2005).	ITE, Foras na Gaeilge
Part-Of-Speech Tagger	Ui Dhonnchadha (forthcoming) has developed a Part-Of-Speech (POS) tagger for Irish.	Ui Dhonnchadha, ITE, DCU

Table 4.6 List of Computational Resources for Irish

Gramadóir (Scannell, 2005) is an open source grammar checker for Irish. It was built using a language independent framework which was designed specifically for Minority Languages. It is

portable, modular and easy to use. It is corpus-based, scalable and free. The error messages are available in English and Irish. The system provides feedback on a wide range of errors, and although in theory it could be suitable for beginners, the language of the error messages means that they are more accessible to advanced or linguistically-aware learners. *Gramadóir* is used as one of the main components of the Writing Checker (WC) Component, which is described in Chapter 2, Section 2.6 and in Chapter 7, Section 7.8.

4.9 Concluding Comments

While Irish still has many detractors in Ireland, there are some grounds for reasonable optimism regarding the language. The increasing numbers of students attending *Gaelscoileanna* and the waiting lists to enter them is a positive sign for the language. This interest in Irish-medium schools is parent-driven, rather than government-driven (O'Reilly, 1999), which should hopefully ensure its success in the long run. In English-medium schools, Irish is not a popular subject for students. There are some linguistic reasons behind this, but the most important one is the socio-cultural position of Irish and the attitude of parents and older students toward the language. Furthermore, parents remember the old-fashioned methods that were used to teach Irish to them and generally do not recall their learning of the Irish language with much joy. Fortunately, the methods used to teach Irish have improved in recent years, most noticeably with the introduction of a more communicative approach to teaching the language. However, it will take time before this is fully rolled-out to all primary schools at all levels, as well as for teachers to adapt to the new system.

CALL is rarely used in the teaching of Irish, both at primary and secondary school levels, so there is enormous potential in this area. Tandem learning projects in which learners communicate in Irish could create a communicative need (as none exists at present). Tandem learning projects appear to be relatively straightforward, but they are rather difficult to implement and require a good deal of planning to be successful. Another possible contribution of CALL to the teaching and learning of Irish is in modernising the perception of the language. Making it available in an electronic format helps dismiss the image of an out-dated language. It demonstrates to the learner that Irish, just like English, can be part of the modern era. While this might seem somewhat simplistic, it is important in the context of Irish, which is not held in the same esteem as other languages such as French, German or Spanish.

CALL can also be useful in a mixed-ability classroom, where students of high, medium and low ability are all grouped together (along with students who are exempt from studying Irish). With more than 30 students to deal with, it is difficult for the teacher to challenge the better students, keep the medium ability students motivated and cater for the needs of weaker students. Providing students with CALL resources that they can use at their own pace and in privacy can

be of benefit to students of all abilities. Furthermore, the possibility of providing immediate feedback is another advantage, especially in a situation where a student may not receive feedback until the following day (e.g. when the teacher corrects homework in class).

Colpaert (2004) notes that parents can also be targeted by CALL materials. In the case of Irish, Harris and Murtagh (1999) reported that some parents would like to be able to help their children with their Irish schoolwork but do not feel confident enough in their language ability to do so. If the CALL materials could provide supplementary information for parents, this could be a further contribution of CALL in the Irish context. Not only would it enable parents to revive their Irish, but it would also increase the number of informed contributors to the language debate in Ireland.

Although CL resources are limited, the quality resources that are available could be used in a focused way and integrated into CALL resources. Indeed, the general trend in CL/CALL integration is to focus on particular niche areas that CL can make a contribution to, rather than the overly ambitious projects of previous years. One useful feature of the CL resources listed in Section 4.8 is that fact that they are mainly open-source or at least their developers are keen that other researchers avail of their software.

4.10 Summary

This chapter provides an overview of Irish. Section 4.2 provides clarification of some terms relating to Irish used in the chapter, including those that come from the language itself. A brief history of Irish is given in Section 4.3, which outlines the three periods of the language: Establishment and Consolidation (up till the 1600s), Decline (from the 1600s to the late 1800s) and Revival (from the late 1800s to the present day). Section 4.4 reviews the current situation of the language, including the number of speakers and the socio-cultural position and looks at the favourable and unfavourable factors that contribute to its perception amongst Irish people in Ireland. General points of interest relating to Irish are listed in Section 4.5, including the fact that it is a Verb-Initial language and that there are no words for "yes" and "no" (used stand-alone) in the language. Education and Irish is discussed in Section 4.6 which looks at education since Independence, the three different school types in Ireland (English-medium, Irish-medium and Irish-medium in Irish speaking areas) and the pedagogical issues that arise when teaching the language. Section 4.7 considers CALL and Irish including Irish CALL for adults, CALL in the primary school context in general and for Irish in the primary school context in particular. Some of the limited Irish Computational Linguistics resources available are outlined in Section 4.8. While there are not many resources, some of them are of sufficiently high-quality that they have the potential to be used in CALL artefacts, particularly if used in a focused manner.

Finally, Section 4.9 provides some concluding comments that indicate that there are grounds for optimism for the use of CL resource for CALL for Irish in the primary school context.

Chapter 5 Analysis

5.1 Introduction

This chapter provides an overview of the CALL development model used throughout this project and focuses particularly on the Analysis Phase of the project. Section 5.2 discusses the Analysis Design Development Implementation Evaluation (ADDIE) model as used by Colpaert (2004) and outlines some minor modifications. It reviews haphazard versus structured design and explains why the ADDIE Model was chosen. Section 5.3 provides a summary of the General Local Differential Targeted (GLDT) Analysis Grid proposed by Colpaert (2004). Section 5.4 looks at the Learner component of the GLDT grid and populates it with information pertaining to language learning. Section 5.5 considers the Teacher component of the GLDT grid and discusses the issues involved in the teaching of Irish in general, as well as in the Primary School context. Pedagogical issues are discussed in Section 5.6, while Section 5.7 talks about Technology. Section 5.8 populates the Content component of the grid, while Section 5.9 considers the Other Actors involved in the language teaching and learning process. Section 5.10 reviews the output of the Analysis Phase and the input to the Design Phase, while Section 5.11 provides some concluding comments. Section 5.12 summarises the chapter.

5.2 ADDIE Model

This section looks at the Analysis Design Development Implementation Evaluation (ADDIE) model of language courseware development. It first considers the difference between haphazard and structured design in Section 5.2.1. Section 5.2.2 reviews the ADDIE model as advocated by Colpaert (2004), which also identifies the role of technology and theory in the process. The reasons for choosing this model for CLICI are outlined in Section 5.2.3. The overview provided here is brief and interested readers are referred to Colpaert (2004) for a comprehensive description of the model. Figure 5.1 shows Colpaert's language courseware engineering loop.

5.2.1 Haphazard versus Structured Design

The issue of design is often neglected in the CALL literature (Hémard and Cushion (2006) is an exception). Inexperienced CALL developers will often adopt a haphazard approach to design rather than a structured one. The temptation when developing CALL materials is to start off with a prototype and proceed from there. However, there are problems when adopting this approach as often the short-cuts made in the development of the prototype can not or should not be replicated when developing materials on a larger scale (Colpaert, 2004). Haphazard design can lead to the development of CALL resources that do not match user requirements, or are inefficient, difficult to maintain and update. Haphazard design often violates some of the fundamentals of good software engineering, namely, modularity, anticipation of change, generality and incrementality (Ghezzi et al., 2003). The use of software engineering principles in the design process can bring many advantages. Colpaert (2004) cites several examples.

These include simplifying the software development and testing process (Allen and Periyasamy, 1997), reducing development costs (Hémard, 1997) and enhancing the technical qualities of the software (Allen and Periyasamy, 1997). From a pedagogical point of view, it can improve the learning process and experience (Godwin-Jones, 1999), increase the user's enjoyment (Green, 2000) and improve the language curriculum in general (Collentine, 1998).

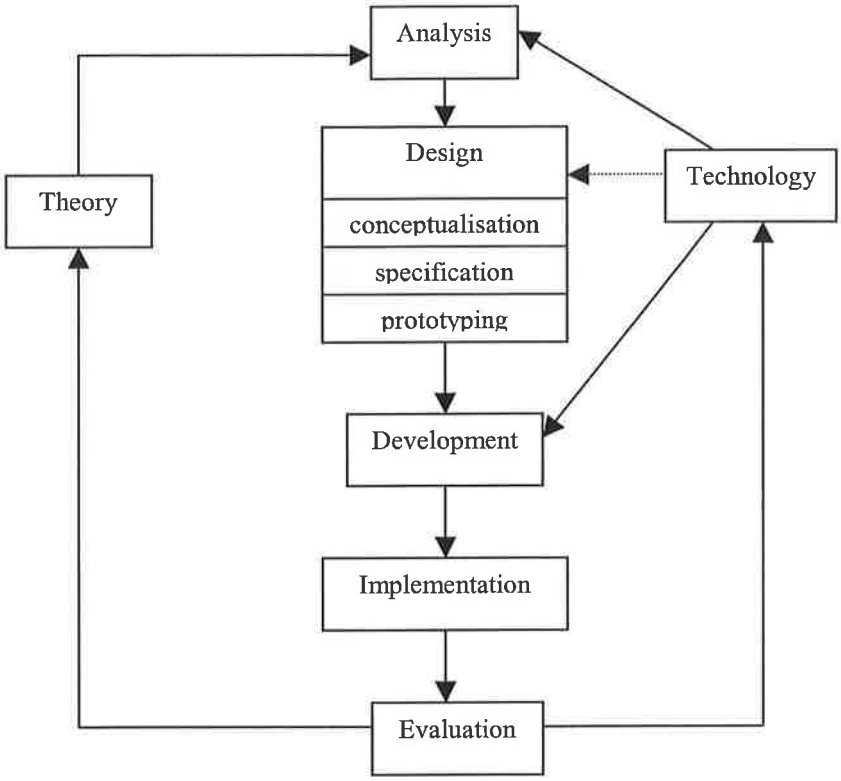

Figure 5.1 Language Courseware Engineering Loop

The use of haphazard, as opposed to structured, design in part arises due to the inherent tension within CALL between technology and pedagogy. Pedagogy is clearly important, as it is fundamental to the language learning process. Technology is also pivotal, as otherwise CALL would not exist. CALL researchers and practitioners, depending on their background and CALL experience, fall into different points on the continuum between pedagogy and technology. Some are cautious in their use of technology, while others may be more adventurous. Practitioners from a pedagogical background can be wary of the use of technology for technology's sake, while those from a technical background may lament the low-level of technology actually used in CALL. One important component that is often neglected as a result of this tension is the importance and value that good software design principles can bring to CALL. Researchers from a non-technical background may not be aware or understand these principles and consider them to be too technical or inaccessible for their needs. On the other hand, researchers from a technical background may be at a loss as to how to apply these principles in the CALL context.

CALL practitioners from a non-technical background sometimes assume that software design is very technical and therefore they will have problems understanding it. There is also the perception that software design is aimed at large-scale projects and is not relevant to smaller-scale projects. While good design principles are essential for large-scale projects, they are equally applicable to small-scale projects. Finally, there is the misconception that software design is for engineers and not for language teachers, learners or CALL researchers and practitioners. Software is not designed and built for software engineers alone (nor should it be) – it is an outward looking process that should be driven by user needs. Software design principles are based on the fact that the software will be built to cater for user demands in different contexts.

CALL researchers and practitioners from a technical background may not have applied software design principles in a CALL context. If they are accustomed to developing software in more traditional contexts, they may find the CALL context daunting. This may cause them to abandon design principles altogether, in effect, over-compensating for the apparent 'chaotic environment' that is language learning. Finally, as is often the case with those new to CALL, there may be a lack of awareness of previous projects that have used software design principles as a fundamental part of their design process. Table 5.1 provides a summary.

Recently, CALL researchers have started to address the issue of good design in CALL. A special issue of the CALL Journal (Hémard and Cushion, 2006) is specifically devoted to this topic, with articles focusing on end-user input and involvement (e.g. Farmer and Grubba, 2006), design for non-technical CALL researchers (Ward, 2006) to specific design issues for context-sensitive help (Heift, 2006).

Non-Technical Background	Technical Background
1. Software design is very technical and not accessible	1. Difficulty in applying software design to CALL
2. Software design is for large-scale projects	2. Abandon software design in CALL context
3. Software design is for engineers	3. Unaware of previous CALL projects that have used software design

Table 5.1 Misconceptions Regarding Software Design in CALL

5.2.2 Colpaert's ADDIE Model

Colpaert advocates a Research-Based Research-Oriented (RBRO) model for CALL. Under this paradigm, CALL development is based on previous research findings and aims to contribute to CALL research. Colpaert's ADDIE Model is an engineering loop in which the output of each phase serves as input to the next phase. The design can be modified after implementation and

evaluation and each iteration leads to a new working hypothesis. This section provides a brief overview of each phase of the model. The remainder of this chapter looks at the Analysis Phase in detail. The Design Phase is covered in Chapter 7, while Chapters 8, 9 and 10 look at the Development, Implementation and Evaluation Phases, respectively.

The Analysis Phase entails gathering as much relevant information as possible about the context of the project. It is based on interdisciplinary expertise, knowledge of the design space and identification of the target. This phase looks at the issues surrounding learners, teachers, pedagogy, technology, content and other interested parties. It considers their requirements at a general, local, differential and targeted level (these are explained in more detail in Section 5.3). It produces a grid with the above information presented in a logical format which is used as input to the Design Phase.

The Design Phase takes the requirements outlined in the Analysis Phase and produces a Design plan that feeds into the Development Phase. The Design Phase is comprised of three stages: Conceptualisation, Specification and Prototyping. Conceptualisation is a combination of concept development and the application of usefulness criteria. Concept development involves identification of personas or user types, the hypothesisation of practical goals, the formulation of scenarios as to how the users will use the system and the description of system tasks. Colpaert lists four usefulness criteria: usability (is it usable by the target users), usage (actual vs. intended use), user satisfaction and didactic efficiency. Conceptualisation feeds into Specification, which describes the back-end of the system (internal components and their interaction) and the front-end (or user interface). Prototyping is then carried out only on those components that developers are unsure about and want to test the feasibility of certain technological aspects. The Design phase is quite comprehensive but Colpaert argues that it is worthwhile to spend the effort getting the design right as it is (largely) technology independent. From a Software Engineering point of view, it is well known that the cost of fixing a problem increases the further down the lifecycle the change must be implemented (Sommerville, 2004).

The Development Phase is relatively straightforward as it implements the plan produced in the Design Phase and includes both coding and testing. This phase is technology dependent and will vary for each project. Colpaert outlines eight stages of testing that are carried out in the development of DIDASCALIA courseware (Colpaert, 2004). They are pre-testing, routing testing, content implementation testing, operational testing (debugging by external users), content testing, beta-testing, real world testing and research evaluation. While Colpaert does not go into detail about each test stage, it is useful having it clearly stated as part of development, as testing is generally scantily reported in the CALL literature. The Implementation Phase refers to the actual deployment of the developed system in the target

learning and teaching environment. Colpaert's Evaluation Phase is mainly summative evaluation which feeds into a working hypothesis for the next development. Colpaert prefers iterative implementations and summative evaluations over formative evaluations (which usually take place using iterative user prototyping), as using this model, development costs are reduced to a minimum. In summary, Colpaert's model is based on a traditional Software Engineering lifecycle model rather than a short design-development-evolutionary user prototyping model. The Design Phase is the most important phase and uses a user-centred design model. It is technology independent and uses the requirements specified in the Analysis Phase as input and produces a plan for the Development Phase.

5.2.3 Reasons for Selection of Colpaert's Model

There are several reasons for choosing Colpaert's ADDIE model for this project. It is based on one of the standard Software Engineering design models that have been used for many years in the field of software development (e.g. Somerville, 2004). While CALL development should not be technology-driven or technology-focused, the structure that the ADDIE model brings to language courseware development can contribute to successful CALL artefact development. Colpaert's Analysis module is comprehensive and guides the designer in focusing on the General/Local/Differential/Targeted needs of the 6 stakeholder groups with an interest in CALL (see Section 5.3 for details). The separation of Analysis from Design is helpful and ensures that the needs are determined before the design process commences. The subdivision of the Design Phase into conceptualisation, specification and prototyping is useful in dealing with this potentially complex phase. One interesting observation is that prototyping is not required for all components of a project; rather it is advised only for those elements that use a new technology or where further clarification is required. Although the Colpaert model does not explicitly state it as a separate element, he does refer to the importance of testing and outlines the eight stages of testing that his group uses when developing CALL software. This is a useful contribution, as often the testing undertaken is only briefly reported in the literature (if at all).

One important feature of Colpaert's model is that the Evaluation Phase provides feedback to Technology and Theory. The feedback to Theory is a central component of the model as it indicates that a Research-Based Research-Oriented (RBRO) CALL project can and should inform CALL theory. This model makes this feedback loop explicit. Colpaert's model is based on the lifecycle engineering loop and is informed by previous CALL courseware models. This is important as it avoids one of the criticisms sometimes levelled at CALL projects, namely that CALL practitioners reinvent the wheel, without undertaking the necessary background research on previous CALL projects to build on findings in the CALL literature to date. Furthermore, Colpaert's model combines the most pertinent aspects of previous models to provide a solid

framework for CALL artefact research and development. He also refers to other models when he feels they have covered a particular area in greater detail.

5.3 GLDT Analysis Grid

The first part of the Analysis Phase involves interdisciplinary expertise, knowledge of the design space and the identification of the target. Interdisciplinary expertise considers what developers should know about the relevant disciplines that are involved in language courseware development. These include the language being studied, language pedagogy, CALL, Software Engineering, Human-Computer Interaction (HCI) and design knowledge. Knowledge of the design space refers to how developers can understand the various components that are involved in the development of language learning resources e.g. the learner, the teacher, the technology available and the language learning context. There are two specific problems that can arise in the context of language courseware development. One is that the developers rarely have experience of using language courseware and the second is that as the design space broadens from the specific (e.g. a particular university class) to the more general (e.g. all English language students), the harder it is to understand user requirements. Identification of the target asks what can be feasibly changed by using the system and whether the resources exist to implement these changes.

Once these issues have been considered, they can be translated onto an operational grid of system requirements. Colpaert calls this the General-Local-Differential-Targeted (GLDT) grid and, as the name suggests, this consists of four levels of requirements: General, Local, Differential and Targeted. General requirements refer to those components that must be considered in relation to language courseware engineering in general. Local requirements refer to requirements that are specific to a particular context. Differential requirements are parameters that will allow the system to adapt to several possibilities within the design space. This phase should identify those aspects subject to change. Finally, targeted requirements are aspects that can be improved and defining these factors leads to the program focus. When the Analysis Phrase is completed each cell in the GLDT grid (shown in Table 5.2) should be completed. The following subsections list the questions that are asked in each cell of the grid. The questions are by necessity generic and may be slightly difficult to understand. Sections 5.4 to 5.9 populate the grid in the context of this research project and the completed grid should assist comprehension of the generic GLDT grid.

5.3.1 Learner

This section of the grid looks at the learner component of the Analysis Phase. The guidance questions for each level are shown in Table 5.3. The General level deals with accepted knowledge about language learners, regardless of the particular context. The Local level looks

at characteristics of learners in the particular design space or context under consideration. The Differential level considers what elements are different within this context and which elements can be changed. The Targeted level asks what aspects can be improved within this particular differential design space.

	General	Local	Differential	Targeted
Learner				
Teacher				
Pedagogy				
Technology				
Content				
Other actors				

Table 5.2 Colpaert's GLDT Grid

Requirement	Question/Answer
General	What are generally accepted findings and principles for language learners?
Local	What are common characteristics of the language learners in this particular design space?
Differential	What distinctions must be made within this design space, or which elements are subject to change?
Targeted	Which characteristics are amenable to improvement (vocabulary, topics, skills, etc.)?

Table 5.3 Learner Components of the GLDT Grid

5.3.2 Teachers

This section of the grid considers the requirements of language teachers. The General requirements include accepted findings and principles for language teachers, regardless of the particular language context in which they teach. The Local requirements focus on the particular requirements of the selected design space. The Differential requirements ask what can be different within this design space, while the Targeted requirements look at those aspects of the design space that are open to improvement. Table 5.4 provides a summary of the teacher components of the GLDT grid.

5.3.3 Pedagogy

The Pedagogy component of the GLDT grid looks at the pedagogical issues involved in language courseware development. The General level reviews the accepted findings for language learning and teaching, while the Local level looks at the methods currently being used in the design space. The Differential level considers what elements are different within this

space. The Targeted level asks which aspects of pedagogy could be improved. A summary is shown in Table 5.5.

Requirement	Question/Answer
General	What findings and principles are generally accepted for language teachers?
Local	What are common characteristics of language teachers in the design space?
Differential	Which distinctions must be made within this design space, or which elements are subject to change?
Targeted	Which characteristics are amenable to improvement?

Table 5.4 Teacher Components of the GLDT Grid

Requirement	Question/Answer
General	What are generally accepted findings and principles for language learning and teaching?
Local	Which language learning/teaching method is currently being used within the design space?
Differential	What distinctions must be made within this design space, or which elements are subject to change?
Targeted	What aspects are amenable to improvement?

Table 5.5 Pedagogical Components of the GLDT Grid

5.3.4 Technology

The Technology component considers all aspects relating to technology and includes both hardware and software issues. The General level reviews a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis of technology in language learning. The Local level looks at what technology is available in the design space and what language courseware has been used previously. The Differential level investigates the technology characteristics which are distinct within the design space and what can be changed. The Targeted level looks at those aspects that can be improved. See Table 5.6 for a summary of the Technology related questions.

5.3.5 Content

The Content component looks at questions relating to actual courseware content. The General level reviews what content is available at a worldwide level, while the Local level identifies what kind of content is currently being used in the design space. The Differential level considers what elements can vary or are subject to change within this design space. The Targeted level looks at those areas that can be improved. See Table 5.7 for a summary.

Requirement	Question/Answer
General	What does a SWOT analysis of technology in language learning show? What does a SWOT evaluation determine about existing comparable language courseware?
Local	What infrastructure and equipment are available in the design space? What language courseware has been used before?
Differential	What distinctions have to be made within the design space or what is subject to change (e.g. operating systems, network types, processor type, and software versions)?
Targeted	Which aspects are amenable to improvement (e.g. less network traffic, faster execution, etc.)?

Table 5.6 Technology Components of the GLDT Grid

Requirement	Question/Answer
General	What content is available worldwide?
Local	What kind of content is being used in this design space (textbook, syllabus, etc.)?
Differential	What distinctions must be made within this design space, or which elements are subject to change?
Targeted	Which aspects are amenable to improvement?

Table 5.7 Content Components of the GLDT Grid

5.3.6 Other Actors

The Other Actors component of the GLDT considers the requirements of the other stakeholders in the language courseware development process. These include, but are not limited to, content providers, native speakers, parents, training managers, software providers and policy makers. The General level looks at the usual role of these actors in the deployment, use and evaluation of language learning courseware. The Local level considers their role within the particular design space of the project. The Differential level asks which types of actor can be identified within the design space and what characteristics can be changed. The Targeted level looks at what aspects pertaining to those actors can be improved. A summary is shown in Table 5.8.

5.3.7 GLDT Grid mapped to this Project

In the context of this project, the General level refers to language learning for both adults and younger learners. The Local level looks at the teaching and learning of Irish in the Primary School in Ireland. The Differential level considers the local context in which the CALL software is to be deployed. There are two different environments – one is a mainstream primary school, while the other is a primary school situated in a disadvantaged area. Further details are provided in Chapter 9. Finally, the Target level of the grid refers to those elements in the

current design space, i.e. the two deployment contexts mentioned above, that are amenable to change. Specifically, the Target level considers how this project can potentially make a contribution to the two groups involved in the project.

Requirement	Question/Answer
General	What is their generally accepted overall role during implementation, use and evaluation?
Local	What is their presence and role in the design space?
Differential	Which types of actor can be distinguished and which actor characteristics are subject to change?
Targeted	What is amenable to improvement (teacher guidance, parent control, mediated communication with native speakers, etc.)?

Table 5.8 Other Actor Components of the GLDT Grid

Sections 5.4 to 5.9 cover the six categories of Colpaert's GLDT grid instantiated to the present project. Note that each component of the GLDT grid merits a fuller description than that provided here, but for reasons of space, only a summary of each component is given. L1 is used to denote the learner's first language, while L2 denotes the target language (which may be the learner's second or nth language).

5.4 Learner

5.4.1 General

The question to be answered here is "What are generally accepted findings and principles for language learners?". While there are no definitive findings to answer this question, there are some general points that are outlined below. In the context of this research project, it is instructive to look at adult learners in general and then to review the situation of younger learners. In the context of this project, a younger learner is defined as a learner up to adolescence.

Spolsky's (1989) theory of conditions for language acquisition states that Knowledge in the Present (Kp) combined with Abilities (A), Motivation (M) and Opportunity (O) can lead to Knowledge in the Future (Kf). This is shown in Figure 5.2. Knowledge in the Present (Kp) varies from learner to learner and is a combination of his/her knowledge of particular languages and languages in general. Ability, motivation and opportunity are the factors that influence the language learning process and these are briefly reviewed in this section. If a learner is motivated and has an aptitude for language learning, the process will probably be a successful one.

Kp + A + M + O = Kf

Kp – Knowledge in the present
A – Abilities
M – Motivation/affect
O – Opportunity
Kf – Knowledge and skills in the future

Figure 5.2 Spolsky's Theory of Conditions for Language Learning

Knowledge in the Present

Learners often use their knowledge of their own language when learning a new language and this can both help and hinder the learning process. The contrastive hypothesis (Lado, 1957) postulated that learners will find it easier to learn items in the target language that are common to their L1, while items that differ between the two languages will be harder to learn. Researchers (e.g. Gass and Selinker, 1994) suggest that this is not the case. Sometimes learners have difficulty with items that are similar but not the same in the L1 and L2, rather than items that are markedly different. Positive transfer occurs when transfer of L1 knowledge results in correct L2 production. It can help in so far as learners are aware of general grammatical constructions and that a language consists of phonological, morphological, syntactic, semantic and pragmatic components. Negative transfer (i.e. when something is incorrectly transferred from the L1 to the L2) can hinder the learning process. In other cases, learners may have difficulty with a structure in the L2 that does not exist in the L1 and vice-versa. For example, Spanish speakers often forget to use a subject in English where one is omitted in Spanish (e.g. "Is important to study each day" instead of "It is important to study each day"). The problem of false friends also arises, where learners assume that a word in the target language has the same meaning as a similar word in their L1. For example, the Spanish word *embarazada* looks like the English word embarrassed, but actually means pregnant.

Aptitude

Aptitude is one of the determining factors in language learning. Aptitude comprises auditory ability, linguistic ability and memory skills (Skehan, 1998). Auditory ability is the ability to be able to identify sounds and relate them to symbols. Linguistic ability is defined as the ability to infer rules and an awareness of grammar. Memory skills refer to the ability to assimilate new material and how the new material is stored and retrieved. The reader is referred to Skehan (1998) for more information on the role of aptitude in language learning. Aptitude also encompasses learning styles, attitude and intercultural competence. Learners use different learning styles and strategies. Oxford (1990) identifies six groups of language learning strategies: memory, compensation, cognitive, meta-cognitive, affective and social. A learner

who uses more strategies is more likely to be successful. Learners tend to have their own learning style, but they can be taught to use different strategies.

Motivation

Motivation is one of the key factors is language learning success. Motivated learners are more likely to be successful than unmotivated learners. Many researchers have investigated the role of motivation in language learning including Crookes and Schmidt (1991), Skehan (1991), Oxford and Shearin (1994) and Dörnyei (1994). Gardner and MacIntyre (1993) outline a socio-educational model that considers factors such as acquisition, gender, age and learning strategies. Dörnyei (1998) provides a model of motivation which considers Language Level, Learner Level and Learning Situation Level. Motivation encourages greater learner effort and thus greater language performance. There are two types of motivation: integrative and instrumental. Integrative motivation, i.e. when learners want to learn to become part of the speech community, is considered important in language learning (Gardner, 1985), while Dörnyei highlights the role of instrumental goals, i.e. when learning for the purposes of obtaining some concrete goals (e.g. job or language certificate) in motivating foreign language learners. Oxford (1996) reports that integrative motivation is more important for second language learners than for foreign language learners. Culture (Markus and Kitayama, 1991), stimulation and setting a personal challenge also have an effect on motivation (Oxford, 1996). Although motivation is complex (Graham, 1994), Dörnyei (1998) states that it provides the impetus to start and the force to continue the language learning process

Opportunity

Long's (1991) Interaction Hypothesis suggests that the more opportunities learners have for interacting in the target language, the better. It is important that learners have exposure to how the language is spoken by native speakers, to learn not just grammatical components, but also rhythm and pragmatics. It is helpful if the language is accessible to the learner, for maximum benefit to be gained from the learning opportunity. Krashen's (1985) Input Hypothesis states that only input in the L2 that is comprehensible to the learner will result in language acquisition. However, even exposure to spoken language that is difficult for the learner to understand can be of some benefit (e.g. it may provide insight to intonation patterns). Listening to audio recordings or viewing videos of native speakers can be of benefit to the learner, especially if access to native speakers is restricted (e.g. in the foreign language learning situation). While learners tend to prefer language input to language output opportunities (as reception is easier than production), access to language production opportunities is also important. Swain's (1995) Output Hypothesis states that learning also occurs when learners are forced to produce correct output, especially for difficult items. She suggests that meaningful output is as important as meaningful input to the learning process. This means that learners should have the opportunity

to use the target language, both with other learners and also with native speakers. In the past, this may have been difficult, but now with the global use of computers and the internet, opportunities exist to interact with native and non-native speakers of many of the world's languages. The more chances learners have of listening, reading, speaking and writing in the target language, the more competent and confident they can become in the use of the language. It is helpful however, if guidance is available to correct errors so that incorrect patterns are spotted and corrected before they become ingrained.

Adult and Younger Learners

There are differences between adult learners and younger learners. While some may consider that adult learners have some disadvantages over younger learners, Johnstone (1994) lists some factors in their favour. They have better general learning strategies (i.e. they have had more time learning than younger learners) and a better grasp of grammatical patterns and rules in language (due to such knowledge in their L1). They also have more practice in negotiating and sustaining conversations. Furthermore, they have a more defined purpose in learning the language (e.g. they have chosen to study the language for a particular reason). Finally, they have a greater knowledge of concepts, e.g. time, which can be transferred to the new language. Younger learners are still learning these concepts in their first language.

Young learners on the other hand have other advantages. It is useful to look at characteristics of younger learners from the point of view of learning age, motivation and language learning time. In terms of learning age, the common-sense assumption that it is easier for younger learners to learn a language (Sharpe, 2001) because they learn their mother tongue so quickly, they are more malleable and their brains more flexible is disputed (e.g. Oller and Nagato, 1974). Aitchison (quoted in Hawkins (1996)) discusses the 'natural sieve' hypothesis which refers to younger learners automatically filtering out complexities, a characteristic that older learners have lost. She also mentions the 'tuning-in' hypothesis, which refers to a learner's ability to pay attention to some particular aspect of language. Infants tune in to sounds, older children to syntax and learners from the age of ten upwards focus on vocabulary and this theory, she suggests ties in well with knowledge of biologically programmed behaviour. Johnstone (quoted in Hawkins (1996)) notes that it is not obvious what age is the best age to start learning a language, but concludes that the available evidence supports the value of starting early.

Sharpe (2001) reports that it is easier to motivate children and that they are more receptive to the wider aspects of language learning (e.g. developing a positive attitude to difference and diversity). The gap between what children want to say and what they can say is smaller than for adults due to the limited world knowledge and this can reduce the frustration of the young language learner compared to an adult learner. Sharpe (2001) concedes that there is little hard

evidence but notes that parents, primary school teachers and the general population accept that it is easier to impact on primary school children compared to adolescents. Sharpe (2001) also notes that primary school teachers are good motivators, the material more flexible and that primary school students are less self-conscious about learning a foreign language.

It could be generally assumed that starting early means that the student spends more time on a language which provides better results (Sharpe, 2001). Although starting early can lead to more learning opportunities, the better results argument only holds if the learning is efficient. Both Singleton (1989) and Sharpe (1991) report that younger does not necessarily imply better. Mitchell et al. (1992) comment that an earlier start has the potential to raise general levels of achievement, if progression issues are properly addressed. Rumley and Sharpe (2000) also stress the importance of continuity between what is learnt in primary school and in secondary school and that the secondary school takes into account the learners previous language knowledge. Martin (2000) suggests that any advantage may be limited to certain areas such as pronunciation or listening comprehension.

Different countries have different philosophies regarding the role of (foreign) languages in early education. In some of the English-speaking parts of the world, the teaching and learning of other languages is a relatively recent phenomenon. However, in many European countries, pupils start learning a foreign language between the ages of 8 and 10 (Sharpe, 2001). The logistics of how a language is taught also varies. In some countries, a visiting teacher gives the language classes while in other countries (e.g. Spain, Greece and Italy) language teaching is part of the primary school teacher's professional responsibility. In other parts of the world, there is great variety and the issues of which languages are taught and by whom depend on the local context.

5.4.2 Local

Irish classrooms in primary school are not usually organised by ability and each class has a mix of pupils, from brighter students to those who require extra support. In the context of Irish in the primary school in Ireland, students in general do not enjoy learning Irish (Harris and Murtagh, 1999; also see Chapter 6). Attitudes to the language were outlined in Chapter 4 and these are often transmitted to students by their parents. They do not see the point in learning a "useless" language that is "hard" and "out-of-date". These attitudes mean that generally students are not positively motivated to learn the language. This makes the learning experience a difficult one for some students. There are some limited opportunities to hear the language at a level suitable for primary school students via TG4, the Irish language television station, which sometimes provides programmes aimed at younger speakers. However, most primary school students have little or no opportunity to speak the language with native or even non-native

speakers outside the classroom. Thus, in terms of the three factors that are important in language learning (ability, motivation and opportunity), lack of motivation and limited interaction opportunity present challenges to Irish language learners in the primary school context. With regards to ability, currently language learning skills or indeed, general learning skills, are not explicitly taught in Irish primary schools. Students are reliant on their own learning skills, although obviously teachers do indirectly try to help them improve these.

5.4.3 Differential

The deployment context in this project is that of male primary school learners i.e. boys. In terms of Computer Assisted Learning some differences have emerged between males and females, although Kay (1992) reports that there are fewer differences between boys and girls at primary school level than at subsequent levels. In general, boys appear to have a greater interest in computers than girls (Miik and Luik, 2003; 2005) and use computers more often (Kay, 1992). Boys enjoy challenges and the competitive aspect when learning with computers (Caftori, 1994). They are good at navigation (Passig and Levin, 2000), have good spatial ability (Chanlin, 1999) and they like information shown in graphical format (Hood and Togo, 1993; 1994). Alessi and Trollip (2001) report that they like to have graphics and text on the same screen.

Studies have shown that in general, boys are less keen on learning languages than girls, although there are exceptions (Batters, 1986). The situation at primary school in particular is less clear, especially in Ireland where the teaching and learning of Foreign Languages in the primary school context is not yet universal. However, anecdotal evidence would suggest that there is no discernible difference in the level of interest between boys and girls at this stage. In summary, it appears that boys are open to Computer Assisted Learning and while the general information presentation and control preferences identified above may not apply to all boys, these preferences should be borne in mind when designing for this target group.

With regard to the schools involved in this project, both schools are positive towards the Irish language and the teachers involved in the Irish CALL project are particularly interested in Irish. This manifests itself in the number of students from both schools interested in Irish and motivated to learn it. The teachers' positive attitude towards the language fosters a similar attitude amongst the students.

5.4.4 Targeted

In this context, there are ample opportunities for helping the learner. There is room for improvement in the four so-called basic language skills, i.e. reading, writing, listening and speaking. Learners have limited exposure to Irish inside and especially outside the classroom and resources that could provide them with more opportunities to interact with the language

would be helpful. The learners would also benefit from having more interesting resources available to them. To date, most learners only have access to the classroom textbook and some additional resources provided by the teacher. All Irish learning takes place in the classroom situation, where all students are expected to study the same thing as all the other students and at the same pace. Providing resources that allow the students to learn in a way that suits them and at their own pace could enhance their learning experience. The target learner group is computer literate and well-disposed towards computers and this is helpful when considering future resources. Table 5.9 provides a summary of the learner component of the GLDT grid.

5.5 Teacher

5.5.1 General

The question to be addressed here is: "What findings and principles are generally accepted for language teachers?". One principle is that teachers should be linguistically competent i.e. they should have sufficient knowledge of the target language to actually be able to teach it. While it is desirable to study with a linguistically competent teacher, one may not always be available. For example, in many parts of the world (especially in developing countries), there are students who are studying English with someone who would not be considered a competent speaker, but as there is no-one else available, the students have no choice. Another important component in being a good language teacher is that the person is pedagogically trained. This means that it is not sufficient that the person can speak the language - s/he must know *how* to teach it. This pedagogical knowledge ranges from basic components such as how to teach the sound system or syntax of a language, to how to teach students of different levels, abilities and native languages. Teachers must be able to use their judgement to determine optimal use of the target language. Pedagogical training can aid someone along the road to becoming a good teacher. One problem that sometimes occurs, especially in Less Commonly Taught or Endangered Language contexts, is that a language teacher receives no pedagogical training and simply replicates how s/he was taught (often by an untrained teacher) and the process repeats itself. Often there is limited knowledge of modern ideas about language teaching and this is to the detriment of both teachers and students.

General	Local	Differential	Targeted
• Motivation, aptitude and opportunity important • Differences between adult and younger learners	• Do not enjoy learning Irish • Some negative attitudes • Limited interaction opportunities	• Boys do not like learning languages • Boys like using computers • Some motivated students	• Need interesting resources • Room for improving the four skills

Table 5.9 CLICI GLDT Grid for Learners

The level of pedagogical training that language teachers receive depends on the context. Primary school teachers receive language pedagogical training as part of their overall teaching programs. They are generalists, rather than language specialists. Secondary school teachers should have pedagogical training specific to their language. The level of pedagogical training expected of language teachers in third level institutions depends on the country and the individual requirements of the institute in question. In some cases, it could be less than that required of secondary school teachers. For adults outside of formal educational establishments, the pedagogical experience and training of teachers can be very variable. For example, the length of time it takes someone to obtain a Teaching English as a Foreign Language (TEFL) certificate can vary from one weekend, (ITOI, 2007), one month (Ferguson and Dunno, 2003) or a year (ICE, 2007) (depending on the awarding body).

One important characteristic of good language teachers is their own personal motivation and their ability to motivate their students. If a teacher is motivated and enjoys teaching the language, the learning experience will be a positive one for the students. If the teacher can motivate the students, it makes their learning more beneficial and productive. A motivated teacher can teach practically anything, while an unmotivated teacher will struggle to teach even something simple. Another important consideration is the degree of fit and flexibility between the teacher's teaching style and that of the institution. If they are closely aligned or teachers have a relatively high degree of freedom in how to impart classes, the teaching experience is more likely to be productive. On the other hand, if there is conflict between the teacher and the institution, this can cause difficulties for all parties in the educational process: the teacher, the institution and, most importantly, the students. For example, if the teacher favours a communicative approach to language teaching but the institution prefers a more audio-lingual approach, this could cause friction, especially if the students move from one teacher to another as they progress through the institution. At a broader level, the alignment between the teacher's language learning philosophy and that of society, is an important and often overlooked aspect of teaching. In the United States of America, there is a policy called "No Child Left Behind" (NCLB, 2002) which tries to ensure that all students reach a certain standard in English. While the motivation is laudable, in some communities there might be a parallel desire to ensure that students learn their heritage language and teachers are often at the forefront of this conflict. They will be judged on the attainment of the students relative to a national scale, yet they are usually conscious of the need to cater for community demands.

In the primary school context, the importance that a teacher attaches to language learning can have a strong impact on the classroom teaching. As the teacher has control over all aspects of the students' learning activities throughout the day, s/he can decide to compartmentalise language learning as an activity that only occurs during its allocated slot, or to integrate it into

all aspects of classroom life. Teachers who consider language learning to be important, will probably try to integrate the target language (or languages) in a holistic manner and thus provide a better learning environment for the students.

5.5.2 Local

Not many of the primary school teachers in Ireland are native Irish speakers and thus language competence can vary considerably from one teacher to another. However, all primary school teachers in Ireland spend three years studying to be teachers. Language pedagogical training is one of the components of their study program. They learn about language pedagogy in the context of teaching both English and Irish. Obviously, teachers with longer classroom experience will have more exposure to educating students and will have acquired many skills along the way. On the other hand, more recently graduated teachers may have more knowledge of modern teaching methods, although refresher courses are available for teachers throughout the year. In Ireland, some teacher training colleges teach all the materials through Irish. As stated in Chapter 4 (Section 4.7), all primary school teachers in Ireland must have a certain competence in Irish (i.e. they must attain at least a grade C on the Higher Irish Leaving Certificate Examination). Given Ireland's increasing multiculturalism and the fact that the compulsory Irish requirement seems to be a particular deterrent for males, this is constantly under review, but for the moment, the requirement still exists. Primary school teachers are generally favourably disposed towards the language (Ó Riagáin, 1986), but as with any group of individuals, attitudes towards the language vary. Teachers sometimes resent the responsibility thrust upon them for maintenance of the language. They would like society and parents in particular to take more responsibility for their children's Irish language education. Teachers are well aware of the negative attitudes that exist towards Irish and are particularly cognisant of the perceived failure of Irish language teaching in the past (INTO, 1985). They would like their students to enjoy their study of Irish, not only for passing on the language, but also to establish a favourable base for future second language study.

In terms of CALL education in the teacher training colleges, the amount of time allocated to CALL is minimal. For example, in St Patrick's College in Dublin, the students receive a one hour lecture during their three years of study on the topic of CALL. The amount of material that can be imparted during this short timeframe is limited and the students graduate without much CALL knowledge.

5.5.3 Differential

The teachers in the CLICI design space are very favourably disposed towards Irish. They try to incorporate Irish into all aspects of daily interaction – it is not just something that is confined to the Irish lesson during the day. Given the highly influential role the teacher has in imparting a

positive attitude towards Irish, this is very relevant and important. Students will obviously have a different experience depending on their teacher and this is something to be taken into account. One other important consideration is the need for the teacher to be able to cater for students of different abilities in the classroom. This will vary from year to year, and sometimes, even during the year. Bright students will need to be challenged, while weaker students must be kept on-board. Moreover, the number and ratio of students with special needs (e.g. dyslexic students) and exemptions from studying Irish also play a role in maintaining balance in the classroom. For example, if the number of special needs students is high, it means that the teacher must orient more of her teaching time towards this group than might otherwise be the case.

5.5.4 Targeted

Teachers are generally favourably disposed towards resources that will help students and make learning more enjoyable and beneficial for them. At the moment, there are very few suitable resources available for the students in the current design space, especially ones that are linked to the curriculum. Therefore, there is a need for resources to complement classroom teaching. These resources could either be specifically linked to the syllabus (e.g. the textbook that the teacher uses in class) or tools that are aimed at the target learner group (e.g. tools such as grammar and spell checkers that are suitable for younger learners). Teachers in Irish primary schools often have between 25 to 30 students in their class. Despite the best intentions of teachers, it is very difficult to monitor all their students across the range of subjects that they cover in any great detail. Therefore, another area amenable to improvement is in monitoring students and their progress in Irish. It would be helpful for teachers to be able to see what and how their students are doing. This is something that is difficult to do accurately as the learning expectations are different for each student. However, a resource that could present relevant information to a teacher would be helpful. As mentioned above, Irish primary school teachers have little or no knowledge of CALL in general and this is an area that is definitely open to improvement. A summary of the teacher component of the GLDT grid is shown in Table 5.10.

5.6 Pedagogy

5.6.1 General

The area of language pedagogy is broad and there are a myriad different philosophies and points of view. It would be impossible to do justice to this topic in one section, but a brief overview is presented here. Egbert and Hanson-Smith (1999) list eight conditions for optimal language learning environments. They are shown in Table 5.11. Learners should have the opportunity to interact and negotiate meaning. They need to be able to try to understand the target language and not just be passive recipients. Learners should interact in the target language with an authentic audience i.e. not just the classroom or language learning setting. They should be

involved in authentic tasks, i.e. tasks that they are likely to want to, and need to, carry out in real life. Learners should be exposed to, and encouraged to, provide varied language. They should try to go beyond the constructs and vocabulary they have formally learnt and not feel afraid to do so. Learners should have enough time to study the language and feedback on their use of the target language. Furthermore, learners should be helped to become aware of the learning process. Studies have shown that learners who have this awareness and know about different language learning styles and strategies are better learners (Oxford, 1990).

General	Local	Differential	Targeted
Desirable traits: • Linguistic competence • Pedagogical training • Motivation • Ability to motivate • Match between teacher and environment	• Not many native speakers • Some pedagogical training • Pressure as main focus of language preservation (resentment) • Need to deal with differing abilities and attitudes	• Positive attitude to Irish • Comfortable with Irish	• CALL knowledge • Resources that make Irish enjoyable • Resources linked to curriculum • Student monitoring

Table 5.10 CLICI GLDT Grid for Teachers

The learning environment should have an appropriate stress/anxiety level. Some level of stress contributes to learning, but too much stress leads to anxiety, which in turn impedes the learning process. Finally, supporting learner autonomy is conducive to language learning. Benson (2001) discusses the role of learner autonomy in the language learning context. These are the core conditions for optimal language learning environments. Obviously, it may not be possible or feasible to meet all the conditions in a given pedagogical context, but the pedagogical advantages of providing a good learning environment should be apparent. There are numerous examples of how these conditions can have an impact on the four so-called basic language skills (reading, writing, listening and speaking). For example, Healey (1999) reports that writing is difficult for learners who do not see the point in writing in the target language. Therefore if learners can communicate in writing with an authentic audience, this can help them overcome this lack of motivation in an artificial context.

1. Learners have opportunities to interact and negotiate meaning.
2. Learners interact in the target language with an authentic audience.
3. Learners are involved in authentic tasks.
4. Learners are exposed to and encouraged to produce varied and creative language.
5. Learners have enough time and feedback.
6. Learners are guided to attend mindfully to the learning process.
7. Learners work in an atmosphere with an ideal stress/anxiety level.
8. Learners' autonomy is supported.

Table 5.11 Conditions for Optimal Language Learning Environments

Another important facet to consider with language pedagogy is the role of input, the attention paid to the input and output. Krashen's (1985) Input Hypothesis identifies the importance of comprehensible input in the learning process. However, simply being exposed to the input is not enough. Schmidt (1990; 1995) highlights the role of consciousness in language learning. He says that 'noticing' is necessary to convert input to intake and consciously paying attention is important and effecting in the learning process. Swain's (1995) Output Hypothesis outlines the need for language production (output) in order to facilitate language learning, especially for difficult items. Holliday (1999) reports that learners differ in their readiness for aspects of the target language. In general, as Schmidt (1990; 1995) points out, development depends on the level of attention paid to the input. Focusing on problematic forms (either in learners' input or output) is more effective than just presenting abstract rules of grammar. Explicit grammar teaching combined with negotiation of meaning can help fluency. Providing plenty of input with target structures is helpful but is not sufficient. Furthermore, learners should try to negotiate the modification of the input. Although there is a place for providing corrective feedback on the learner's output, it is not always the most desirable strategy. The quantity and quality of modifications made to the input and output are affected by the gender of the participants. Finally, the syntax of the target language can be highlighted by changes to input and output made as a result of negotiations. A summary of Holliday's findings is shown in Table 5.12.

- Learners differ in readiness for aspects of the target language
- Development depends on attention to the input
- Focus on problematic forms is more effective than presenting abstract grammar rules
- Explicit grammar teaching can help fluency
- Exposure to target structures is useful but not sufficient
- It is helpful to negotiate the modifications of the input
- Corrective feedback has a role, but care should be taken
- Gender has an affect on modifications to input and output

Table 5.12 Holliday's Summary of Research Findings on Input and Output

Primary School Context

Primary school is a suitable environment for language learning. Primary school teachers can embed a foreign language in the classroom and integrate it into the whole curriculum. The Council of Europe Workshop 8B (quoted in Driscoll and Frost, 1999) reported on the need for primary school teachers with foreign language pedagogical experience who can integrate the language and culture of other countries. Primary schools are better suited to deliver a programme of communicative competence in a language than secondary schools. Sharpe (2001) lists the multifaceted role of the teacher, the broad educational aims, the informal classroom organisation, the communal ambience and the flexible timetable as favourable factors in the primary school context. Sharpe (2001) states that there are four key ideas that are important to the success of primary school language teaching. These are communication, culture, context and confidence. He lists 12 propositions that combine with these key ideas to constitute a manifesto for good practice in primary school language teaching (Sharpe, 1992) and these are shown in Table 5.13. While it might be argued that some of the propositions are a bit vague or aspirational, they provide a useful list of guidelines for language teaching in primary schools.

5.6.2 Local

As reported in Chapter 4 (Section 4.4.2.2), until recently an audio-lingual approach was the common way to teach Irish. It was unpopular with students and teachers and has been replaced by a communicative approach. This communicative approach is still being rolled-out in primary schools, but a pilot project by Harris and Murtagh (1999) provided encouraging indicators. However, given the relative freedom that a primary school teacher has, it is quite probable that teachers adopt an eclectic approach to teaching Irish. Some teachers will favour an emphasis on function, while others will prefer a more structured approach with a focus on form combined with function. There is room for improvement in the four so-called basic language skills. Students have limited time to study the language and very limited exposure outside of the classroom. For example, students read very little in the language and practically nothing outside of the classroom. Several studies have shown the importance of reading in the language learning process. Hickey (2001) has advocated increased reading for improving the language learning process for Irish.

In Ireland, the primary school classroom was considered a homogenous environment until relatively recently. There were very few resources for students with special needs and they were expected to participate in all classroom activities regardless of the difficulties it posed for them. Now however, there is a better understanding of their needs and the number of resource teachers for students with special needs (e.g. dyslexia or learning difficulties) has increased.

Communication	
1	The overriding purpose of learning any foreign language is to be able to communicate.
2	Priority should be given to oral/aural communication
3	Communication is for real

Culture

4	Teaching a foreign language necessarily implies teaching the culture in which it is embedded.
5	A corollary of the centrality of culture is that direct translation should be avoided as far as possible.
6	Effective teaching of foreign culture 'from the inside' in primary language teaching should aim to help children overcome sociocultural stereotypes.

Context

7	The most important methodological strategy for teaching languages in primary school is the use of contexts
8	Through practice in contexts pupils can be encouraged to 'make the language their own'
9	Contexts cover three main phases in language learning: introduction, practice, reinforcement

Confidence

10	It is a prime responsibility of the primary school language teacher to foster pupil confidence in handling the L2 being taught
11	Teachers need to feel confident too
12	Primary language teaching should give children a confidence about language learning in general

Table 5.13 Sharpe's 12 Propositions for Good Practice in Primary School Language Teaching

Furthermore, Ireland has become a much more multicultural society since the early 1990s and this is reflected in the primary school student population. Some recent immigrants may not speak English and this is forcing primary school teachers to deal with a new classroom phenomenon. In short, the primary school classroom is now recognised as being a diverse environment and teachers are expected to consider the needs of each individual child and ensure that each achieve their potential. In terms of teaching Irish, teachers not only have to deal with

students who are exempt from studying Irish, but they also have to cater for students of different abilities and attitudes towards the language. They must balance the needs of the brighter students (e.g. to keep them challenged) with those of weaker students (e.g. making sure they stay engaged and understand the material).

5.6.3 Differential

In the CLICI design space, the learning environment is one in which the teachers try to incorporate Irish into all aspects of classroom life, not just the Irish slot in the daily schedule. The teachers have a positive attitude towards Irish and would like their students to learn Irish in a holistic manner. The two main teachers involved with the CLICI project have quite different pedagogical approaches. The teacher in School 1 believes that the children are capable of and can benefit from learning grammar rules. She integrates the teaching of certain basic rules into her language classes before the age outlined in the curriculum guidelines. On the other hand, while not ignoring the rules completely, the teacher in School 2 focuses much more on oral and aural skills. Both teachers are very pro-Irish and consider that their approach is the most suitable one for their group of students.

5.6.4 Targeted

One area within the teaching of Irish that is amenable to improvement is the ability to handle learners of different abilities and learning styles. Currently, when a teacher teaches a class of 20 – 30 students all at the same time, she must try and balance the different needs of each student. This is hard to do, especially when the students are not particularly interested in the material or have a negative attitude towards the subject. CALL resources could help in this regard, by providing material that could cater for students of different levels and different learning styles. The material could be presented in differing ways and the students could select how to actually use the materials. Another area open to improvement is that of providing a forum for reinforcing learning. Given the crowded timetable, students only have a limited amount of time available to study the language during the day. Providing them with a means of revising material that they have already covered in class, will enable students to go over what the teacher has taught them and enable the weaker students to catch up if they had difficulty understanding the material in class. Given the patient, private environment of CALL materials, students can work at their own pace and no-one need know if they are only at the beginning of a section and repeat it many times. The teacher cannot be expected to answer the individual queries of each student many times, but this is something that can be expected of the computer.

In order to be able to cater for the needs of the better students, there is a need for a resource that these students could use to try-out new material and to adopt an explorative learning approach.

A CALL artefact that enables these students to construct their own texts in Irish and to get immediate feedback on the content is one such possibility. Students could either use sentences and phrases they have learnt in class or could try to create their own original sentences. This could help maintain the interest of the brighter students, who may find the "middle-level" pitch of the class lessons a bit boring. Language pedagogy is not something that is frozen in time. It should adapt as new findings come to light. With this in mind, it would be useful to have access to a corpus of learner Irish, so that pedagogical specialists and teachers could analyse the language produced by students in a scientific manner. Based on these findings, areas of weakness could be examined and new strategies developed to help remedy problems. While there is an electronic corpus of Irish (NCI, 2005) it contains texts from a variety of genres, mainly from adult native speakers. At the moment there is no electronic corpus of learner Irish (i.e. a corpus of texts from students studying Irish – see Chapter 7, Section 7.8 for an overview of Computer Learner Corpora (CLC)), particularly for the primary school context and it could be beneficial to the teaching of Irish if such a resource existed. Table 5.14 shows a summary of the pedagogical component of the grid.

General	Local	Differential	Targeted
• Must provide opportunities to interact in L2 • Role of input and output important • Primary school potentially good environment for L2 learning	• Communicative approach (new) • Eclectic style • Mixed ability groups	• Holistic approach • School 1: students can benefit from grammar rules • School 2: emphasis on aural and oral skills	• Handle learners of different abilities and attitudes • Forum for reinforcing learning • Explorative learning for brighter students • Gather corpus of learner Irish

Table 5.14 CLICI GLDT Grid for Pedagogy

5.7 Technology

5.7.1 General

A brief Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis of technology in language learning is presented here. The first SWOT analysis looks at technology in language learning in general, while the second one considers existing comparable language courseware. Summaries are shown in Tables 5.15 and 5.16, respectively.

5.7.1.1 SWOT Analysis – General

Strengths

This section covers some of the main strengths of the use of technology in language learning. It is by no means a comprehensive list, but aims to highlight the benefits that technology can bring to the language learning process. There are two types of technology to consider here. First, there are general technologies such as the cassette recorder, CD-players, DVD-players, video-players and televisions. These technologies can provide access to learning resources that would otherwise be unavailable. For example, if learners do not have access to native speakers of the target language, they can hear the language being spoken by native speakers using a simple technology such as a cassette recorder. These technologies are widely available and not specifically designed for language learners, but language learners can certainly make use of them. Second, there is technology specifically aimed at or used by language learners, which fits into the CALL domain. There are several strengths to using technology (specifically computers) in the language learning process. Learners can have access to resources in private, which is helpful for self-conscious learners (Brett, 1996). Learners can have more autonomy (control) over the learning process. Although Benson (2001) points out that it is difficult to prove the benefits of learner autonomy, Naiman et al. (1978) note that successful language learners assume responsibility for their own learning. They can work at their own pace and are not tied to someone else's schedule. They can work where, when and how they want, which increases learning flexibility. Learners can study and learn in a way that suits their learning strategies and styles (which leads to more effective learning).

Using computer technology, resources can be made available in multi-media and interactive formats. Students who find the static information in books uninteresting, can be stimulated by the simultaneous display of the same text in colour, with audio and visual presentations. It is important that the learner receives feedback and Neri et. al. (2001) report that the provision of (almost) immediate feedback is beneficial for the learner. In the traditional classroom setting, this may not always be possible and the ability of the computer to provide such feedback is welcome. Another CALL strength is the ability to repeatedly review information (Brett, 1996). Repetition and reinforcement are important elements in learning (Hebb, 1949; Hergenhahn and Olson, 1997) and CALL provides an opportunity for learners that may not otherwise be available. Reinforcement can shape the learner's attitude toward the CALL artefact. Feedback can be a powerful reinforcement tool, but how the feedback is provided is important (Heift and Schulze, 2007). Heift and Schulze (2007) report that excessive use of praise words (e.g. excellent) is counter-productive and caution on the use of punishment or negative reinforcement (e.g. negative comments). They recommend that due care should be giving to the wording of feedback to the learner and note that some CALL projects use feedback messages that could be improved (e.g. use of feedback messages such as "Wrong!" or "False!"). Although the

interactive component of CALL is sometimes overstated, CALL can promote interactivity. Learners have to interact (even passively) with the computer and cannot hide behind their classmates. They have to select what to study and if and when to listen to an audio file or view a video. They are forced to drive the process, even if what they have to do is pre-selected by the teacher.

There are also technology-specific learning activities to consider. These are activities that are only possible with the use of the computer (Felix, 1999). A simple example is that of interactive exercises. Instead of seeing the same questions being asked, students can be asked to answer different questions and the degree of difficulty can be tailored to the individual student. Another example is that of virtual worlds and MOOs (Multi-User Object Oriented) environments. These are worlds that users create between themselves and can range from simple environments to large, complex systems. Users interact with other users in the world (see Shield et al., 1999 for more details). Computers provide learners with increased opportunities for speech-related learning via the provisions of audio files (for listening) and voice-recording software (for speaking). The ability to hear native speakers, especially if there are new sounds in the language, can be helpful. Likewise, students can now hear their own voice and compare it to that of native speakers.

There are also strengths from the teacher's point of view. Bishop (1999) reports that CALL can be beneficial where the class size is large and where there are students of differing ability in the same class. It is also useful where students need CALL to prepare for their real-life environment (e.g. email correspondence). Furthermore, teachers have more opportunities for providing a collaborative learning environment for their students. Teachers have improved content authoring possibilities. Previously, teachers and learners only had access to already-printed information. If a teacher wanted to create new materials, s/he had to compose, write-up or type new material, print it out and photocopy the documents. This was a tedious process and it was cumbersome to correct errors. Nowadays, the process is somewhat simpler. The teacher still has to compose the new materials, but authoring tools and general purpose editing tools have made the task much simpler. Finally, CALL has the potential to increase learner motivation. It may be the private environment, access to additional information or the multi-media presentation that encourages the student to learn, especially when the current learning environment (e.g. classroom situation) is not stimulating or enticing for the student. Whatever the reason, increased motivation is to be welcomed.

Weaknesses

One of the main weaknesses of technology in language learning is the limited availability of resources. These resources include: time and money to develop (Levy, 1997) or acquire CALL

materials, lack of or limited hardware resources, connectivity options (e.g. intranet/internet, dial-up/broadband/wireless connections) and lack of technical support. Obviously, these can all have a negative impact on the language learning process. Pennington (1996) notes that CALL programs may promote anti-social behaviour. Learners may be "wrapped-up" in the program and focus on learning the language in isolation rather than learning to communicate with others. If learners use CALL programs that are not checked for quality, they may be using programs that provide misleading or oversimplified content. Some CALL programs may be developed from a generic template and in order to fit in such a template, the content providers have to simplify the contents or their related explanation. This can waste students' time, confuse them and fail to meet their learning needs. Although progress is on-going, in general, CALL programs have a problem in dealing with learner input. It is easier to develop CALL programs for output (reading and listening) than input (writing and speech). It is technically challenging to deal with writing and speech for native speakers, and even more of a challenge for language learners as learner output is likely to contain errors. In terms of language learning this is a significant weakness as writing and speech are important language skills.

Another weakness that can arise is the underutilisation of CALL resources. CALL programs have the potential to provide the learner with a rich and stimulating learning environment, but users may not make full use of the software (Chapelle et. al., 1996; Cobb and Stevens, 1996). Although this can be partly overcome with user training and guidance, it is still a potential problem with CALL resources. If there is a mismatch between the perceived and actual setting of a CALL program, its effectiveness may be limited. For example, is a single-user program being used in a group context? Hubbard (1996) points out the importance of effective deployment of CALL programs. There is the temptation to use CALL for the wrong reasons and Bishop (1999) warns against using CALL solely because it is enjoyable, available and will keep the students occupied. There are other weaknesses in terms of deployment (or use) of CALL materials. They can be overcome with time, training and increased resources, but for the moment they are still an issue. These include slow access, server complications, unknown end-user configuration, potential need for plug-ins and technophobic students and teachers.

Opportunities

Computers are becoming increasingly more available and this naturally creates an opportunity for wider use of CALL resources. Computers are also becoming more powerful and this will increase what they can do and how the learner can use them. Programs that previously took a long time to load-up, can now be loaded much quicker and this improves the learner experience. Although there are still technophobic students and teachers, there are an increasing number of students and teachers that are comfortable with using computers in general and for learning in particular. This means that they will be more willing and interested in using CALL applications

and will not consider it something out-of-the-ordinary to use a computer for language learning purposes. In parallel with this, CALL is increasingly becoming a more professional academic field, and while continued research is required, this should help education institutions, teachers and students to accept CALL as a recognised language learning resource rather than view it with scepticism.

In today's increasingly interconnected world, there is a growing need for language resources. Given the difficulties in providing these resources to all that would like to have them, learners and teachers may be more open to using new resources and new learning modes. This means that they may consider the use of CALL resources that otherwise would have been overlooked. Furthermore, there is a need for more L1/L2 combinations and, in situations where suitable teachers are not available, students may welcome the availability of CALL resources. One final observation is that as computers become a more accepted part of everyday life and the learning environment (i.e. become 'brownware' (Bouziane, 2005)), they will increasingly become a normal element of the learning process and this will provide more opportunities for CALL deployment.

Threats

The main threat to technology in language learning is the scepticism that surrounds CALL in the minds of those in positions of power in educational institutions, teachers and learners. They doubt the benefits of using CALL and may question whether or not it is worth the effort involved. Teachers may feel that there is insufficient time available to them and their students for current language learning activities and may not want to cede this precious time to CALL activities. Students may feel that CALL is not 'real' learning and may question the value of using CALL resources. There is also a threat from the other direction. Educational institutions, teachers and learners may expect too much from CALL applications. Their unrealistic expectations cannot be met and they may end up disillusioned with CALL in general and not recognise that it has a role to play in language education. Although computers are becoming evermore prevalent in society and in educational institutions, there is still quite a sizeable proportion of students and more especially teachers who do not like using computers. Until their aversion to computers can be overcome, technophobes will find it challenging to enjoy and benefit from CALL applications. Although computers are more readily available than before, there are still many people who have limited access to computers. Even among those who do have access, their computer use may be quite limited. This represents a threat to the use of CALL in many environments.

One problem that those outside of the CALL community have with CALL is that research to date shows that CALL is no better or no worse than traditional language learning. They feel

that CALL should be shown to be demonstrably better in order to merit its use. Although the point is that CALL can be better in some ways than traditional language learning situations, this is often missed out by critics of CALL. This perceived lack of superiority of CALL could hinder its use outside of its current contexts. The efficacy of CALL crucially depends on how and where it is used. If it is used in its intended environment and deployment context, it can be of benefit. However, if the CALL resources are used outside this environment and context, there could be frustration on the part of the learner, if the resources do not live up to expectations. Finally, there is no magic formula for the development of the 'optimal' or best CALL resource. The CALL community is still searching for the key to optimise CALL resources and while this could be considered as a positive feature from a research point of view, those new to CALL may consider it to be a drawback.

5.7.1.2 SWOT Analysis – Comparable Language Courseware

This section provides a SWOT analysis of comparable language courseware. In the context of this project this section will analyse briefly CALL resources for primary schools.

Strengths of CALL in the Primary School Context

There are several factors that favour the use of technology in the primary school context. The learners are at the start of their educational journey and are therefore beginners in all subject areas. Most of the materials available are aimed at beginners and this means that there are potentially more resources available to this learner group. Young learners are less technophobic than older learners, although it should not be assumed that all young learners are technophiles. Many primary school students have access to a computer at home or have played games on a computer. While computer game playing does not necessarily translate to successful use of CALL, it generally means that the user is computer savvy. Young learners tend to be aware that computers are fallible and are more forgiving when the computer crashes than previous generations of learners. Young learners are also open-minded. Their mind-set has not been set in stone and they are open to new possibilities.

Edwards et al. (2002) report on the benefits of the Fabula project, which provides authoring software to enable young learners to create bilingual digital books in European minority languages. These include the fact that multimedia can enrich bilingual books and that the self-made materials motivate learners. Older primary school children were particularly motivated by the prospect of their work being published at a European level. The authors note that this type of CALL resource can provide language materials in an environment in which such resources are scarce. Moreover, it has led to a community of users keen to develop high quality language teaching resources.

Strengths	Opportunities
Can provide access to learning resources that would otherwise be unavailable Learners can have access to resources in private Learner Autonomy Learners can work at their own pace and place Learners can study in their own way Resources can be made available in multi-media and interactive formats Feedback Repetition and reinforcement Interactivity Technology-specific learning activities Interactive exercises MOOs, virtual worlds Increased opportunities for speech-related learning Potentially increased motivation Opportunities for teachers Useful for large classes and students of differing abilities Useful for preparing students for real-life environment Can provide students with collaborative learning environment Content Authoring	Computers are more available Computers are more powerful Students and teachers are more computer literate CALL is becoming more professional Openness to new applications/learning modes Need for alternative resources Computers more accepted ('brownware')
Weaknesses	**Threats**
Limited availability of resources Anti-social behaviour Misleading, oversimplified content Problems with learner input (written/spoken) Underutilisation of resources Ineffective deployment Temptation to use CALL for the wrong reasons Limitations in the deployment of CALL materials	Scepticism amongst educational institutions, teachers and learners Unrealistic expectations Technophobe teachers and students Availability and use of technology not uniform "No better" than traditional language learning Environment and deployment dependent CALL community still searching for 'optimal' CALL

Table 5.15 SWOT Analysis of Technology in Language Learning

Specifically, in the Irish context, the CALL resources produced by *Fios Feasa* (2003) contain bright cartoon animated pictures with games, exercises, information and questions. Young learners can enjoy the CD-ROM resources and make learning Irish a fun experience – something that they do not usually associate with the language.

Weaknesses of CALL in the Primary School Context

Lack of Awareness

Primary school teachers may not be aware of CALL or Computer Assisted Instruction (CAI), as it not generally a central part of their teacher training education. Naturally, the core of their training is based on pedagogy and other elements of child education. Granted, primary education training will include some computer component (e.g. general word-processing), information about the internet and perhaps a brief introduction to CAI in general. However, CALL will not be a major component of study. If teachers are unaware of CALL, they cannot be expected to use it.

Lack of Resources

Teacher awareness is only one component in the deployment of CALL. Another key component is the availability of CALL materials. Even the most enthusiastic teacher cannot be expected to use CALL, if suitable software is not available. Most of the commercial CALL resources are developed with older children or adults in mind. For example, a review of the products listed on the Linguist List web site (Linguist List, 2003) reveals that very few of the products are aimed at primary school children and the vast majority of these products are available for English. However, it is unreasonable to expect teachers to use CALL materials (if they exist) that do not easily integrate with the core curriculum.

Lack of Pedagogical Awareness

Another factor is the lack of pedagogical awareness of how CALL can best be deployed in primary schools. Primary school pedagogy is not a new area of research, but the deployment of CALL in primary schools is relatively novel. The CALL community is continually trying to determine what works in what circumstances, and why, in better understood CALL domains (e.g. universities). Therefore, it is reasonable to expect that the same questions must be investigated and some pointers provided in the primary school context before teachers can feel confident and comfortable using CALL in their day-to-day teaching. In many countries, foreign languages are not taught in primary schools and thus, there is very little CALL deployment and research in this area. There has been some research into CAI in primary schools that can provide some pointers, but even this is fairly limited. Mumtaz and Hammond (2002) state that there are many issues still outstanding when considering the interaction of word processors and writing skills in primary school children, and ask if this relatively well established technology has

unanswered questions. What does this imply for newer technologies? Blok et al. (2001) report that in the past 10 years, there have only been 5 studies of the effectiveness of learning L1 words in the primary school. Van der Meij and Boersma (2002) have looked at the use of email in the primary school (in the Netherlands) and conclude that there is still much to be studied and understood in this emerging email genre.

Goodison (2002) reports on a study of three primary schools in England that were successful users of ICT. Many of the benefits of ICT identified by the teachers as enhancing students' learning were similar to those reported in other CALL situations (e.g. motivation, learner autonomy, and interactivity). The main negative point raised was that care must be taken to ensure that the pedagogical objectives are paramount as it is sometimes easy to be distracted by the technology (this is also relevant in other CALL contexts).

There are general User Interface guidelines for online materials available for adults (e.g. Neilson, 1996, 1999). However, when developing CALL materials for children, it is important to incorporate some elements over and above those of the usual CALL situation. The materials must be user-friendly and be easy to use for the target audience. Short, clear instructions should be provided to the students. Child-friendly images and colours should be used. As of now, further research is required into what is appropriate and desirable for younger learners.

Lack of Integration with the Curriculum

Primary school teachers must cover specified material as part of their established curriculum. Many primary teachers feel sufficiently challenged to fit all they should/want to teach into the limited time available to them and the burden of trying to find time for something that does not immediately integrate well into the curriculum can seem too much. From a commercial point of view, it is easy to see why particular products are not tied to a specific curriculum as the potential market for such a product would be rather small. However, from a pedagogical and deployment point of view, it is hard to see how a product would realistically be used if it is *not* integrated with the curriculum. BECTA (2001) identified the integration of ICT into classroom practice and existing teacher interventions as being an important condition for success of ICT in the primary school.

Logistical Issues

One elementary issue that the teacher faces is how to combine the use of the computer lab and the classroom from a purely physical point of view. The computer lab cannot be adjacent to every classroom and in many cases, will not contain a sufficient number of computers for all the children in the class. This means that the teacher must have some children in the computer lab, while the rest of the class remains in the classroom. The teacher cannot physically be in both

places at once to supervise the students. This is particularly important in the primary school context where the children are usually less than 12 years of age. There are several potential solutions, but most of them involve careful co-ordination with another teacher (in terms of supervision) and lesson planning for the off-line classroom component.

Lack of Need

A more basic reason for the lack of CALL in primary schools is that in some cases there is no need for CALL, as no foreign languages are taught at primary level. For example, in the United States, foreign languages are generally not taught in primary schools (although, there are exceptions, especially in areas where there is a strong desire amongst the community for the teaching of a heritage language, e.g. Spanish in the United States). All these factors militate against the use of CALL at primary level, although this is not to imply that there is no CALL in primary schools in different parts of the world. However, primary schools that use CALL mainly use it for L1 education rather than L2 learning.

Opportunities for CALL in the Primary School Context

Primary school children are keen to use computers and this is one key opportunity for using Irish CALL materials. Research undertaken in primary schools in Ireland (see Chapter 6), as well as other international studies, show that young learners, particularly boys, are keen on using computers. Another area that could enhance the environment for CALL deployment is the fact that computers are becoming more available and that learners have improved access to computers both in school and at home. Related to this is the increasing awareness of how to *use* computers for educational benefit, even if the computing resources are limited (e.g. Egbert and Yang, 2003). Another positive factor is that computers are seen as progressive and necessary in educational terms. The computer is increasingly being viewed as a resource that learners must be able to use, rather than just an optional extra. Tying this point of view with the need to enhance cross-curriculum learning means that CALL usage could be increased in primary schools in the future.

Threats to CALL in the Primary School Context

Many of the weaknesses of technology in comparable language courseware also exist as threats from an external point of view. Lack of awareness of the costs and benefits of CALL amongst parents and educationalists in general means that expectations of CALL are often incorrect and can result in under-deployment or disappointment with CALL. Lack of resources (e.g. provision of CALL developers, buying-out teachers to contribute to development) means that CALL resources may be developed by interested parties on a somewhat voluntary basis, rather than having a dedicated team available to develop professional materials. The issue of lack of pedagogical awareness also applies at a macro-level within the education system. While people

in positions of power in the education establishment (e.g. senior civil servants in the Department of Education, Head school teachers) may have some knowledge of CALL, at present there is very little expertise regarding the use of CALL in the primary school context in Ireland and this has an impact on CALL deployment. Furthermore, there is a lack of integration with the curriculum at a broad level and this can hamper an individual teacher's ability to use CALL resources in a flexible manner. There are also logistical issues to be addressed. For example, who should develop the software? Who should pay for the software? How is it to be monitored? Although other countries may have more CALL deployment experience than Ireland (e.g. Belgium (Decoo and Colpaert, 1999)), these questions will have to be addressed at a macro-level within the specific Irish context. The issue of the need to learn the language and indeed, the role of Irish in education in Ireland, is one that is subject to on-going debate. The uncertainty surrounding it could be seen as a threat to the use of Irish CALL, although, it could paradoxically be seen as a reason to use CALL rather than traditional education methods. Table 5.16 shows a summary of the SWOT analysis of technology in comparable language courseware.

5.7.2 Local

The questions to be addressed here are "What infrastructure and equipment are available in the design space?" and "What language courseware has been used before?". There are plenty of older technologies available in primary schools in Ireland. These include cassette recorders, televisions and in some cases video and DVD players. Not all classrooms would have these resources and in general, there is limited use of these technologies, especially if the teacher has to move the resource from a central storage area to the classroom or move the students to where the resource is set up.

Strengths	**Opportunities**
Generally dealing with beginners Learners less technophobic Learners more forgiving Learners open-minded	Learners keen to use computers Computers becoming more available Computer seen as 'progressive' and necessary
Weaknesses	**Threats**
Lack of awareness amongst teachers Lack of resources Lack of pedagogical awareness Lack of integration with the curriculum Logistical issues Lack of need	Lack of awareness amongst parents and educationalists Lack of resources Lack of pedagogical awareness Lack of integration with the curriculum Logistical issues Lack of need

Table 5.16 SWOT Analysis of Technology in Comparable Language Courseware

Nearly all primary schools in Ireland have access to a computer, be it in a computer lab or in the classroom. However, some of the machines may actually be quite old (in computer terms) and may lack useful hardware such as CD-writers. Most schools have reasonably up-to-date versions of software installed on their computer, but this may not always be the case. Furthermore, not all schools have access to suitable technical support and this can impinge on the effectiveness of the computer resources available. In theory, all schools have access to the internet, but in some cases this amounts to a single dial-up connection (which is not ideal for multi-student use). However, there was a national plan to roll-out broadband to all primary schools by the end of 2005. It remains to be seen whether or not this has actually happened, but there is a definite push at government level to ensure that all schools have a broadband connection as soon as possible. In many cases, this will be a wireless connection, thereby allowing teachers and students to access the internet from an individual computer in their own classroom.

In terms of language courseware, there have not been many resources that have been tried on a wide-scale up to now. The *Fios Feasa* series (Fios Feasa, 2003) is an example of a professionally produced resource for Irish, aimed at primary school learners. When the student makes a mistake, an ambulance comes out and fixes the error. It is relatively expensive and, as it is curriculum-independent, there are some difficulties in integrating it into the learning schedule. Most of the other technology-related learning resources involve web-sites for teachers that have downloadable materials based on particular learning themes. For example, there are resources available on ScoilNet for Irish on Halloween, but these are mainly learning exercises and wordlists that can be printed out by the teacher. In terms of modern CALL resources, there are really very few available for Irish primary school learners.

Computer Lab Usage Issues

There are often logistical issues with using a computer lab. Often only half the class can use the lab at any one time, which means that the teacher must have an assistant to attend to the students in the lab or to look after the non-computer using students while the other group use the lab. Alternatively, the students must use the computer in pairs. Egbert and Yang (2003) has several suggestions as to imaginative ways to use a computer in this type of situation. However, while this can be educationally beneficial, there are occasions when it is desirable to be able to allow each student to have individual use of a computer. Bearing these factors in mind, the trend in the current design space is to have an individual computer in the classroom. This means that the teacher can assign a scheduled slot to each student or can allow a student to use the computer when a suitable opportunity arises during the school week. The teacher can continue to work with the rest of the class and does not require external assistance for supervising the student

using the computer. The downside of this approach is the limited exposure to the computer and the fact that the student may miss out on what the teacher is teaching while using the computer.

5.7.3 Differential

In terms of actual technology, the software that is available in the current design space is reasonable, but not leading edge. The computers do not have to have the very latest version of the operating system or even useful resources such as a CD-writer. While it can be reasonably assumed that the computers will be upgraded in time, it must be borne in mind that it is unlikely that these school computers will contain the most up-to-date version of software (and the designed system must take this into account). Both schools have a computer lab but due to the difficulties outlined above, both teachers prefer to use a computer in the classroom. At the start of the project, neither school had a classroom computer, so a second-hand computer was acquired for each school.

There are also space issues to consider in the current design space. The classrooms have toilets and a sink included in their structure and the amount of free space available for the positioning of extra resources, such as a computer, is limited. This means that there is not a lot of open space available around the student using the computer and this limits the possibilities for students recording sound for example. Not only might the quality of the recording not be very good, given the potentially high levels of ambient noise, more importantly there could be an element of mutual distraction between the computer student and the rest of the class. This is something that must be borne in mind when considering possible resources for this design space. One final point is that the issue of security must also be considered. While each school endeavours to ensure that all of its equipment is safe, there is always the risk that a nice, new looking machine might attract the attention of someone from outside the school environment. Therefore, reasonable care must be taken to ensure the physical security of the computer, especially if it is in a stand-alone classroom.

5.7.4 Targeted

In terms of what can be improved, there are several possibilities. One is to provide resources developed specifically with the target student population in mind. While lessons can be learnt from similar populations in other contexts, there are bound to be difficulties and teething problems when developing for this group. The developed resources must be pedagogically driven and robust. The need for pedagogically driven resources should be obvious. The need for robust resources arises from the fact that the teacher cannot be assumed to be a technological expert and the software must be able to cater for most eventualities, without the need for on-the-spot technical support (which in any case, will not be available). In the worst-case scenario, the software should die gracefully and not impinge on the running of other programs on the

machine in question. Any resources developed must take into account the actual technology available in the design space, but should have the capacity to grow as the technology is updated. Table 5.17 shows a summary of the Technology component of the GLDT grid.

5.8 Content

5.8.1 General

At a worldwide level, there is a bewildering array of content available to language learners. There are resources specifically developed for language learners and other resources that are not designed with language learners in mind, but can be of use to them. In general, the amount, variety and quality of resources available depend on the language being studied. For the Most Commonly Taught Languages (MCLTs) such as English, French and Spanish, there is a wide variety of language learning materials available to students of all levels. In the case of English, probably the most studied foreign language, there are materials available for babies up to advanced adult level. The materials are available in traditional textbook format and in more modern online and digital formats (and everything in between). There are resources aimed at sub-groups of learners e.g. for learners of English for Academic Purposes. Some of the materials are aimed at a world-wide audience, while others are tailored to a particular learning group (e.g. French speakers learning English). There are many commercial materials available and a more limited range of non-commercial, often academically-produced resources. With the continued expansion of technology in today's world, teachers are sharing their resources with other teachers and so the amount of resources available to language teachers is constantly on the increase.

General	Local	Differential	Targeted
• SWOT analysis shows that CALL has a role in language learning • SWOT analysis in the Primary school context reveals that there are many challenges	• Computers available, although actual access and usage rates are variable • Older technologies also in use	• Basic PC for individual classroom use • Physical space issues	• Robust resources with capacity to grow with technological advances

Table 5.17 CLICI GLDT Grid for Technology

There is also an almost unlimited amount of authentic material available in the MCTLs (i.e. material in the target language that is aimed at native speakers of the language). There has been an increasing focus of late in the use of authentic resources for language learners, but it is not simply a matter of making the resource available to students and assuming that no preparation or modification is required. Authentic materials that are inaccessible to students because of the level of vocabulary and language knowledge required will not only be useless, but could discourage students. Care must be taken to ensure that students are provided with sufficient resources and preparation to understand the authentic resources, at both a linguistic and a semantic level.

For Less Commonly Taught Languages (LCTLs), there are fewer resources available. Most of the content is available in textbook format only, although there is increasing use being made of authentic materials available in digital format. In the LCTL situation, a lot depends on the individual teacher's enthusiasm in developing and searching out suitable content for the students. As can be expected, the situation for Endangered Languages is even worse. The resources available are often aimed at beginners and may be out-of-print. If the material is written by linguists for linguists, it will be unsuitable for language learners. One important factor in the availability of content for ELs is the local socio-economic context. For example, EL communities in North America have greater access and potential to create language learning resources, as they have the financial resources, and maybe literate speakers, to help them develop such resources. On the other hand, EL communities in developing countries do not have these resources available to them and therefore struggle to develop language learning materials.

5.8.2 Local

The primary school curriculum for Irish is set at national level. The curriculum is divided into different sections, depending on the primary school class. The curriculum is publicly available in Irish in printed form and online (NCCA, 1999). The syllabus is based on the curriculum and teachers have a certain degree of flexibility as to what they teach. There are several book companies that produce books for the primary school market and most of them have a book range that cater for students in first class up to sixth class in primary school. Two of the more popular books are *Treo Nua* (New Way (Collins, 2003)) and *Inis Dom* (Tell me (Breatnach, 2001)). *Maith Thú* (Good for You (De Bhaldraithe, 2003)) is a new range of books that has been developed in conjunction with the new communicative curriculum. These books are colourful and focus on oral and aural skills. While they are pedagogically desirable books, the widespread deployment of the books has been slow for several reasons. Teachers are used to using the older style books and have found them relatively successful to date. They sometimes question the effectiveness of the new method, saying that it lacks a focus on grammar and they

wish to combine the two approaches. Also, the parents are reticent in buying new books (for any subject) if they feel it is simply a ploy on the part of book companies to generate sales. They would like to be able to use the books that previous students and siblings have used, without the need to buy new books. In the case of Irish, where some parents question the importance of learning the language, this reticence can be more pronounced. While *Fios Feasa* (2003) is a digital resource that is available for Irish, it is little used in primary schools to date.

One interesting resource that has recently become available for Irish is TG4, the Irish language television station. During the daytime and children's viewing hours, TG4 broadcasts cartoons, often international cartoons (e.g. Sponge Box Square Pants) in Irish. It also broadcasts other programmes aimed at children in Irish (sometimes with English subtitles). Teachers can suggest to their students to look at a certain programme and they might discuss it the next day in class. Needless to say, teachers also produce their own resources for the students and will continue to do so for many years to come.

5.8.3 Differential

Within the current design space, there are two different contexts to consider. In the mainstream school context, the class contains the normal mix of students with a range of abilities. These students use two of the main, traditional textbooks for the study of Irish. The teacher supplements these books with material from a more grammatically oriented textbook as well as the development of her own classroom material. One interesting feature of this environment is the generally positive attitude of the local area towards Irish. Each year, in the week leading up to St Patrick's Day (March 17, the National Day), the local area organises Irish culture and language events. Students are encouraged to produce pictures and materials in Irish during this week.

In the disadvantaged school context, the level of ability of the students in English and their general academic ability relative to their peer group, is less than the national average. Therefore there are many students with special learning needs and, in terms of Irish, this manifests itself in the fact that the students are generally one year behind in their study of Irish. Also several students will have exemptions from studying the language. Consequently, the teacher uses books aimed at students of a lower level than would be expected e.g. Treo Nua 3 is used with 4th class students, whereas in other schools, these students would use Treo Nua 4.

5.8.4 Targeted

As there are currently no curriculum–linked CALL resources for Irish, one area that is open to improvement is the provision of curriculum-linked electronic resources for primary school students. Following on from this, there is a need to be able to provide teachers with an easy

mechanism for producing their own materials in a digital format. This does not necessarily imply the creation of Irish specific resources, rather the need to inform teachers of the CALL authoring tools that are available (e.g. Hot Potatoes (Holmes and Arniel, 1998), Malted, (Malted, 2000) and ILS (ND)). Table 5.18 shows a summary of the content component of the GLDT grid.

5.9 Other Actors

5.9.1 General

Other actors include content providers, native speakers, parents, training managers, software providers and policy makers. Their generally accepted role during implementation, use and evaluation varies from context to context. For example, for adults learning a new language purely out of interest, the role of parents is not relevant. However, in the primary school context, parents can play an important role in the language learning process. In some cases, they may encourage the school to teach a language that has not been previously taught. In the case of primary and secondary school students, the government or some other public body may be responsible for the design, implementation and evaluation of the curriculum. For adults, there may be one or several international organisations that set standards for language learners (e.g. the Cambridge English exams (CEOSL, 2006)). The role of content providers can also vary. In the case of a Most Commonly Taught Language (MCTL), commercial providers aim to provide professionally produced resources and are driven by commercial profit. Some commercial providers may be linked to academic institutions and try to incorporate pedagogically sound materials into their publications (e.g. Cambridge Preparation for the TOEFL® Test (Gear and Gear, 2002)). In the case of Less Commonly Taught Languages (LCTLs), content providers may be provided with some state support to produce materials, or the content providers may be a not-for-profit organisation whose aim is to provide learning materials for the sake of the language.

General	Local	Differential	Targeted
• Resource availability depends on language and context • Many authentic, non-learner oriented materials available	• Curriculum is set at national level • Variety of textbooks available • Some reluctance to buy new books	• School 1: uses several textbooks • School 2: One year behind peers	• Provision of target-group oriented, curriculum-linked resources

Table 5.18 CLICI GLDT for Content

Native speakers should be consulted when developing language learning materials. They should review the materials for correctness, register and appropriateness. However, simply being a native speaker of a language does not mean that the person has the necessary ability to carry out these tasks. Furthermore, the dialect of the language spoken by the person should also be taken into account. For example, if a textbook aims to teach British English, it is important that the native speaker be a native British English speaker and not a speaker of Australian English. The role of native speakers also varies depending on context. In the case of languages that are spoken by many speakers, with an established writing system and a commonly accepted standard language, the role native speakers play in the development of language learning materials is not usually controversial. However, in the situation where these conditions do not hold, the role and responsibilities of native speakers can be very different. If there is no commonly accepted writing system or standardised version of the language, which system and which dialect should be taught? Do content providers use educated native speakers as their source, do they go along with the wishes of the majority, or follow guidelines set-down by policy makers? There are no clear-cut answers and the decisions taken will vary depending on local conditions.

Policy makers can play an important role in the development and promotion of language learning materials. For example, some languages (e.g. French) have an academic standards body that aims to ensure the purity and correctness of the language is maintained (AF, 2006) and would hope that these standards are followed in language learning materials. Bodies specifically set-up to promote the development of a language will try to influence policy makers as to the importance of the language and the role it should play in the educational system of a country. Non-language related organisations may have an interest in the language education policy of a country. For example, in the UK, the government has dropped the requirement for the compulsory study of a language after the age of 15. However, business groups are not happy that the number of students studying foreign languages in the UK is continually dropping and have warned that this affects the country's future economic potential due to the lack of linguistically competent workers. At a more macro level, the role of language in society, who determines that role and what languages should be studied, can be influenced by geographical location. For example, the emphasis in Europe, particularly in the European Union, is on learning other languages of the community. In Australia, there is a growing interest in learning languages of the neighbouring countries (e.g. Indonesian, Chinese) rather than the more traditionally studied languages (e.g. French, German). In the United States of America, the emphasis is on learning languages that are of strategic importance, either for security reasons (e.g. Arabic or Farsi) or economic reasons (e.g. Chinese). In Africa, some countries place importance on learning and teaching through one of the major colonial languages (e.g. English, French), while others are becoming interested in teaching in local languages (e.g. South Africa).

In a large organisation whose focus is on language learning, training managers can play a role in the use and evaluation of language resources. Unless the organisation is particularly large or has a relationship with other departments within the organisation, it is less likely to have an influential role in the development of language resources – even though they may have a lot to contribute to the process. Responsible software providers will have an interest in developing appropriate software resources for their target audience. They will monitor the use of these resources and carry-out investigations into their effectiveness, with the intention of improving software releases. In theory, the more stakeholders are part of the analysis and design process for the development of language learning resources, the more successful that process is likely to be. However, given the often conflicting agendas and levels of interest of the various parties, it is seldom that they come together and aim towards a mutually acceptable goal.

5.9.2 Local

In the context of Irish in the primary school, parents, the Department of Education, content providers, Foras na Gaeilge (the state-funded Irish Language Body), other non-government Irish language bodies, the Irish Language Officer, political parties and the public in general are the main stakeholders in the language learning arena. The role of parents varies depending on the school type, with parents of Irish-language school children being the most involved in language education. In the current design space, that of English-medium primary schools, parents generally play a passive role in language education. Their main contribution is the attitude towards the language that they impart to their children. If they foster a positive attitude, this can help their child in learning the language and vice- versa. Some parents may try to help their children with the Irish homework, but many are reluctant to do this, as they have little confidence in their Irish ability or may have forgotten what they have learnt of the language.

The National Centre for Curriculum Development (NCCD), under the auspices of the Department of Education, devises the curriculum for Irish both at primary and secondary level. It adopts an inclusive, iterative mechanism for the development of the curriculum. It consults different organisations and allows for a consultation period for interested parties to provide feedback on its provisional curriculum. These contributions are taken into account and a new curriculum produced. The current curriculum for Irish was developed in 1999 and one of the main drivers was a comprehensive study by Harris and Murtagh (1999) with regard to the teaching of Irish in primary schools and how it could be improved.

Foras na Gaeilge (Foras, 2006) is the state-funded Irish language body. It is an all-island body set up after the Good Friday Agreement (1998). It took over the role that Bord na Gaeilge had in the Republic of Ireland until then. Its main responsibilities include promotion of the Irish language, facilitating and encouraging its use and advice to public and private groups. A fairly

comprehensive list of Irish language bodies is provided by Gaeilge (2005). These groups all have a slightly different focus, but one of the aims is the promotion and development of the language. They are keen to maintain the special position of Irish in the education system.

The Irish Language Officer (ILO) was a role set up under the Irish Language Act 2003. The role of the ILO is to monitor the way public bodies comply with the provisions of the Act and to take measures to ensure that they fulfil their duties sunder the Act. In 2006 the ILO, Seán Ó Cuirreáin, questioned the effectiveness of Irish language education to date and has advocated a review of how the language is taught. The role of Irish in modern Ireland and its unique role in the education system is not something that is a hot political issue. Political parties have tended to keep a low profile on this potentially divisive topic. However, in recent years, the topic has been brought into the political forum once again. The Irish Language Act 2003 puts an onus on state and semi-state organisations to improve the delivery of their services to Irish speakers. Irish became an official language of the European Union in 2007. The mobilisation of the public to support this move helped thrust the language issue into the public arena, although it is not something that exercised the public attention to any great extent. Plans are being considered to drop the compulsory Irish requirement for recruits into the Garda Siochana (the police force). Enda Kenny, leader of the main opposition party, has called for the dropping of compulsory Irish in secondary schools (November, 2005). The reaction to such a suggestions ranges from "It's a good idea." (some parents) to "It's terrible!" (some Irish language enthusiasts) and to "What's going to happen to all the Irish language teachers?" (labour and union groups).

In theory, the public should have an interest in the issue of Irish language education, but in practice, it plays a minor role. People do not generally discuss the language issue in public, mainly out of lack of interest. If it is discussed, people tend to reflect on their negative experience in school and they point out the fact that Ireland is now part of an increasingly multi-lingual Europe and it is important that we look outward, while at the same time acknowledging the importance of maintaining the language. Some Irish people are surprised when immigrant children seem to pick-up Irish quicker than Irish children after a relatively short period of learning the language, but this is probably due to the fact that they already speak more than one language and have no negative baggage associated with Irish. What it should demonstrate to them is that Irish can be learnt by children and that the more languages a person knows the easier it is to learn other languages. However, Ireland is going through a transition period from a mainly mono-cultural to a multi-cultural state and the impact of the arrival of over 100,000 Polish people or 60,000 Chinese people is yet to unfold. If these communities embrace the language as an integral part of the educational process, they could provide the mainstream society with fewer reasons to be negative towards the language.

5.9.3 Differential

In the current design space, the mainstream school is located in an area that is generally favourable towards the language. There is a local branch of Comhaltas Ceoltíri Éireann, the traditional music education group (Comhaltas, 2006). There is also a traditional Irish set-dancing class each Wednesday in the local school hall. The community also hosts an Irish language week in March, leading up to St Patrick's Day. Although there is positive support for the language, there is no special parental involvement in Irish language education in the school. In the context of the disadvantaged school, there is a general lack of parental interest in education in general and Irish is no exception. Even where the parents are interested, they may have quite a low level of attainment in Irish themselves and not be in a position to help their children. There are some groups with an interest in Irish in the community, but the socio-economic situation of the area means that other issues are more prominent in daily life.

5.9.4 Targeted

In the context of Other Actors, there are many possible improvements. Resources could be provided for parents to enable them to help their children with Irish and, as a consequence, to engender a positive attitude amongst their children towards the language. As several of the interested parties do not have much knowledge of CALL, it would be beneficial to provide pedagogically-sound proof-of-concept resources in Irish to demonstrate to them the potential that CALL has in this area. Table 5.19 shows a summary of the Other Actors component of the GLDT grid.

General	Local	Differential	Targeted
• Many actors external to the actual learning environment can influence the learning process	• Department of Education, Foras na Gaeilge, other Irish language bodies, Irish Language Officer, political parties and public all play a role	• School 1: community generally supportive of Irish • School 2: some lack of interest in education, including Irish	• Provide resources for parents • Provide pedagogically-sound, proof-of-concept resources • Raise awareness of CALL potential for Irish

Table 5.19 CLICI GLDT Grid for Other Actors

5.10 Input to Design Phase

The output of the Analysis Phase feeds into the Design Phase. Table 5.20 shows a summary of the findings from the Analysis Phase and their implication for the Design Phase.

Learner

Although the research findings are not conclusive, there is merit to someone starting to learn a language from an early age. In Ireland, Primary School children start learning Irish from 4 or 5 years of age and there is little discussion about changing this in the near future. Irish is effectively a Foreign Language (FL) for most people in Ireland and there is a need for more exposure to the language as it is not pervasive in daily use. Although the new communicative syllabus focuses on the oral and aural aspects, there is room for improvement in all the four so-called basic language skills areas i.e. reading, writing, listening and speaking. Based on these findings, there is a need for providing interesting ways to learn Irish for young learners that addresses the four key language learning skills.

Teacher

Generally there is a set curriculum and syllabus and teachers select a particular textbook for a given class. However, due to the eclectic teaching styles, teachers often use more than one book or other resources during class as they feel that one book does not cover all the aspects they wish to cover or they may want to show the information in a different format. Furthermore, there is acknowledgement that there are learners of different abilities in the class and the teacher must be able to cater for their learning needs. They need to keep the bright students challenged and interested, ensure that the middle-ability students are following the material and cater for the weaker students who find the material difficult (see Section 5.5). This can be difficult in the traditional classroom, especially when there are over 25 students in the class and students are not grouped by ability. Taking these findings into account, there is a need for a simple mechanism of providing (new) materials as the teacher sees fit. Furthermore, there is a need for flexible materials that the teacher and students can use that provide learning opportunities for students of all abilities. These materials should be flexible in terms of content and sequence so that different students can use the material how and in an order that suits them (within the limits set by the teacher). Another observation is that primary school teachers in general have very little knowledge of Computer Assisted Learning (CAL), let alone CALL and there is a need for teacher education in this area. This lack of knowledge must also be taken into account when designing CALL resources.

Pedagogy

The Communicative Language Teaching (CLT) is a broad approach to language teaching that focuses on the negotiation of meaning, rather than a specific teaching method. The concept of communicative competence (Hymes, 1972) is the main driver behind the communicative approach. In this approach, that communication is not only based on linguistic production but the non-linguistic elements of communication (e.g. gestures) are also important.

Communicative language teaching is best described as a list or a set of principles. One of the most recognized of these lists is David Nunan's (1991) five features of CLT:

1. An emphasis on learning to communicate through interaction in the target language.
2. The introduction of authentic texts into the learning situation.
3. The provision of opportunities for learners to focus, not only on language but also on the learning process itself.
4. An enhancement of the learner's own personal experiences as important contributing elements to classroom learning.
5. An attempt to link classroom language learning with language activities outside the classroom.

Krashen's (1981) five hypotheses on Second Language Acquisition have formed some of the ideas behind communicative language teaching. His Acquisition-Learning Hypothesis states that the subconscious acquisition of language (akin to how children learn their L1) is more important than learning via formal instruction. His Natural Order Hypothesis states that the acquisition of grammatical structures occurs in a natural order. His Monitor Hypothesis states that subconsciously acquired language is responsible for fluency, while learnt language is responsible for editing the output. His Input Hypothesis states that input must be comprehensible to learners – it should be a "little bit beyond" where the learner is now (i.e. if the learner is at level i, the input must be at level i+1 level). His Affective Filter Hypothesis states that the learner's motivation and self-confidence affect how L2 input is received by the learner.

A communicative approach to teaching Irish is being rolled-out in primary schools in Ireland. The guidelines suggest a focus on oral and aural aspects of the language. However, individual teachers tend to adopt an eclectic approach and combine a communicative approach with other approaches, e.g. a focus on form. The modern teaching environment that is emerging for Irish is welcome and should be supported. One basic problem in teaching the language is the lack of communicative need for the language as all the Irish speakers are bilingual and, from a utilitarian point of view, it is unlikely that the students will ever really need to speak the language. With these findings in mind, the Design Phase should ensure that the current pedagogical practices (e.g. a blend of communicative language teaching with focus on form) are supported by future CALL resources for the language. There is a need to have a modern focus (e.g. topics of interest to young urban dwellers) and presentation of language materials. Also, there is a need to establish a quasi-communicative need for the students (e.g. through telepals).

Technology

Most primary schools in Ireland have some computer access (see Chapter 4, Section 4.8.3). This access may include internet access, but this may be via a dial-up connect as opposed to broadband, although there are plans in place for a nationwide roll-out of broadband services. Many schools at the moment have a computer lab, which students can use during a timetabled slot in their weekly timetable. However, for a variety of reasons, there is a move away from this approach and a move towards a computer-in-the-classroom scenario. One other point of interest is that most schools do not have dedicated technical support available on-site and this has implications for the use of CALL resources in schools. Thus, there is a need for CALL resources that take into account the current and future deployment facilities in the schools. This means that the proposed resources should not assume the availability of broadband internet. The student/computer ratio is another important factor as it has implications on how often and how long a student can use the computer. A computer-in-the-classroom scenario means that one or, less likely, two students working on the computer while the rest of the class work on a different activity will be the norm. The physical space as well as the feasibility of using speech-related activities must also be considered. Furthermore, it is imperative that robust resources are developed, given that most schools have limited, out-of-hours-only or non-existent technical support available to them. Another implication is that it is important to make the teacher and students aware of potential difficulties and how to deal with them (in the unlikely case that any occur).

Content

There are several textbooks available for Irish in the primary school. Some of them are more modern than others. For example, *Maith Thú* (De Bhaldraithe, 2003) adopts a communicative approach and the layout of the book (e.g. fonts and colours) is very modern. However, there are very few suitable, accurate electronic resources available for Irish for the primary school sector. The few resources that are available are not linked to the curriculum and there are cost implications for the school. Therefore, there is a need for age-appropriate, quality electronic resources for the primary school sector. As stated above, these resources should cater for students of varying abilities.

Other Actors

In the context of Irish in the primary school in Ireland, other actors to consider are parents, content developers and Irish language bodies. Parents often have an ambivalent attitude towards the language and especially the teaching of it. They would not like the language to disappear and feel that it is important that their children learn the language. They would also like to be able to help their children with their homework, but often lack the confidence to do so. On the other hand, they often have painful memories of studying the language themselves

and would not like their children to suffer as they did. Also, given worldwide changes and especially an enlarged European Union, they are conscious of the need for their children to learn to speak a "useful" foreign language and some muse that the time spent teaching/learning Irish would be better spent on learning another language. Content developers (mainly book publishers) are usually commercial operations and are often wary of providing their content in electronic format. Furthermore, they are often mildly resistant to change, especially in a relatively small market such as the Irish primary school textbook market. Irish language bodies are interested in the preservation and promotion of the language and they could be one of the main drivers of CALL resources. However, they tend to lack CALL expertise and their focus often lies elsewhere. Therefore, there is a need to consider extending resources to cater for parental interest, so that they in turn can help their children. There is also a need to provide pedagogically-sound CALL resources as proof-of-concept artefacts so that content developers can see their value. Finally, there is a need to raise awareness of the potential of CALL resources for Irish, especially in the primary school context, so that Irish language bodies can be made aware of them and promote them to others.

	Findings	**Input to Design Phase**
Learner	- It can be of benefit to start learning a language at an early age, if subsequent years take previous knowledge into account - Children learning Irish need more exposure to the language - Children would like more interesting ways of learning Irish - There is scope for improvement in all the 4 skills areas: reading/writing/listening/speaking	- Need to provide interesting ways of learning Irish for younger learners - Need to provide resources that cater for the 4 skills
Teacher	- Need flexible materials - Need to be able to cope with learners of different abilities - Need to learn about CALL	- Need for flexible materials, that can be used in conjunction with classroom activities and in variable sequence - Need to take into consideration the teachers' lack of CALL knowledge when designing CALL resources

Table 5.20 Analysis Findings and Input to Design Part 1

Pedagogy	- A communicative approach is being rolled-out to schools, but individual teachers tend to adopt an eclectic approach - A modern teaching environment would be good for teaching Irish - Lack of authentic communicative function for Irish	- Current pedagogical practices should be supported by future CALL resources - Need for a modern focus and presentation for teaching materials - Need for communicative need to be created (e.g. via telepals)
Technology	- Most schools have some computer access - Most schools have internet access but not all have broadband - Schools are moving towards a computer-in-the-classroom scenario - Most schools have limited technical support	- Need to consider limited computer access (student/computer ratio) - Need to consider computer availability (lab vs classroom) - Need to consider lack of broadband internet access and implications - Need to provide robust resources given the limited tech support available in schools
Content	- Books available, but very few suitable electronic resources exist	- Need for age-appropriate, quality electronic resources that cater for students of varying abilities
Other actors	- Parents could avail of Irish resources to help students at home - Content providers do not have accompanying electronic resources for Irish at present - Irish language bodies need to be more aware of CALL potential	- Need to consider extending resources to cater for parental interest - Need to provide pedagogically-sound CALL resources as proof-of-concept artefacts - Need to raise awareness of the potential of CALL resources for Irish

Table 5.20 Analysis Findings and Input to Design Part 2

Given the lack of available material for children learning Irish in the Primary School context in Ireland, there is plenty of scope for the development of Irish CALL resources for this target group. In order to find out what would be desirable, feasible, efficient and potentially effective, a pilot study with primary school students was undertaken. This study and its findings were

used to decide on the resources to be developed and they were combined with the GLDT Analysis Phase to feed into the Design Phase. The pilot study is described in Chapter 6, while Chapter 7 reports on the Design Phase.

5.11 Concluding Comments

Colpaert's GLDT grid is very useful for forcing the CALL researcher to consider all the potentially interested parties from several perspectives when thinking about developing CALL resources. The general level forces the researcher to review the relevant literature on the various components and how the general findings relate to the specific project context. The targeted level helps the research to focus on what aspects of the intended deployment context can be improved, rather than what would be desirable but very difficult to achieve. In the context of the CLICI project, the Analysis Phase identified many potential areas that could be targeted by a CALL project for Irish in the primary school context. Colpaert's GLDT helps the CALL researcher to provide comprehensive analysis of a given deployment content, and this is a requirement for a successful CALL project.

5.12 Summary

Section 5.1 introduces the chapter. Section 5.2 reviews the ADDIE development Model and the Language Courseware engineering loop advocated by Colpaert (2004). It compares haphazard versus structured design and the reasons for choosing Colpaert's model. Colpaert's General-Local-Differential-Targeted analysis grid is outlined in Section 5.3, which also explains how this grid is used in this research project. Sections 5.4 through to 5.9 populate the grid for each of the six components, namely, Learner, Teacher, Pedagogy, Technology, Content and Other Actors given the particulars of the research project. The Learner section, Section 5.4, very briefly provides an outline of aspects pertaining to the learner in general, as well as in the primary school context in Ireland. The role of the teacher in general and in the project context is discussed in Section 5.5. Pedagogy is discussed in Section 5.6, which provides an overview of pedagogical issues in the primary school setting. Section 5.7 looks at Technology and a SWOT analysis is provided for CALL. Content is reviewed in Section 5.8 and this section points out that there were very few suitable CALL resources available for Irish. Section 5.9 discusses the role of Other Actors, which in this case include parents, government bodies and Irish language bodies. Section 5.10 looks at the output of the Analysis Phase and the input into the Design Phase and explains the reasons for undertaking the pilot study (which is described in Chapter 6). Finally, Section 5.11 provides some concluding comments and reflections on the Analysis Phase.

Chapter 6 Pilot Study

6.1 Introduction

This chapter describes the pilot study that was undertaken as part of the research project. Chapter 5 showed that there are many possibilities for CALL development activities in the context of Irish in the primary school. In order to narrow down the possibilities, a pilot study was carried out to assess students' attitudes to Irish on CALL in a primary school context. Section 6.2 explains the motivation behind the pilot study and the methodologies involved. Section 6.3 discusses the attitudes of the students toward Irish and their experience of using the CALL materials developed in the pilot study. Section 6.4 reviews the courseware and findings of the pilot study. The teachers' input and feedback is outlined in Section 6.5 which also describes the different development methodologies piloted as part of the study. Section 6.6 looks at the logistical issue that arose during the pilot study and the resources that were chosen for development are outlined in Section 6.7. Concluding comments are provided in Section 6.8, while Section 6.9 summarises the chapter.

6.2 Motivation and Methodologies

The Analysis Phase revealed that there are plenty of options for development of NLP/CALL materials for students studying Irish in the primary school. In fact, given the endless possibilities, it was difficult to determine what should be developed, so a pilot study was undertaken to try to narrow down the possibilities. The overall aim of the pilot study was to determine what resources could be developed for the target learning group taking into account the findings from the Analysis Phase and the particular interest in integrating computational linguistics techniques in CALL. There were four separate yet interrelated threads in the pilot study: students' attitudes, teachers' attitudes and experience, development strategies and logistical issues. Each of these threads is dealt with in the following sections.

Contact was made with two mainstream schools and one of them responded positively to the invitation to take part in the pilot study. This school will be referred to as School 1 (S1). Interested teachers in this school were then invited to meet with the researcher to talk about CALL in general and Irish CALL in particular. Several meetings took place on the school premises during school time and the teachers and researcher discussed pedagogical issues, development methodologies and logistical issues. Four teachers decided to participate and each decided on his/her own development strategy. Class 1 (C1), a 2nd class (7-8 year olds), Class 2 (C2) and Class 3 (C3) two 5th classes (10-11 year olds) and Class 4, a 6th class (11–12 year olds) participated in the pilot study. An attitudinal survey (see Appendix H Pilot Study) was carried out in each class using a survey similar to surveys in Harris and Murtagh (1999). The survey was previewed and revised by the teachers in advance. Due to logistical issues (preparations for confirmation (a religious ceremony) and secondary school entrance exams), the 6th class (C4)

teacher (T4) decided not to continue with the pilot study. The 2nd class (C1) teacher (T1) decided to use her own material. The Class 2 (5th class) teacher (T2) decided to write her own sample CALL lesson, while the other 5th class, C3, teacher (T3) decided to get the students to create lesson exercises. Sample CALL lessons were then developed by the researcher using an existing CALL template (Ward, 2001). These were combined with sound recordings to produce the pilot material.

A second school, School 2 (S2), from a designated disadvantaged area, was also involved in the pilot study. Keogh and Green (2004) had carried out CALL research in the primary school local to the researcher's university and the teacher had continued to work with Keogh on CALL matters. This teacher (T5) kindly agreed to work on the Irish CALL project as well. The class, C5, consisted of 3rd class students (8 -10 year olds). A sample lesson was developed from a class textbook. In both schools, students tested the relevant material and any difficulties and issues that arose were noted. The students and teachers provided feedback on the process and this was used to define the resources that would be useful in this specific context. The classes involved in the pilot study and the themes of their sample lessons are shown in Table 6.1. More information on the schools involved is available in Chapter 9.

Teacher	Class	Year (Age)	Source	Theme	Students	Participants	Computers
T1	C1	2nd (7-8)	Own	Our Class	25	25	15
T2	C2	5th (10-11)	Own	Accident	30	30	15
T3	C3	5th (10-11)	Book	The Thrush	32	32	15
T4	C4	6th (11-12)	*This group did not participate in the pilot study.*				
T5	C5	3rd (8-10)	Book	Museum Visit	24	16	0[1]

Table 6. 1 Classes Involved in the Pilot Study

6.3 Attitudes

Harris and Murtagh (1999) carried out a very comprehensive study of primary school students' attitude to Irish. The majority of Irish students "sometimes" like Irish, but attitudes are generally negative. Harris & Murtagh (1999) reported that primary school children are apathetic in relation to Irish and have difficulty understanding the subject. They find Irish boring, too hard and useless. Some students do not understand why they should have to speak a language that "no-one uses anymore".

[1] The group C5 used computers in Dublin City University, as there were problems with their own computers.

Given the negative attitudes of the students towards the language, and the general disappointment in how the language is taught, it was felt that CALL could be used to change the students' perception of the language and perhaps motivate them a little more. If the students could see that learning Irish on the computer was fun, then perhaps they would dislike the subject a little less. The focus in the pilot study was on motivation and attitude, rather than specific pedagogical gain. McFarlane et al. (2002) report that increased motivation can increase attention and concentration, two areas that Harris & Murtagh (1999) reported as needing attention during Irish classroom lessons. Dörnyei (2003) suggests motivation is not static and that its dynamic character and temporal variation has been understudied. Even if the motivating influence of using CALL materials on the computer did not manifest itself in the classroom, perhaps it would last at least for the duration of the time spent on the computer.

Several authors (e.g. Setzer & Monke, 2001; Okan, 2003) express the need to take a critical look at the use of "edutainment" in children's education and warn that children may get used to getting motivated to play, rather than to learn. However, the pilot project consisted of texts and some language exercises (given the title "games") and was a long way away from being classified as a game (Hubbard, 1991) or "edutainment". Debski (2000) reports on the ProCALL project in a university in Australia in which students developed materials. It was not possible to include all the elements of ProCALL in this pilot project, but the use of the students' own voices was intended to give them a sense of involvement in the project. Also, in one of the classes the students were allowed to choose the lesson topic, while in another, they helped with the creation of the games (exercises).

Salomon (1995) states that the success of CAI depends on various players and factors in the whole learning environment. Goodwin (2002) identifies the factors that contribute to the success of ICT at primary schools. He lists a sound learning environment, head teacher commitment, good forward planning and staff commitment as important elements in successful ICT use. This pilot project tried to take these players and factors into consideration. The head teachers were supportive of the project and the teachers that piloted the project were interested in and willing to try CALL. The project was planned with the teachers in advance and the general learning environment was a good one.

The aim of the survey in the pilot study was to find out the attitudes of the students in these two schools, not only to Irish, but also to the use of CALL for Irish. Felix (2005) warns of the weakness of surveying students after just one treatment (i.e. use of CALL resources) and the results reported must be viewed in this context. This potential defect of the pilot was borne in mind for later evaluations. However, as there was little if any information available on this

topic in this specific context, the findings provide an indication of attitudes and interest. The issue of evaluation is again addressed in Chapter 10.

Student Survey

In the Pilot project, students did a pre- and a post-project survey. The survey had several aims:

- to find out about the students' attitude to Irish,
- to find out what they liked and did not like about Irish,
- to see what they would like to do in their Irish class,
- to see if they enjoyed learning Irish on the computer.

Fowler (1995) outlines several principles for survey design. He states that it is important to ask participants about their firsthand experiences, not questions to which they do not know the answer. It is also important to ask one question at a time, rather than embedding several questions in one (which causes confusion). Care must be taken to ensure that all respondents are answering the same question and that answering the questions is as easy as possible. The questionnaire was specifically designed with the age of the students in mind. A separate, simpler version was developed for C1 and C5 (the 2nd and 3rd class students, the younger group in the study). There were closed questions at the beginning and several open-ended questions. There were several iterations before the final wording was decided upon. The survey was pilot tested and no major errors were found. A script was prepared and was read out to each class before the survey was administered to ensure consistency (Fowler, 1995).

The teachers left the classroom while the students filled out the survey. They were told that the teacher would not see their answers and that they should be as honest as possible. In line with recommendations from the teachers, the questions were read out one at a time to the students and sufficient time was given to the students to write their answer. Harris & Murtagh (1999) reported that, despite their concerns, the students did not have problems with their questionnaire (which contained 77 questions, many with a 5-point Likert scale component). Similarly, there were no major problems with the survey used in the pilot study.

Pre-Project Survey Results

The summary results are shown in Table 6.2. Note that C1 (n=25) and C5 (n=16) have been grouped together as Group 1 (2nd and 3rd class) and C2 (n=30) and C3 (n=32) have been grouped as Group 2. The reason for this grouping is that C1 and C5 are similar in age and at a similar stage in the primary school cycle and it is instructive to compare them as a group with the older students in Group 2. Both the classes in Group 2 (C2 and C3) are 5th classes and have students of the same age and ability. Overall, only 24% of the students said they liked Irish, while 45% said they sometimes like Irish.

Do you like Irish?	No	Not Really	Sometimes	Yes
Group 1	12%	*	41%	46%
Group 2	31%	13%	47%	10%
Combined	23%	8%	45%	24%

Table 6.2 Pre-Project Survey Results

* Note: Group 1, the younger group, only had three options No/Sometimes/Yes

One interesting finding in terms of attitude to Irish was the difference between 2nd and 3rd class students (Group 1) compared to the 5th class students (Group 2). Group 1 students were more positive towards Irish (46% said the liked Irish) and considered it important to study it. It's "our language" said one of the students. However, by the time the students reach 5th class, their attitude has become more negative, with only 10% saying they enjoyed the subject. Also the question "I like Irish because ... " was left blank by several students or many simply stated that they did not like Irish.

Different questionnaires where used for the two groups and thus their responses will be reviewed separately[2]. Table 6.3 shows a summary of the Group 1 answers. The students were given several open-ended questions and encouraged to write whatever they thought. Only the most-mentioned items are shown in descending order, with the number of mentions shown in brackets. The things Group1 liked about Irish were reading, poems, fun and "our language". The things they disliked were reading and questions but the most mentioned item was the fact that it was hard. The students would improve teaching by having more fun and games, while they would avoid doing reading, questions and "hard things". "Games" refers to games like Bingo that are played in the classroom. The majority of Group 1 students (77%) said they thought Irish was important.

Table 6.4 shows a summary of the Group 2 replies. They liked Irish because it is "our native language" and the games. Many students said what they did not like was the fact that it was hard and boring. They would like to do more games (frequently mentioned). Asked if they would like more Irish a resounding 66% said "No", although this is hardly surprising as what student would want more classes in any subject (apart from maybe art or games, depending on the child).

[2] The questionnaire for Group 1 was simpler that that for Group 2 due to the younger age profile of the students.

One thing that both Groups 1 and 2 agreed on was the fact that Irish was "hard" (i.e. a difficult subject for them). Other negative comments included "boring" and "rubbish" (i.e. not very good, perhaps not worth studying).

Things you like about Irish
C1: Fun (5), Our language (4)
C5: Reading (5), Poems (5), Questions (4)
Things you don't like about Irish
C1: Hard (10), Questions (2)
C5: Reading (5), Questions (2)
Things you would do to improve teaching Irish
C1: Fun (12), Games (7), Stories (3)
C5: Games (12), Reading (6), Poems (3), Talking (3)
Things would you stop doing to improve teaching Irish
C1: Hard things (7), Questions (4), Book (4)
C5: Reading (8), Work (4), Questions (4)
Favourite part of Irish
C1: Games (6), Reading (3)
C5: Reading (8), Poems (7), Games (3)
Is Irish important?
C1: Yes (78%), No (13%), Maybe (9%)
C5: Yes (75%), No (12.5%), Maybe (12.5%)
Combined: Yes (77%), No (13%), Maybe (10%)

Table 6.3 Summary of Survey Results for Group 1 (C1 and C5)

There were more negative responses from C2 than C3. This could perhaps in part be explained by the manner in which the survey was carried out. In all cases, the students were assured that the teacher would not see what they wrote, so they could write honestly what they thought. C2 was the first surveyed class, and to a certain extent demonstrates the pitfalls of a naïve researcher. In the case of C2, the teacher went to the staff room "to ensure privacy" and the students became slightly unruly, so perhaps were more negative just because they could be (for example, some students put down "sex education" as their favourite subject). In the case of C3,

the teacher left the room, but stayed outside the door. The students were much better behaved and perhaps the answers more measured. The teachers informed me that there is no academic difference between the two classes.

I like Irish because ...
C2: Native language (5), Games (5)
C3: Native language (16), Games (5), Fun (5), New language (5)
I don't like Irish because ....
C2: Hard (18), Boring (4)
C3: Hard (15), Boring (3), Difficult to read (2)
What do you think about Irish?
C2: Rubbish (12), Boring (9), Hard (7), OK (6)
C3: Good (8), Hard (7), OK (4), Easy (4)
What do you like to do in Irish?
C2: Games (9)
C3: Games (12)
I would like more ...
C2: Fun (12), Games (10)
C3: Games (6), Stories (4)
Would you like more Irish?
C2: Yes (13%), No (74%), Maybe (13%)
C3: Yes (16%), No (59%), Maybe (25%)
Combined: Yes (15%), No (66%), Maybe (19%)

Table 6.4 Summary of Survey Results for Group 2 (C2 and C3)

The free text comments of the students are interesting (see Table 6.5). Question 8 was open-ended and provided space for the students to write a comment. Not all students wrote something, but the majority who did expressed their dislike for the subject or how they would like to change it. Some of them are within the teacher's control (e.g. to explain more), but some are not (e.g. to make the language easier). One of the more poignant comments was "*Why do we have to learn more Irish? Don't kill me - I'm only ten.*"

Comments
C2
I think learning verbs is not as effective as speaking it fluently. Why do we have to learn more Irish? Don't kill me - I'm only ten.
C3
The teacher should explain more. It's boring, put a bit of life in it. They should write more Irish stories like interesting English stories. If the people could make Irish easier.

Table 6.5 Student Comments

6. 4 Pilot Study Courseware and Findings

The sample lessons consisted of three sections, which contained about one third of the text of the lesson. Each section contained an exercise (game) and a small vocabulary page. In line with how Irish is taught in primary school, there was no overt mention of grammar in the courseware. Images used in the courseware were taken from the Language Learning ClipArt collection from the University of Victoria, Canada (UVIC, 2001). The initial idea was to use student drawings, but images from the clipart collection were used due to scheduling difficulties. Figure 6.1 shows a sample lesson.

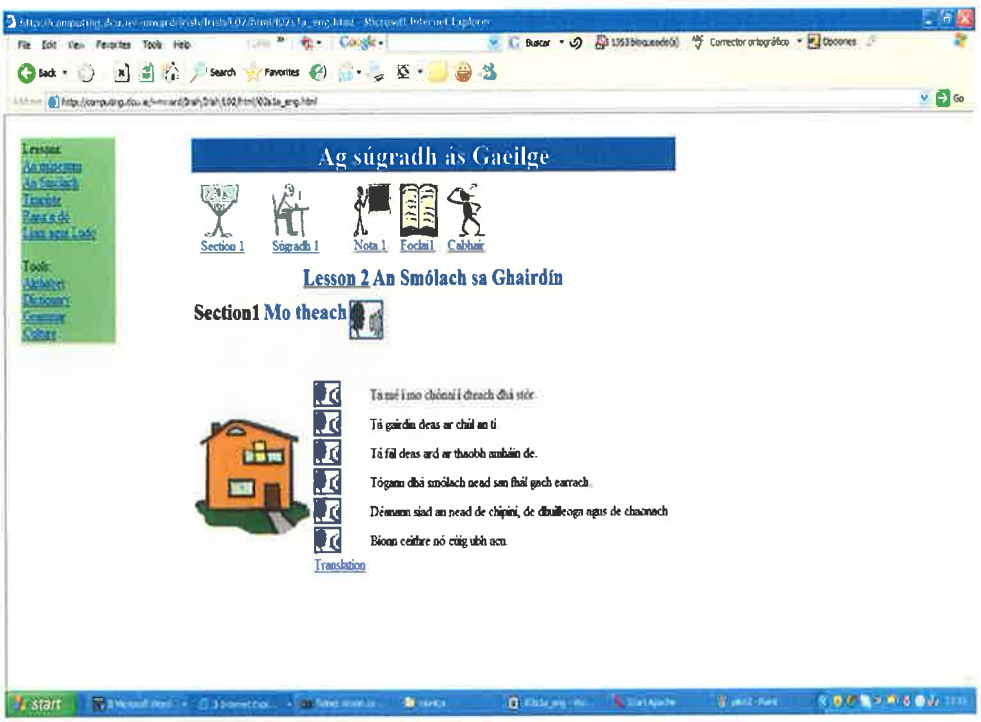

Figure 6.1 Lesson Example

The content of each section was available via a sound icon, either for the whole section or for each individual line of text. The audio files were recorded by the students themselves. Two of the classes recorded the files in groups (C1 and C3), one class opted for pairs (C2) and in the other class (C5) each student was recorded individually (this was possible due to the small numbers of children in the class). The combined sound file for the section was then simply the amalgamation of the individual sound files for that section, except in one case (C3), the three section contents were recorded by three students recommended by the teacher as good Irish speakers.

A CALL Template (Ward, 2001) was used to produce the courseware. Hot Potatoes software (Holmes and Arneil, 1998) was used to produce the three types of exercises used in the CALL materials. The exercises were call games to dovetail with the students' suggestion that games would make Irish more fun. The three types of exercises used were matching (jmatch), multiple-choice (jbc) and a writing exercise (a modified version of jquiz).

Overall, while other material development strategies were perhaps perceived to be pedagogically superior, the use of textbook materials was deemed the most appropriate. This was mainly due to the time commitment required to develop original material either on the teachers' part or that of the students. Also, given the logistical issues involved in recording each student, it was felt that using a few good students or one (relatively) competent adult reader was a preferable alternative.

Findings

Overall the students enjoyed learning Irish on the computer (only 6% said they did not enjoy it). Table 6.6 shows a summary of the results. The students said that they thought the computer would encourage them in their study of Irish (46% yes, 41% maybe, 13% no). 49% of the students said they would prefer using the computer and 34% said they would prefer both combining the computer with classroom-based learning. One has to guard against the "excitement" of initial CALL exposure here, but the students in question are not novice computer users, so at least the thrill of using the computer per se can be somewhat discounted. The trends between both groups is broadly similar, except for the question "Do you think that the computer would make you more interested in Irish?". The question was not put to C1, so the figures in the table for Group 1 only reflect the numbers for C5 (the question was not originally on the Group 1 questionnaire but was added before C5 were surveyed). Therefore, the difference between the "yes" figures (Group 1: 64% and Group 2: 42%) must be read with this in mind.

Enjoy using computer	**No**	**A little**	**Yes**
Group 1	3%	44%	53%
Group 2	8%	55%	37%
Combined	6%	51%	43%
Prefer using the Computer	**No**	**Yes**	**Both**
Group 1	11%	47%	42%
Group 2	20%	51%	29%
Combined	16%	49%	34%
Would it increase interest	**No**	**Maybe**	**Yes**
Group 1	9%	27%	63%
Group 2	14%	44%	42%
Combined	13%	41%	46%

Table 6.6 Post-project Survey Results

It was pleasing to note that all the students had sufficient computer literacy to use the courseware without any additional instruction apart from how to navigate through the courseware. Even the 7-year old students had no problems. They were able to click to hear the sounds, do the interactive activities and move around the courseware without difficulty. Some of the students were keen to "progress through the courseware" as quickly as possible. There was an element of competition when some students heard that one of their peers was on section two before them. Keogh & Green (2004) reported on similar behaviour in their study of 6th class boys learning French and German via CALL in an Irish primary school.

The feedback on the exercises ("games") was particularly interesting. The students generally agreed that the matching game was easy, some said too easy. The multiple-choice exercise was generally more acceptable (not too easy/hard) for the students. As expected, the writing exercise was reported to be "too hard" by some of the students. Apart from the general fact that matching and multiple-choice exercises are easier than a production exercise like the writing exercise, the difficulties of Irish orthography make this type of exercise particularly difficult for students. They all availed of the sound file with the answer to help them figure out what the missing word or words were. When they managed to figure out the word, but could not get the correct spelling, they were encouraged to go back to the lesson to see how it should be spelt.

While most of the observations from the students were in line with expectations, there was one particularly interesting comment from several of the 5th class students (Group 2). They said that the system was too easy and was not suitable for a subject like Irish. One student reported

that the idea was interesting, but probably more suitable "for younger children". Possible explanations for this observation include the fact that the students consider Irish a serious subject and the light-hearted approach of the courseware clashed with this perception. Furthermore, even in 5th class, students are aware that they will sit an entrance exam for secondary school at the end of 6th class that includes English, Maths and Irish. This can contribute to their concept that Irish is not to be trivialised. Selwyn & Bulloon (2000) in their report on primary school children's use of ICT in Wales, also report that younger children tend to be more positive towards the use of computers, while older children tend to be more discriminating. Perhaps this can help explain this attitude.

Sound

Seikel et. al (1995) reported that university students studying phonetics were most motivated when working with their own voices and that they felt a sense of ownership of the work. In this study, the children liked the use of the sound files in the courseware. They were excited to hear themselves and their classmates on the computer. They readily identified those audio components that were clear and easy to understand, as well as those that were "hard to hear" and "not quite right". Hearing sound components of varying quality may help students reflect on their own spoken component and help them to make sure that they "sound good" the next time.

One practical difficulty that arose with the availability of the sound component is that the condition of the headphones was not always optimal. For example, some of the headphones were missing the foam cover that separated the plastic from the student's ear. Some of them had stray cables that had become disconnected. However, the students were remarkably resilient and managed to enjoy the audio component despite these difficulties.

6.5 Teachers

The teachers in the pilot study were self-selecting. In School 1 (S1), four teachers (T1 – T4) expressed an interest in CALL, even thought they had no experience with CALL. Over a period of time, they learnt about CALL in general and how it might work for them. Although the 6th class teacher (T4) was initially interested, he decided that the time pressures were such that his class could not participate in the pilot study. The C2 teacher (T2) felt it was a useful experience but thought that it was quite difficult to develop suitable original lesson material. The C3 teacher (T3) was very keen and liked the idea of students developing material. He also liked the fact that each student got to record at least one sentence in Irish. This encouraged them to pay more attention to reading and pronunciation. The C1 teacher (T1) enjoyed the process and expressed an interest in participating in future Irish CALL research. In School 2 (S2), the C5 teacher (T5) was already familiar with CALL and had a positive experience with CALL. The teacher expressed a need for something to challenge and interest the more able students. She

spent a lot of time on oral and aural aspects of Irish and thought that something that dealt with reading and writing might be suitable.

Overall, the teachers felt that Irish CALL resources could be useful for their students. It would be another medium of exposure to Irish, it would give it a modern touch and would allow students to work at their own pace. Given the delays involved in developing the sample lessons, there was a need for a tool to make the development of lessons easier. When the teachers were asked for their suggestion of pedagogical areas where they felt CALL would be of benefit, verb conjugation was one item that emerged. Teaching verb conjugation is not that riveting for the teacher nor is it that interesting for the students. Anything that could make it less onerous would be welcome. Also, there was a need to provide a resource to challenge the brighter students and to provide an open-ended learning environment for all students regardless of ability. Given the difficulties students had with Irish writing, a tool to help with this learning skill would be useful.

There were different methodologies used for the development of lessons. The C1 teacher (T1) developed her own sample lesson. The pedagogical motivation was to present known material in a new piece of text. The aim was to make the text interesting and perhaps more relevant to the student than text from a textbook. The C2 teacher (T2) also decided to develop her own sample lesson from scratch. She reported that it was actually quite difficult to write the text and that the time involved was such that she would find it difficult to develop a suite of lessons in this manner. The C3 teacher (T3) liked the idea of student participation in the development of materials. Therefore, text from a class textbook was used and students also devised exercises in groups. Each student recorded a sentence of the lesson text. The pedagogical motivation was to get each student to listen carefully to the correct pronunciation so that he could reproduce it when it came to recording it. As the recordings took place during classtime, when all the students were together, it provided an opportunity for repetition or reinforced learning. The aim of getting students to develop exercise materials was to encourage them to produce and be creative with Irish. While the experience was positive, there was a certain amount of effort involved in coordinating the recording and the development of student materials. The students took great delight in trying to figure out who narrated what sentence and when students heard their own sentence, they were either pleased with their effort or motivated to do better next time. The C4 teacher used a standard text narrated by the researcher and this approach of minimal input effort was welcomed.

6.6 Logistical Issues

Two main logistical problems emerged during the pilot study. One related to supervision and the other to equipment. Both the schools in the study had a computer lab. There were

approximately 15 functioning computers in each lab in both schools. When the pilot study CALL material was being tested by the students, the class had to be divided into two groups. One group tested the material, supervised by the researcher, while the other group stayed in the classroom with the teacher. This worked fine for the pilot study, but in a real scenario, this would present problems as both groups of students would have to be supervised by an adult. The equipment in School 1, particularly the headphones, was not ideal. Some of the headphones were faulty, while some were missing the foam covering. This made them uncomfortable for the students. The occasional computer had a problem with its mouse. The students were generally tolerant of these problems, but obviously, better equipment would provide a better learning experience for the students.

Some other interesting observations were made. Regardless of the amount of material available, students had a maximum concentration span of 15-20 minutes. This was useful information for future development efforts. Although ideally there should have been no errors, either linguistic or technical, students were tolerant of minor glitches. It was not surprising to find that students were more computer-savvy than their teacher. Students were competent computer users and knew how to navigate web pages, use the mouse and click on the audio links. Only minimal instructions were required to show them how to do the (Hot Potatoes-based) exercises.

Based on the above observations, having a dedicated computer in the classroom seemed a better option. There would be minimal supervision difficulties and good equipment (e.g. headphones) would be required for just one machine rather than 16. Also, it would be easy for the teacher to mind the equipment as only his/her students would be using it.

6.7 Resources to Develop

Drawing on the information obtained in the Analysis Phase and the findings of the pilot study along with the SWOT analysis of NLP/CALL, three distinct resources emerged as candidates for development. A tool to facilitate the development of lessons using the CALL template (Ward, 2001) would be useful. A tool to help the teaching and learning of verbs would be welcome. Also, a resource to enable students to write in Irish and receive feedback would be useful. A brief outline of these tools follows. The decision as to what resources to develop was based on pedagogical reasons, logistical issues, language skills, available resources, NLP/CALL research and research interests. The pedagogical reasons were to be able to provide suitable, interesting materials for the student, including grammar information and to provide a mechanism for reinforced learning. Reading, listening and writing were the language skills that would be addressed in the project as the resources available for speaking were limited and difficult to develop within the scope of the project. The logistical considerations included the need for suitable, basic resources that could be developed within the time and resource

constraints of the project. The available resources included a CALL Template for the development of language lessons (Ward, 2001), a FST-based morphological engine for Irish (Uí Dhonnchadha, 2002) and general CL tools. It was also important to draw on the lessons from the SWOT analysis of NLP/CALL. These included using NLP resources to develop otherwise impossible learning materials, availing of the ability to develop flexible systems and to encourage learner autonomy. It also meant that it was necessary to deal with the integration issues and evaluation from the beginning, as well as managing user expectations and the need to develop a suitable interface for the target users. The research interests were the use of CL techniques and resources in CALL and whether they could be efficiently used in building effective CALL resources. A further research interest was to see if the strategy used to develop resources for Irish, a Minority Language, could be used for other languages, including Endangered Languages such as Nawat, that have fewer CL resources at their disposal.

Project Focus

The first focus area was the provision of a Lesson Generation component. This would address the need for teachers to be able to create lessons easily. The motivation behind this was that teachers are best placed to know and understand the needs of their students and would be able to provide lessons specifically tailored to their students. This could address the need to provide interesting ways of learning Irish and provide resources for reading. It would enable teachers to provide age-appropriate materials that would be fully integrated into classroom activities. Although this component would not use CL resources directly, it would mirror the ability to automate CALL development provided by the use of these types of resources. At the same time, it would also be a gentle introduction to CALL for the teachers involved.

The second focus area was the provision of a Verb Conjugation component. This would show verb conjugation information to learners in either a static or an animated format. The motivation for this was that it could potentially make an uninteresting area of language learning more interesting for the students. Students could decide on how they wanted to view the information according to their learning preferences. Also, it would present the same information in different formats that could potentially enhance the learning efficacy. This component would avail of CL resources to automate CALL development i.e. by using verb conjugation information to develop the actual CALL resource.

The third area of focus was a Writing Checker component. This would enable students to type in any text in Irish and the CALL resource would provide error and spelling feedback. The motivation for this was to provide an interesting resource for writing in Irish (which is generally unpopular with students), an exploratory learning environment for students and a resource that could provide immediate, private feedback to students. The provision of this type of feedback

has been mentioned by various researchers (e.g. Dodigovic, 2005b, Heift, 2003) as one of the areas in which NLP can make a useful contribution to CALL. This component could also avail of the potential of tracking users (e.g. do they make corrections?) and their output could be compiled into a corpus of learner Irish, along the lines of ICLE (Granger, 2002). Lack of full language coverage has been mentioned as one of the main reasons for not using NLP/CALL (Salaberry, 1996), but as Hamburger et al., (1999) has pointed out, focusing on a sublanguage is one way to overcome this problem. The limited L1 and L2 ability of the target group implies that full language coverage is not as essential as it would be for older language learner groups.

It was important to be aware of the reported weaknesses of NLP/CALL (see Chapter 3, Section 3.6.2) and to try to overcome them were possible. The integration issues (Chapter 3, Section 3.5) were mitigated by dealing directly with the teachers involved in the project, by having a CALL focus from the outset and by drawing of previous NLP/CALL research where relevant. Instead of developing a prototype system only, the aim was to develop a system that could be scaled-up, even if the initial version was only of limited coverage. Both teachers and students were to be made aware of the limitations of the system, so that their expectations would be realistic. Previous NLP/CALL research was studied to learn the lessons from previous projects and to avoid repeating mistakes. The need for proper evaluation would be addressed by planning evaluation from the start and not addressing it only as an afterthought. The issue of poor user interfaces would be dealt with by following general user interface design guidelines (e.g. Nielsen, 1999), as well as working directly with the students and teachers. This project was not tied to a particular pedagogical theory, but would try to link up with the pedagogical philosophy of the teachers directly involved in teaching the language.

For completeness sake, this section summarises those targeted areas that are not addressed in the project. Aural and oral skills were not a focus for the project. This is primarily due to difficulty in providing quality CALL resources for Irish based on speech recognition and synthesis. The philosophy behind the project was to try to use current resources efficiently and it was felt that teachers were best placed to do this at the moment. The need to provide a communicative need for Irish was not addressed, mainly for pragmatic reasons (i.e. lack of internet connectivity and difficulty in setting-up and maintaining a tandem-learning or similar project). The needs of other actors (especially parents) were not addressed in the project due to the lack of resources available and the logistical difficulties involved. However, some of the monitoring functions available to the teacher could be of interest to parents in the future. It should be noted that the NLP/CALL opportunities and threats outlined in Chapter 3, Section 3.6.3 and Section 3.6.4 also pertain to this project. For example, improving computer technology means that applications that were previously impossible are now a possibility, while the desirability of a multidisciplinary team still remains.

6.8 Concluding Comments

Conducting a pilot study was useful for several reasons. It enabled the researcher, the teachers and the target student group to decide on what CALL resources would be useful. It enabled them to check the feasibility of using CALL materials in this context. Several, not unexpected, constraints and desirable elements emerged. These include providing resources to satisfy the brighter students, while bearing in mind that students will only maintain an interest for a maximum of 15-20 minutes. Although students are tolerant when problems arise, it is important to ensure robust software, while at the same time providing them with strategies to cope if problems arise (independent of the CALL software). Good equipment enhances the learning experience. It is important to ensure that the audio recordings are sufficiently audible. Students are familiar with the computer but need to be shown how to input accents (diacritics).

While this pilot study has only been conducted on a small group of students, there were some positive indications for the future. The students seemed to enjoy the experience. The teachers felt that the learning benefit for the students did not merit the amount of time spent on the project from their point of view. As most CALL researchers already know, the effort required to produce even a modest amount of CALL materials is disproportionally large relative to the quantity produced (assuming that quality is important). The teachers' time input involved several preparation meetings about the project, learning about CALL and deciding what they wanted to do in the project. While the meetings were not especially long, the logistical issues (organising alternate student supervision and loss of in-class time) involved in taking 30 - 45 minutes out of the classroom were raised by the teachers. The two teachers who decided to produce their own story obviously had to invest time in the writing of the text. All teachers also had to give over class time to the recording of the sound files. So, although the teachers were shielded from the production time issues, as the CALL materials were produced off-site, they still felt that the cost-benefit analysis was not particularly favourable to CALL.

Some further observations pertain to the primary school context in general. Although teachers have a degree of flexibility, the school day is rather full and teachers do not have much "spare" time to give to "extra-curricular" activities. There has to be a balance between students having individual time for learning on the computer and the need for students to learn together when the teacher is explaining a new learning topic. The teacher must coordinate the students' computer usage. Also, when carrying out surveys with this type of student group, it is advisable to have the teacher either in the classroom or nearby, while maintaining confidentially of information. Otherwise, students, particularly the older students may run riot and try to out-do each other with "funny" responses (as this researcher found out the hard way). Finally, the pilot study enabled all the parties to get to know each other and establish a cordial, working relationship.

6.9 Summary

This chapter focuses on the pilot study that was undertaken as part of the research project. The need for the pilot study and an outline of its methodology is described in Section 6.2. The attitudes of the students towards Irish and their feedback on the Irish CALL materials developed specifically for them are reported in Section 6.3. Section 6.4 describes the courseware used in the pilot study and the findings of the study. The teachers' input and feedback on the pilot study and the different development methodologies piloted in the study are reviewed in Section 6.5, along with suggestions for CALL resources. The logistical issues that arose during the pilot study are reported in Section 6.6 and the resources that were chosen for development are outlined in Section 6.7. Concluding comments are provided in Section 6.8 which noted the value of carrying out the pilot study.

Chapter 7 Design

7.1 Introduction

This chapter focuses on the Design Phase of the CLICI project. Section 7.2 looks at the link between analysis and design and refers to Levy's (1999) design space distinctions. Section 7.3 reviews Colpaert's (2004) high-level design questions while Section 7.4 outlines his design model. The application of this model to the CLICI project is discussed in Section 7.5. The design sub-phases of conceptualisation, specification and prototype are detailed for the Lesson Generator component, the Verb Conjugation component and the Writing Checker component in Sections 7.6, 7.7 and 7.8, respectively. Section 7.9 provides some concluding comments, while Section 7.10 summarises the chapter.

7.2 Link between Analysis and Design

The information gained in the Analysis Phase provides the backbone of the Design Phase. Key information such as who the target users are and their needs should inform decisions made in the Design Phase. This project follows the ADDIE model, where analysis preceeds design and is one of the standard models from the field of Software Engineering. In the field of CALL, Levy (1999) has advocated the need for defining the design context and not just the principles or guidelines that the developer should follow. It is not in opposition to the ADDIE model, but is a complementary way of clearly specifying the design space of a CALL project. Before looking at the Design Phase in detail, it is useful to consider and clarify the project according to Levy's design space distinctions.

Levy (1999) outlined the need for clearly stating the assumptions and limitations associated with the design space. He identifies three features that impact on CALL design. These are the need to know the potential users and learning context, to be aware of the fact that design is basically a creative process and that the hardware and software development tools used have an influence on design. In order to clarify the design space, it is important to state whether a holistic or discrete approach is used (i.e. whether the design is limited to student interaction with the computer or whether it looks at the learning environment in a broader sense), the role of the computer (i.e. tool or tutor (Levy, 1997)) and whether the project goal is theory testing or an application for usage in a real setting. He also notes the need to report on the characteristics of the learner and the learning context. These distinctions should be viewed as continua rather than dichotomies. Apart from clarifying the design space, Levy provides some other design heuristics, including knowing the strengths and weaknesses of existing CALL materials and the need for testing and evaluation with users. There is some overlap between Levy's (1999) design space distinctions and Colpaert's (2004) Analysis Phase and Levy's suggestions have been taken into account in the Design Phase.

The CLICI project adopted a discrete approach in the sense that it focused on the computer-usage aspect of learning, although it did take into account the whole learning environment. In the Tool/Tutor distinction, the tutor evaluates student input while the tool does not. The CLICI project aimed to produce one tool (the Lesson Generator Component) and two tutors (the Verb Conjugation Component and the Writing Checker Component). Although ICALL tutors are usually theory-testing projects, in the case of CLICI, the focus was on actual use by students in a real educational setting. CLICI avails of theoretical-pluralism (Jacobson, 1994) where multiple theories work in a complementary fashion. Levy (1999) lists some characteristics of application-based projects. These include prototype/larger-scale usage, the importance of the user interface, the need for formative and summative evaluation, curriculum integration, multi-media presentation and documentation. CLICI aimed to provide an initial version of CALL courseware that could be enhanced, rather than just a prototype. Recommended user interface guidelines were followed from the start. Evaluation was considered at the outset and carried out at various stages. The CALL resources were not tightly coupled with the curriculum as they were intended to fit in with the teacher's general style and philosophy (although they were designed to be compatible and adaptable to the curriculum). Multi-media presentations were intended for two of the components, while minimal documentation would be provided given the black-box nature of the resources and the target user. The target learner is a primary school student studying Irish. The focus of the project is boys aged between 8-12 years of age, but its resources should also be suitable for girls. The students typically have, at least, basic computer skills. The learners have been studying Irish from their first year in school (typically 4-5 years of age), so they have 4 or more years of education in Irish. Irish is taught for around 40 minutes every day for 185 school days a year. Taking into account the fact that in their initial school years, Irish language education is informal, they have approximately 400 hours of Irish language instruction. The learning context is that of an English-medium primary school. There are usually between 25-30 students in the class and lessons are given by the class teachers. A summary of the design space is shown in Table 7.1.

7.3 Colpaert's High-Level Design Questions

Colpaert lists ten high-level design questions in the CALL context and these are shown in Table 7.2. His answers to these questions are logical and lead to a better design process. The question of whether or not development can be considered as research (in the context of CALL) is one that arises in the field of CALL. The EUROCALL research policy document (Eurocall, 1999) defines development as the creation of pedagogical materials or the production of tools that enable content developers to produce language learning materials. It states that, for pragmatic reasons, CALL development is sometimes labelled as research in academic contexts where development is sometimes not rewarded. However, the policy document also notes that CALL development is not just about producing software, it also includes pedagogical expertise and is

more that simply producing content. Colpaert contends that development *is* research and it is important to investigate how development should be carried out. CALL researchers should report their experiences in this area in the relevant research journals and conferences and it is this aspect that distinguishes development as research from non-research development. Previous NLP/CALL projects have suffered because they did not make it out to the 'real world'. The CLICI project aims to work in the classroom, directly with the students, as it is important to find out if the resources are useful and usable by the target learners. The separation of analysis from

Design Space Distinction	Characteristic
Holistic/Discrete	Discrete
Tool/Tutor	1 Tool (Lesson Generator), 2 Tutors (Verb Conjugator and Writing Checker)
Theory-testing/application building	Application building
Learner	Primary school student
Learning context	Primary school, classroom based instruction

Table 7.1 Summary of the CLICI Design Space

design and design from development is good software engineering practice and there is no reason why CALL projects should not adopt this approach. One of the complaints levelled against CALL developers with a technological background is that they try to find a use for their technology, rather than looking at what CALL resources are required. Rouet et al. (2001) note the shift from what can be done to what should be done with technology to design meaningful instructional applications. The CLICI project tries to reflect this by looking at what resources would be useful, while at the same time being aware of the technological possibilities. Although advocating that technology should not shape the concept, at the same time Colpaert (2004) suggests that CALL researchers should not be afraid to state that their research is technology-driven or affordances driven. For the purposes of the CLICI project, all of the major design decisions were in line with those of Colpaert's. It should be pointed out that while the aim of the CLICI project is to integrate CL resources and techniques in CALL and a large-scale use mentality was adopted, realistically it was accepted that initial versions of CLICI would be deployed in a local, small-scale setting.

7.4 Colpaert's Design Model

The Design Phase is broken down into three stages: conceptualisation, specification and prototyping.

Issue	Choice	Decision
1	Development as research or no	Development as research
2	Real-world versus laboratory-based	Real-world
3	Local versus large-scale use	Large scale
4	Design loop versus engineering loop	Engineering loop
5	Analysis versus design	Separate analysis from design
6	Design versus development	Separate design from development
7	Design and technology	Technology should not shape the concept
8	Design and theory	Theory should inform design
9	Design and language method	Method should be chosen before design
10	Design stages	Staged and systematic approach

Table 7.2 Colpaert's Design Decisions

Design Phase – Conceptualisation Stage

The conceptualisation stage consists of concept development and the application of usefulness criteria. Concept development involves identifying personas or learner types, the realisation of practical goals (as opposed to pedagogical or personal goals), the description of scenarios of system usage and translating the scenarios into system tasks. The concept should be checked against usefulness criteria. Colpaert's lists four usefulness criteria: usability (can it be used by the target users?), usage (correspondence between actual and intended use), user satisfaction (e.g. acceptability, user-friendliness and quality) and didactic efficiency (the effectiveness and efficiency of the teaching and learning process). The specification stage describes the back-end (the system structure) and the front-end (the user interface) of the system. It provides a description of system components and their interaction. The prototype stage involves the actual development of discrete elements of the system for which developers wish to try out a particular technology. This is mainly for cases where the developers want to try out a new technology or to see which of several options is the most suitable for the system in question.

Colpaert has proposed a Generic and Comprehensive Construct (GCC) or model of program properties. It consists of three layers: the courseware layer, the interaction types and the user types. The courseware layer considers functionalities at the application, modus, document and item level. The interaction types are user input, system output and system processing. The user types are learner, teacher, designer, content provider and parent. Consideration is also given to an environmental layer (between the application and modus layers), which is based on the degrees of freedom a learner has (from 100% learner control to 100% teacher or system control).

The Application level refers to the entire application. The system can check if the user has permission to login and save user results and usage information. The user can log in or out and can provide feedback on the system. The designer can update part of the program without recompiling the system and likewise, the content provider can update content without system recompilation. The Environmental level gives control to the system but with an eye to providing teacher and student control at a later date, if required. At the Modus level (e.g. a particular learning mode), the system determines which version (if applicable) the learner sees. The system could also be capable of providing this choice to the student and/or teacher if it is deemed pedagogically acceptable. The Document level is the learner task or exercise. The system may store tracking information (answers and results), retrieve the relevant data, generate items and format the exercises. The learner can navigate between the items in the exercise and outputs the document for checking. The system could display the exercises and show scoring and evaluation information to the learner. The Item level is the particular exercise item or question. The system can record basic information for each item, process it and provide an evaluation on the input. The learner can input an answer to each item. The system provides simple feedback (i.e. right or wrong) to the learner. While intelligent feedback is the ultimate goal, it may be provided manually. Appendix B (Colpaert's Functionalities Table) explains the levels and their sub-components in more detail.

The conceptualisation phase is iterative, and the designer and teacher work together to arrive at the concept design. When discussing various aspects with the teacher, the design must take care to use appropriate terminology and to avoid using technical terms and phrases that could confuse the teacher. Obviously the designer must listen to what the teacher is saying, as her knowledge is based on her real-world experience, and not on the designer's pre-conceived ideas or idealised deployment context. For example, the teacher is a primary school teacher and not a language pedagogical specialist nor CALL designer. The teacher cannot be expected to be familiar with usefulness criteria or Chapelle's (2001) evaluation criteria and the designer must ensure that the concept is checked with the teacher against these criteria in an appropriate manner. Often even simple diagrams of the proposed system can be quite helpful and ensure that the designer and teacher are talking about the same thing. It is important that the teacher and designer understand each other and have the same vision of the proposed system, otherwise only disappointment and frustration will result. Furthermore, errors detected early on in the lifecycle of a system are orders of magnitude less costly to fix than those that have to be corrected later on in the lifecycle (Sommerville, 2004).

Design Phase - Specification Stage

The specification stage involves describing the system components and their interaction. The specification stage is more technical than the conceptualisation stage and more specific to an

individual project. It describes the back-end of the system i.e. the system structure and the front-end, i.e. the user interface. The back-end description can be done using natural language, diagrams or in Unified Modeling Language (UML). The front-end description could consist of screen designs, menu systems and navigation. Colpaert advocates the involvement of teachers in this stage and outlines how this could happen. However, this depends on the resources available to the project and may not be always be possible. For example, it depends on the willingness of, and time available to, the teachers to participate in the process.

Design Phase - Prototype Stage

Colpaert stresses that prototyping should only be carried out for unknown or exploratory components of the system. For example, if the developers need to check out a new technology on a small-scale then a prototype can be built. However, prototypes are not required for already known or familiar technology.

7.5 Applying Colpaert's Model to the CLICI Project

Design Phase – Conceptualisation Stage

The conceptualisation phase is the part of design in which teachers can actively participate and provide input and feedback. The conceptualisation stage of the Design Phase identified personas, practical goals, scenarios and system tasks. A summary is shown in Table 7.3. There were three types of personas considered: learner type A (a bright student), learner type B (an average student) and learner type C (a weaker student). The practical goals identified for these learner types were to provide an interesting and challenging environment (for learner type A), to provide an environment for reinforced learning and gentle exploration (for learner type B) and to provide a safe and discrete environment for revision (for learner type C). Cooper (1997) distinguishes between daily use (frequent), necessary use (important but not frequent) and edge-case (uncommon) scenarios. In this case, the daily (or frequent) use scenario was the main focus. In this scenario, the student would have access to the computer once a week for a 20-minute period. During this session, the student could choose to do a lesson, study verbs and/or write a short piece of text. Unless directed by the teacher, the student could decide how to spend the time on the computer, depending on his interest and ability. Translating this scenario into system tasks identified that the Lesson Generator Component should consist of tools to display text and play audio files and a mentor function to provide scores to the learner for the games (exercises). The Verb Conjugation Component should consist of a tool to provide static and animated verb conjugation information, along with a mentor function to provide scores for the learning exercises. The Writing Checker Component would principally be a mentor function that provides feedback on the learner input.

Concept development activity	Information	
Personas	Learner type A	Bright student, finds classroom material easy/boring and needs to be challenged to maintain interest.
	Learner type B	Average student, does not particularly like Irish but copes with the subject.
	Learner type C	Weak student, has difficulty with classroom material and struggles to keep up with other students.
Practical goals	Learner type A	Needs to be challenged.
	Learner type B	Needs to review material covered in class and opportunities for gentle exploration.
	Learner type C	Needs time and privacy to review material at his own pace.
Scenarios	"Daily" (frequent) use	Student will have access to the system once a week for 20 minutes and will be allowed to choose learning component, unless otherwise directed by teacher.
System tasks	Lesson Generator	Tools to display text and play audio files; mentor function to provide scores.
	Verb Conjugation	Tools to display information, mentor function to provide results.
	Writing Checker	Mentor function to provide feedback on learner input.

Table 7.3 CLICI Conceptualisation Stage

Checking the concept design against the usefulness criteria means checking it for usability, usage, user satisfaction and didactic efficiency. Within usability, consideration had to be given to whether there were the resources available for the actual use by the target users of the system. This meant that the proposed system was to take into account the actual deployment setting of the system, which indicated that limited technical resources were available (e.g. hardware, software and technical support). If these limitations were borne in mind, the system would be able to pass the usability criteria. Usage criteria gave consideration to the correspondence between actual and intended use. In part, this project was an investigative one in which the participants explored how best CALL resources could be deployed and, as such, the issue of usage was left open, although it was perceived that the concept design could lead to a good fit between actual and intended usage. User satisfaction checking was based on previous research with a similar group of learners in the pilot study (see Chapter 6) and lessons from that research were incorporated into the concept design to ensure a suitable satisfaction level. Finally,

didactic efficiency reflected on the teaching and learning suitability of the proposed concept design. Using Chapelle's criteria (Chapelle, 2001), language learning potential, learner focus, meaning focus, authenticity, positive impact and practicality were considered. While the system as proposed would only meet some of the criteria and not others (e.g. meaning focus), the concept design was deemed to be sufficient. Table 7.4 shows a summary of the checking of the concept design against usefulness criteria.

Usefulness Criterion	**Check**	
Usability	Concept design takes into account the resource limitations	
Usage	Unknown, but anticipated to be sufficient	
User satisfaction	Concept design incorporates lessons from previous projects in same context	
Didactic efficiency	Language learning potential	Opportunities to focus on form exist
	Learner focus	System is designed specifically with target learners in mind
	Meaning focus	Limited focus in the Lesson component, but not a focus of this project
	Authenticity	Adequate correspondence between CALL activities and target language activities (realistically, very limited usage outside the classroom)
	Positive impact	Previous projects have indicated that students enjoy this type of system
	Practicality	The system is designed taking the resource limitations of the deployment context into consideration, while at the same time factoring in potential future changes.

Table 7.4 Checking Concept Design Against Usefulness Criteria

Generic and Comprehensive Construct

This section looks at the mapping of the courseware layer of the Generic and Comprehensive Construct (GCC) to the CLICI project. The Application Level and Modus Level of the CLICI system are outlined here as they are common across the three components. The Document Level and Item Level are discussed for the individual components in Sections 7.6 to 7.8. The items in brackets are the tags that Colpaert uses in his model (see Appendix B for details). Two

of the components of the CLICI system i.e. the Verb Conjugation Component (VCC) and the Writing Checker Component (WCC) will be visible to the end-user. The Lesson Generator Component (LGC) component is used to produce the lesson materials and is not viewed by the language learner. In the CLICI project, the Application Level is the entire CLICI application. The Modus Level consists of two options – static or animated mode for the verb conjugation pages.

Application Level

The Application Level is the entire CLICI system. Access to the system will be via a username and password unique to each user (applies administration rules). The system will record when the user enters and exits the CALL software (saves tracking information). It will also decide whether the learner sees the static or the animated version of the VCC (retrieves modus), and will display the required version to the user (loads modus). The user will log in and out of the system (logs in/off). The learner can provide feedback on the system (gives feedback). The user will not be able to request reports or choose between options, although this feature could be added later. The teacher will be able to define what options the learner sees (defines modus), the designer will be able to modify the options (adapts modus) and the content provider will be able to update content (update content) where appropriate. The system will provide learning reports to the teacher (learning report). The designer will be able to see learning reports (learning report), system usage reports (usage report) and user feedback (learner feedback). The content provider will also have access to student reports (learning reports), usage (usage report) and content feedback (feedback content). Initially, these reports will be quite simple. In the current implementation, parents would not have access to the system, although this might be an option in the future. The learner will not see learner reports, although this could be added later.

Modus Level

The Modus Level refers to the modes in which a learner can use the software. In the initial version of the system, only the VCC has different versions. In this context, the system will display the required component to each student (presents modus) (see Table 7.5).

Specification Stage

This stage saw the design of individual components to generate lessons and exercises (LGC), produce verb information files from externally supplied verb data (Ui Dhonnchadha, 2002), animate verb conjugation information (Koller, 2004) (VCC), process user input, correct and provide feedback on user input (WCC) and monitor student progress. At all times, there was a strict separation between the user interface (tier A), administration (tier B) and data (tier C). Not only does such a separation make sense at a logical level, it makes sense on a practical level, as the developer can change one module without affecting other modules. This module

independence (or weak coupling) is very important in software development (Sommerville, 2004).

System		Modus level	Application level CLICI Program
		Loads modus	Saves tracking info Applies admin rules
User Input	Learner	Makes choices	Logs in/off Gives feedback
	Designer		Adapts modus
	Content Provider		Updates content
System output to	Learner	Presents modus	Learning report
	Teacher		Learning report
	Designer		Learning report Usage report Learner feedback

Table 7.5 Modus Level for the CLICI Project

Prototype Stage

No prototype was necessary for the system as a whole. The modular approach would ensure that the separate components (i.e. VCC and WCC) should fit into the system architecture without any problems. As the Lesson Generator Component was going to provide a wrapper around an existing CALL template (Ward, 2001), there was no real need for a prototype for this component. The Verb Conjugation Component involved putting a wrapper around two new resources and providing two new features – the extraction of relevant verb information from an external source and the animation of information. As both of these features were experimental, two small resources were prototyped to check the feasibility of this approach. The Writing Checker component was the most innovative component and a prototype was developed to see if the concept was feasible that a wrapper could be placed around an existing grammar checker (*Gramadóir* (Scannell, 2005)), and if a useful resource could be developed for the target audience. Teacher feedback was used to improve the pedagogical aspects of the prototype while learner feedback was used to refine the user interface. After several iterations, a suitable specification for the Writing Checker component was outlined. A summary is shown in Table 7.6.

Qualities	Judgemental Evaluation
Language learning potential	The language exercises provide an opportunity for beneficial focus on form (T).
Learner fit	The level of difficulty is appropriate for the learner as the content is based on their textbook. The reading, listening and language exercises are suitable for the target learners (T).
Meaning focus	Some level of meaning focus is required to understand the lesson (T).
Authenticity	Viewing authenticity in a modified form, there is a strong correspondence between the CALL task and the learners' classroom tasks (T).
Impact	The use of sound can help the learners' understand the written form of some orthographically difficult words in Irish (T). The pedagogical practices of the CALL lessons mirror those of the teacher (T). The majority of the students enjoyed the lessons (S) and the teacher felt they were worthwhile (T). The self-reported information from the students suggests that they adopted different strategies for using the software (S). The high proportion of the students who read and/or listened to the texts before doing the exercises indicated that there was some attention to the lesson content (S). The feedback from the students (S) and teacher (T) indicated that they had a positive experience with the software.
Practicality	The students were able to use the CALL lessons without any problems.

Table 10.11 Chapelle's (2001) Judgemental Evaluation Criteria Applied to the Lesson Generator Component

Very limited empirical data was collected on the usage of the CALL lessons. The only data collected reported when the students entered and left the system. This data showed that all of the relevant students used the system at least once during the lessons evaluation period. With this in mind, Chapelle's empirical analysis criteria can be answered as shown in Table 10.12.

10.5.2 Lesson Generator Component - ICT4LT Evaluation Criteria

A summary of the ICT4LT evaluation criteria applied to the LGC is shown in Table 10.13. Findings from the teachers are shown with (T), while findings from the students are shown with (S). According to the findings, the LGC engine and the lessons generated by using the engine were appropriate.

Qualities	Empirical Evaluation
Language learning potential	No empirical evaluation was carried out on language acquisition data for the LGC.
Learner fit	The only evidence to suggest that the lessons were appropriate for the learners is that they were able to use the system without difficulty.
Meaning focus	No data collected.
Authenticity	The information from the teacher and general knowledge of how Irish is taught in schools indicated that the CALL tasks mirror the classroom situation.
Impact	No empirical data available.
Practicality	The students were able to use the lessons on a regular basis over several weeks without any problems.

Table 10.12 Chapelle's (2001) Empirical Evaluation Criteria Applied to the Lesson Generator Component

Criteria	Lessons
Language level indicated	Yes
User Interface	UI of the LGC engine is rudimentary, but acceptable for expected knowledgeable developer. The UI for the courseware produced was fine (T).
Program navigation	Easy for the student to navigate (S)
Feedback	Intrinsic feedback related to the specific error (T)
Explanations	None provided (not deemed to be necessary for target users) (T)
Learner help	None provided (not deemed to be necessary for target users) (T)
Remedial routines	No (better provided by the teacher in class) (T)
Easy to quit	Yes (S)
Mental processing	Mixture of exercise types (T)
Pictures	Yes (T)
Sound	Sound standard is fine. Initially various voices were to be used, but for practical reasons this did not materialise (T).
Learner voice	No – but is a possibility.
Video	No video
Scoring	Hot Potatoes scoring for relevant exercises.

Table 10.13 ICT4LT (2005) Software Evaluation Criteria for the Lesson Generator Component

10.5.3 Lesson Generator Component - Colpaert's Usefulness Criteria

Colpaert's usefulness criteria look at usability, usage, user satisfaction and didactic efficiency. The LGC was intended for use by the content developer, which, in this case, was a combination of the teacher providing the content and the CALL developer actually producing the content. This combination was able to use the software as provided, meeting the usability criteria. The software was used as intended, meeting the usage criteria. The program will continue to be used and, while there is room for improvement, it meets the user needs and user satisfaction conditions. The question of didactic efficiency has been addressed by using Chapelle's evaluation criteria (see Tables 10.11 and 10.12). In summary (see Table 10.14), the LGC provides minimal functionality but it is useful for its intended purpose.

Criteria	Summary
Usability	The LGC is usable by the target audience.
Usage	The actual use corresponds with intended use.
User satisfaction	The user will continue to use the program and she is as satisfied as possible.
Didactic efficiency	Discussed using Chapelle's (2001) criteria above.

Table 10.14 Colpaert's (2004) Usefulness Criteria Applied to the Lesson Generator Component

10.6 Verb Conjugation Component

The Verb Conjugation Component (VCC) produces web pages with CALL learning materials. In this context, all three sets of CALL evaluation criteria (Chapelle (2001), ICT4LT and Colpaert (2004)) are applicable. Evaluation was carried out by the teacher (T1), the students (C6) in S1 and the developer. Evaluation was carried out on a subjective and objective basis. Subjective evaluations were provided by the teacher via questionnaires and interviews. The learners also provided subjective evaluation via questionnaires. Objective evaluation was carried out by analysing data produced by the learners. The students were asked to give their opinion on the VCC.

10.6.1 Verb Conjugation Component - Chapelle's Evaluation Criteria

This section evaluates the VCC using Chapelle's evaluation criteria.

10.6.1.1 Verb Conjugation Component - Chapelle's Judgemental Evaluation Criteria

C6 Student Questionnaire-based Survey November 2005

This section reviews the information reported by the C6 students from a questionnaire-based survey taken in November 2005 (n = 20) (see Appendix J Survey November 2005 Part 2 for details). The students were surveyed previously, but only limited numbers had actually used the software and therefore the data is not particularly helpful.

The majority of the students (85%) enjoyed the verb part at least a little bit, with only 15% not enjoying it at all. A sizeable majority (80%) found it helpful at least some of the time, while only a minority (20%) did not find the VCC at least somewhat helpful. Those that found it helpful cited that it helped them learn their verbs ("show and tells what it means"; "helps me with my spellings"; "I was always getting confused and now I'm not"). Those that said it was not helpful cited that fact that there was nothing new ("know already"; "I remember them"; "too boring"). The students preferred the animated mode of presentation over the static mode (60%), a small minority preferred the static mode (15%), while the remainder showed no preference (10%) or had not seen the CALL resources (15%). Those that preferred the animated presentation said it helped them ("makes me understand"; "I kept on forgetting the h"; "It will get you used to putting in silent letters") and enjoyable ("more fun"). Those that favoured the static presentation said that the animation was irritating ("It's annoying"). Those who did not have a preference said that they learn it in class ("I get it when my teacher tells me") or that they liked the visual aspect ("I'm able to see it"). This data indicates that the students in the main preferred the animated version and found the VCC materials at least somewhat enjoyable and helpful. A summary is shown in Table 10.15.

Question	Yes	No	A Little/Both	Didn't See
Did you like the verb lessons?	40%	15%	45%	
Did you find them helpful?	45%	20%	35%	
Do you prefer the animated mode?	60%	15%	10%	15%

Table 10.15 C6 Student Feedback on the Verb Conjugation Component (November 2005)

The students, in the main, preferred the animated version of the verb pages. This was the anticipated outcome as it was thought that the animated mode would be more interesting and attractive for the students. A small minority (17%) preferred the static mode, which possibly indicates that the group was not homogenous in terms of learning style, even at this early age. Only a small minority (15%) did not like the verb pages, with the remainder at least liking them somewhat. This is important as one of the aims of the CLICI project was to make the study of Irish more enjoyable for the students. A slightly larger minority (20%) did not find them helpful, but the rest did (at least somewhat).

C6 Student Online Feedback on VCC

There were 23 completed surveys after the C6 students had seen the static presentation, 20 for the animated presentation, giving a total of 43 surveys in total. A minority of the students (17%) did not find the verb lessons helpful. Similarly, a small minority of the students (12%) did not like the Championship exercise. A majority (54%) found the Championship exercise

somewhat hard. There was not much variation between the students who had viewed the static presentation over the animated presentation. This mainly related to how hard they found the Championship, with the students who viewed the animated presentation reporting less difficulty then the static presentation students. Table 10.16 shows a summary (see Appendix K VCC Online Feedback for details).

Question	No	A Little	Yes
Did you find the verb lessons helpful?	16%	35%	49%
Static:	17%	35%	48%
Animated:	15%	35%	50%
Did you like the Championship?	12%	18%	70%
Static:	13%	13%	74%
Animated:	10%	25%	65%
Did you find the Championship hard?	46%	36%	18%
Static:	35%	39%	26%
Animated:	57%	33%	10%

Table 10.16 C6 Student Online Feedback on the Verb Conjugation Component (November 2005)

The online feedback provided by the students after completing a Championship exercise (see Appendix K C6 VCC Online Feedback for details) enabled tracking of the student opinions with the presentation mode (n = 43, n = 20 (static), n = 23 (animated)). Most of the students found the VCC at least somewhat useful (84%), with little difference between static (83%) and animated (85%) presentations. 15% of the students found the Championship exercise hard, with only 10% of those exposed to the animated version and 26% of the static mode students saying it was hard. Of those who had seen the VCC, 69% preferred the animated presentation format. Due to the limited numbers involved, caution must be taken when analysing the data.

Teacher 1 (T1) carried out a judgemental evaluation of the VCC. She reported that it had sufficient language learning potential as it focused on verb conjugation forms and the students did well in the verb tests. It suited the learners, it had the right level of difficulty, was sufficiently challenging and the task was appropriate for them. It contained learning material (i.e. verb conjugation data) and provided language exercises for the students to practice their verb conjugation knowledge. There was no overt focus on the meaning of the language used, although the tense was indicated in English (i.e. the words "Past", "Present" or "Future" were displayed as a heading on the screen). Only verbs already studied in class were included in the CLICI software (the teacher supplied a list of required verbs in advance). If authenticity is

interpreted as outlined in Section 10.3, then the VCC CALL task can be considered to be authentic. T1 said that although the students would have little opportunity to use Irish outside the classroom, using the VCC improved their knowledge of verbs which she noticed during classroom tests. The question of impact involves considering whether the students learn about the target language and language learning strategies, whether instructors observe sound pedagogical practice by using the task and whether the teachers and students have a positive learning experience with technology by using the task. The VCC does not explicitly teach the students about language learning strategies, but draws their attention to changes required for verb conjugation. When the students were being taught how to use the software, they were told that there were several ways of looking at the information and doing the exercises and they could chose how they wanted to work with the software. This provided some minimal exposure to the concept that there were different ways of learning and that none was intrinsically better than another. The teacher felt that explicit exposure to verb conjugation forms was pedagogically appropriate for her students. The resources were practical as the students were able to use the CALL resources successfully without any major problems and the teacher reported that it worked well in her classroom. Table 10.17 shows a summary of Chapelle's (2001) judgemental evaluation criteria applied to the VCC.

10.6.1.2 Verb Conjugation Component – Chapelle's Empirical Evaluation Criteria

Empirical data was collected on the C6 students during their interaction with the VCC during the period November – December 2005 (n = 22, 62 test scores). This data related to their test score results and the aim of this data collection and analysis was to determine if a particular presentation mode resulted in higher test scores. A summary is shown below and details are given in Appendix L VCC Empirical Data. In some cases there is only one student in a particular category (e.g. medium-ability student who saw a regular verb in animated presentation), so the data is not particularly reliable. Unfortunately, the system did not log students' interaction with the software and their actual use of the animation - this limits the conclusion that can be drawn about the VCC. Statistically speaking, there is no significance between the test results for static and animated presentation modes (see Appendix L VCC Empirical Data for ANOVA and t-test data). The static presentation was better for irregular verbs in all cases. Note that the test results ignore case errors i.e. where the student did not capitalise the first letter of the verb in the answer and blank tests (i.e. where the student did not actually answer any questions). A summary of the average mark for each combination of student level/presentation mode/verb type, along with the number of students in each group is shown in Table 10.18. The scores are calculated by awarding a student 1 mark for each correct multiple-choice answer (4 questions), and 2 marks for each correct gap-fill answer (3 questions), giving a maximum total of 10 for each test.

Qualities	Judgemental Evaluation
Language learning potential	The focus is on form due to the very nature of verb conjugation.
Learner fit	The type of verb conjugation information shown was chosen by the teacher with the target group in mind.
Meaning focus	Not a focus of the VCC
Authenticity	Using a modified definition of authenticity for Irish, there is a link between the CALL task and the classroom task.
Impact	The learners will have been made aware of the changes that occur in order to conjugate a verb correctly. The students reported that the VCC was somewhat useful and some identified how it helped them (e.g. "It will get you used to putting in silent letters"). The teacher was happy with it and wants to continue to use it.
Practicality	The students could use the VCC without any problems.

Table 10.17 Chapelle's (2001) Judgemental Evaluation Criteria Applied to the Verb Conjugation Component

Variable	Static		Animated	
	Regular	Irregular	Regular	Irregular
Good	3.17 (n=6)	8.17 (n=6)	7.13 (n=8)	6.21 (n=14)
Medium	5.00 (n=5)	4.40 (n=5)	1.00 (n=1)	4.17 (n=6)
Weak	7.33 (n=3)	1.00 (n=1)	3.33 (n=3)	1.00 (n=4)
Overall	4.71 (n=14)	6.00 (n=12)	5.67 (n=12)	4.83 (n=24)

Table 10.18 C6 Student Championship Scores (September - December 2005)

A second experiment was carried out with another class in School 1 (S1). This class, Class 7 (C7), consisted of 26 students. The initial aim was to repeat the VCC evaluation experiment that was carried out by C6. However, this was not possible and the students only had access to the software for 3 weeks and there was no switching. The limited data available for this group (only 18 students got to use the verb pages) shows that static mode of presentation was better for both regular and irregular verbs (although the data for the regular animated verbs is skewed by one bad test score).

18 of the 26 students had a chance to use the VCC. Their scores were all very high. This may be because the two verbs that they studied were *bí* (to be), probably the most frequently used verb and *bris* (to break), a regular verb and the tests took place later in the school year. The

static presentation produced much better scores for both regular and irregular verbs. However, if one odd result from one student who seems to have mistyped his answers is removed from the data set, the animated regular average rises to 9.75. This serves to highlight the caution that must be applied when interpreting findings with such limited data. A summary of the results for static/animated and regular/irregular verbs along with the number of test scores for each combination for C7 is shown in Table 10.19.

Variable	Static		Animated	
	Regular	Irregular	Regular	Irregular
Overall	10 (n=9)	9.11 (n=7)	6.57 (n=6)	6.66 (n=4)

Table 10.19 C7 Student Championship Scores

Empirical Evaluation - Problems

One of the criticisms of CALL research is that often results are compared after students have been exposed to only one session with the CALL resource. Although the exposure to the VCC was not particularly long, in theory it amounted to nine sessions per student. However, in practice, not all students participated equally. As the students also had access to the CALL lessons, some students opted to spend most of their allotted time on the LGC lessons and did not get to use the VCC. Some students studied one verb per week, other students studied more than one, while other students studied the verbs but did not take the test (Championship exercise). The students were able to study any verb of their choosing (from the list specified by the teacher), and, as a consequence, students studied different verbs. All these factors combined meant that it was not possible to carry out the empirical evaluation as planned. The combination of groups, verbs studied, verb classification (e.g. regular or irregular), number of verbs studied and VCC usage meant that the sub-groups were too small for any statistical analysis to be statistically significant. Despite this problem, the students' Championship marks, which contained scores for multiple-choice and gap-fill answers, were analysed to provide indications as to the value of using the VCC. Table 10.20 shows the application of Chapelle's (2001) empirical evaluation criteria applied to the VCC. Table 10.21 provides an overview of the empirical evaluation (based on research design reporting suggestions in Felix (2005)), while Table 10.22 gives more detailed information on the empirical evaluation of the VCC (see Appendix L VCC Empirical Data form more details).

The questions asked in the empirical evaluation of the VCC were:

- Does the use of animation lead to better test results?
- Which students benefit most?
- What verb type/animation combination produces better results?

As outlined above, the numbers involved in each combination (see Table 10.19) were too small to carry out hypothesis testing, but several pointers can be drawn from the results. The combination of regular verb/animation resulted in better test scores. For irregular verbs, it seems that the static presentation leads to better test scores. This may be due to the repeated patterns involved in the conjugation of regular verbs, whereas the irregular verbs have no regular pattern and animation may be a slight distraction or hindrance for the students. In summary, it would appear that the use of animation does help the students, but not in all cases. It appears to work best for the regular verb/animation combination, and seems to be least effective for the irregular verb/animation combination. The data did not indicate which one category of students (good/medium/weak) benefited more than any other category. However, given the small numbers involved, statistically meaningful analysis could not be carried out and therefore caution must be observed in relation to these conclusions. One interesting observation is that the classification of the students provided by the teacher corresponded with their test results. In other words, her intuition and knowledge of the students was accurate.

Qualities	**Empirical Evaluation**
Language learning potential	The students were able to attempt the Championship (verb conjugation) exercise, with most students getting at least some questions correct.
Learner fit	The spread of correct answers for C6 from 0 to 9 indicates that it was neither too easy nor too hard for the student group. The students could spend as long as they liked on an exercise and they could prepare for the exercise in whatever way they preferred.
Meaning focus	Not relevant.
Authenticity	Not relevant.
Impact	Animation works better for regular verbs, while the static presentation was better for irregular verbs. Only a small minority (15%) did not like the verb lessons.
Practicality	Neither the teacher nor the students reported any problems with the software.

Table 10.20 Chapelle's (2001) Empirical Evaluation Criteria Applied to the Verb Conjugation Component

10.6.2 Verb Conjugation Component - ICT4LT Evaluation Criteria

The ICT4LT evaluation criteria are complementary to Chapelle's. A summary of the VCC using these criteria is shown in Table 10.23. The User Interface (UI) and navigation were easy to understand and the students reported no problems with them. The multiple-choice, matching,

mixed-up sentences and gap-fill exercises provided minimal feedback to the students (either right or wrong). The Championship provided right/wrong information, the student's response and the correct answer. Explanations or other help were not provided, as it was felt that they would not be used and not required by the students. Also, it is easier for the teacher to provide such information in class. There are no remedial exercises, as the information provided is very basic.

Item	Information
Question	Does providing animated verb conjugation information aid the learning process? Do the students find it useful?
Summary	Animated verb conjugation information is useful for regular Irish verbs but not so for irregular verbs. The students found the animation helpful and most would choose to see the animated version over the static version.
Limitations	- self-reporting by young learners - small-scale study - lack of "pure" control group - irregular, uneven usage - no empirical monitoring of actual use of animation
Analysis	Animated display is helpful for regular verbs as there is a pattern to help the students. Irregular verbs in Irish (especially in the past tense), are quite distinct from regular verbs and from each other, and there is no pattern to help the learner remember their form. It was anticipated that the learners would like the animated display of information, as it helps to maintain interest in an aspect of language learning that is usually considered boring.
Further investigation	- check for animation affect with other tenses - check for longer –term affect
Future improvements	- monitor investigation - measure time spent on task
Overall figures	Although the animated mode data is slightly higher for regular verbs than the static mode, the results are not statistically significant. Static mode results are higher for irregular verb, but again the results are not statistically significant.
Details	See Table 10.22

Table 10.21 Empirical Evaluation of the Verb Conjugation Component - Summary

Variable	Information – Verb Conjugation
Date	Sept – Dec 2005
No. of students	26 in class (but only 22 actual participants) (C6 in S1)
Measures	Objective and Subjective (online survey)
No. of sessions	Varies for each student, average is 3 per student (min of 1, max of 7)
CALL experience	One primary school academic year, with fairly regular CALL usage
"Traditional" experience	Students would do verbs tests in class
Training:	Pedagogical: Students were shown that changes in verb conjugation were displayed in red (and animated) Technical: Students were shown how to use the software in groups of 4
Intervention	No intervention took place, except to ensure that all students could use the system
Research design used When, subj. selection, type	Pre, during, post-test Control group, random subjects (based on ability): good, medium, weak) with comparison of post-test results.
Technology	PC, MS Windows, Apache web server, web pages (html, XML, Perl)
Setting	One PC located in the classroom
Language	Irish
Skill	Grammar (verb conjugation knowledge)
Variable	Does providing animated verb conjugation info aid learning? Ans: Yes for regular verbs, no for irregular verbs

Table 10.22 Empirical Evaluation of the Verb Conjugation Component - Details

Learners can quit when they wish to leave a particular part of the program (except the Championship). Although there is limited mental processing required for the Hot Potatoes-based exercises, the Championship forces the student to produce verb conjugation data. No pictures were provided in the VCC. It would have been helpful to use pictures to visualise the verbs, but given that the aim was to automate production, this did not happen. In future, a databank of verb related images could be used for this purpose. Likewise, there was no sound provided in the VCC. Until good quality Text-To-Speech software is available for Irish, it will not be possible to provide sound automatically in the VCC (or similar products).

10.6.3 Colpaert's Usefulness Criteria

Applying Colpaert's usefulness criteria to the VCC means looking at its usability, usage, user satisfaction and didactic efficiency. The internal components of the VCC were usable by a developer to produce CALL courseware. The CALL courseware produced using the VCC was usable by the target users. Thus, the usability component was satisfied. The VCC was intended to be used to produce verb conjugation courseware for primary school students and it was successfully used for this purpose, meeting the usage criteria. User satisfaction involves looking at whether or not the software will continue to be used and if the users are satisfied with the software. The teacher has expressed an interest in continuing to use the software for her students and the students reacted positively to the VCC. From a content development point of view, it is fairly easy to use the system and if the courseware needs to be extended, the VCC will be used to generate the required courseware. The didactic efficiency issue has been reviewed using Chapelle's criteria above. Table 10.24 shows a summary.

Criteria	Lessons
Language level indicated	Yes
User Interface	UI of the VCC engine is basic, but acceptable for expected knowledgeable developer. The UI for the courseware produced was fine.
Program navigation	Easy for the student to navigate
Feedback	Minimal
Explanations	None provided (not deemed to be necessary for target users)
Learner help	None provided (not deemed to be necessary for target users)
Remedial routines	No (better provided by the teacher in class)
Easy to quit	Yes
Mental processing	Mixture of exercise types
Pictures	No
Sound	No
Learner voice	No
Video	No
Scoring	Hot Potatoes scoring for relevant exercises. More detailed scoring for Championship exercise.

Table 10.23 ICT4LT's (2005) CALL Software Evaluation Criteria Applied to the Verb Conjugation Component

Criteria	Summary
Usability	It is usable by the target audience.
Usage	Actual use corresponds with intended use.
User satisfaction	The user will continue to use the program as is she as satisfied as possible.
Didactic efficiency	Discussed above under Chapelle's (2001) criteria.

Table 10.24 Colpaert's (2004) Usefulness Criteria Applied to the Verb Conjugation Component

10.7 Writing Checker Component

This section evaluates the Writing Checker Component (WCC). All three sets of criteria (Chapelle's (2001), ICT4LT (2005) and Colpaert's (2004)) are applicable. Evaluation was carried out by the students (via surveys), by the teacher (T1) and by the researcher. Empirical data was gathered on the texts the students submitted to the WCC.

10.7.1 Chapelle's Evaluation Criteria

This section evaluates the WCC using Chapelle's (2001) criteria.

10.7.1.1 Writing Checker Component – Chapelle's Judgemental Evaluation Criteria

Class 6 Student Feedback on WCC

The Class 6 (C6) students provided feedback on the Writing Checker Component (WCC) in November 2005 (n = 20; see Appendix J Survey November 2005 Part 4). The majority at least somewhat enjoyed the writing checker (70%) but a sizeable minority (40%) did not find it helpful. They said it was difficult to use ("hard"), boring or that they already know how to write ("I already know how to write"; "I knew the spellings"). Those who found it helpful said that it indicated errors ("You will see if you are right or wrong") and that it was of general assistance ("It helped me write on the computer"; "I forgot the words"). Some students who reported that it was somewhat helpful wanted more help ("Helped a good bit but not all the help I needed"). The students reported problems with using the keyboard ("Hard to find the buttons") and said that they did not enjoy writing in Irish ("I don't like writing"). Table 10.25 shows a summary.

Question	Yes	No	A Little/Both
Did you like the writing checker?	20%	30%	50%
Did you find it helpful?	20%	40%	40%

Table 10.25 C6 Student Feedback on the Writing Checker Component (November 2005)

In June 2006, a questionnaire-based survey was carried out with C6 (n = 19). The objective of the survey was to learn about the students' opinion on the WCC and writing in Irish. Table 10.26 and Table 10.27 show a summary of the responses (see Appendix N Survey June 2006 for more details). 19 students completed the questionnaire out of a total of 26 students (the remainder were absent on the day the questionnaire was administered). The students' replies are grouped by level i.e. good, medium and weak, as defined by the teacher at the start of the academic year. There were 12 good, 9 medium and 5 weak students overall, while 8 good, 8 medium and 3 weak students answered the questionnaire, so the data must be interpreted with this in mind. Caution must be observed particularly in the case of the weak students, especially for those questions to which only one student replied. Broadly speaking the good students tended to understand the error messages better than the other students. They also found the WCC more enjoyable and helpful than the other levels (see Appendix M C1 Learner Corpus for more examples).

The results reported here are overall results for the three levels – Appendix N shows the responses broken down by level. Many students (42%) do not like Irish and the majority (56%) do not like writing in Irish. The reasons given include the fact that is difficult ("It is hard") and they have problems with the spellings ("Because I can't spell and it I can't write it") and accents ("You forget fadas"). When asked what type of stories they write, the answers reported were quite varied from "bad" to "good", "from the textbook" to "about anything" (the empirical data from the session logs confirm this). A significant part (42%) did not understand the grammar error messages nor did they find them helpful (47%). Although a majority (75%) reported that they made corrections, a review of the logged data does not concur with this. Coincidentally, the same percentage of students (42%) did not understand the spelling error messages nor find them helpful (47%), with a majority (59%) reporting they made corrections to their spelling errors (unconfirmed by the logged data). The majority of students (72%) at least enjoyed using the WCC a little and found it somewhat helpful (72%). There were no issues with time, as the vast majority (80%) of the students said they had enough time to write their stories. Some students reported that they found the WCC unclear ("It was confusing"), had problems with the spellings or problems with 'everything', while other students reported that there were no problems. A majority of the students (63%) would prefer to write stories in their copy because it was easier, faster and there were no problems with the keyboard ("Because on the computer I don't know where keys are"). One student said he would prefer using the WCC because it would tell you your errors ("It tells you your mistakes"). A few suggestions for changes to the WCC included making the error messages more understandable and improvements to the feedback on spellings.

Question	No	A Little	Yes
Do you like Irish?	42%	47%	11%
Do you like writing in Irish?	56%	33%	11%
Did you understand the error messages?	42%	42%	16%
Were they helpful?	47%	24%	29%
Did you correct your errors?	25%		75%
Did you understand the spelling errors?	32%	42%	26%
Were they helpful?	30%	35%	35%
Did you correct your spelling errors?	41%		59%
Did you enjoy using the Writing Checker?	28%	50%	22%
Did you find the Writing Checker helpful?	28%	28%	44%
Did you have enough time to write your stories?	20%		80%
Would you prefer your copy for writing Irish?	37%		63%

Table 10.26 C6 Student Survey on the Writing Checker Component - Part 1 (June 2006)

The information reported in this section comes from a questionnaire-based survey administered to C6 in June 2006 (see Table 10.28 and Appendix N Survey June 2006 for details). While only 19 of the 26 students were present, their responses are probably fairly representative. However, some of their responses are inconsistent, e.g. some students report that they did not use the writing checker yet reply to the questions as if they had used it. Nevertheless, their answers are interesting. In general, the students did not understand the grammar and spelling error messages and did not find them helpful. Paradoxically, they enjoyed using the WCC and found it somewhat helpful. The majority of students had enough time to use the WCC. Some students said they had problems with the WCC, but unfortunately they did not specify what they were. Most students would prefer to write in Irish in their copy rather than the WCC, mainly because it was "easier" (probably due to the difficulties of actually typing in the story).

Although in some respects the students' answers are disappointing, in other respects they are welcome. Their honesty in reporting problems means that their responses are probably not affected by the 'smile coefficient' and are probably an accurate reflection of their opinions. In December 2005, the students reported that they were having problems with the error messages and a refresher training session was given in January 2006. It would seem that the problem is deeper than just understanding where the messages are and how to use them (as appeared to be the case in December 2005). Although the error messages were phrased with the young learners in mind, it seems that they are not suitable for the students in their current format. This is an area that merits future investigation. The main reasons why the students would prefer to write

manually in their copy as opposed to using the Writing Checker Component (WCC) arise from the physical issues of writing on the computer (e.g. logging into the computer and typing on the keyboard). It is interesting to note that the percentage of students who either enjoyed using the WCC or found it helpful, was higher than that of those who liked writing in Irish, so perhaps, the WCC ameliorates the negative aura that surrounds writing in Irish for the students.

Question	Finding
Why do you like/dislike writing in Irish?	Like: our national language Dislike: Hard, boring, hard spellings, accents
What type of stories do you write?	Long, short, good, bad, from textbook, about anything
What problems did you have with the WCC?	None, a few, a lot, everything, spellings, confusing
Why would you prefer the WCC or your copy for writing?	WCC: tells you your mistakes Copy: easier, faster, no keyboard problems
What changes would you like to the WCC?	None, games and help, spellings, easier to understand

Table 10.27 C6 Student Survey on the Writing Checker Component - Part 2 (June 2006)

Question	Response
Do you like writing in Irish?	Only a small minority (11%) actually like writing in Irish, with a majority (56%) not liking it at all.
Did you understand the (grammar) error messages?	The vast majority (84%) had problems with the error messages at least some of the time.
Did you understand the spelling error messages?	Many students (76%) had problems with the spelling error messages at least some of the time.
Did you enjoy using the Writing Checker?	A minority (28%) did not enjoy it at all, with the remainder (72%) enjoying it at least some of the time.
Did you find it helpful?	A majority (72%) found it helpful at least some of the time.
Which would you prefer for writing in Irish, the Writing Checker or your copy? Why?	The majority (63%) would prefer to use their copy to write stories in Irish, mainly because it would be faster, easier and there would not be problems with the keyboard.

Table 10.28 Summary of C1 Students' Feedback on the Writing Checker (June 2006)

Teacher Feedback

The C6 teacher (T1) also answered a questionnaire in June 2006. She reported that she thought that the WCC was beneficial for her students. It enabled them to work independently on a different medium. She said that it enabled her students to construct sentences and stories. She felt it was at an appropriate level for the learners as all the boys could use the software (learner fit). She reported that the students' activity can be monitored and their competency in grammar, sentence structure and understanding of the language can be checked. She would like her students to continue to use the WCC as she perceived it as enjoyable, providing variation and an opportunity to learn and revise whilst not "working". She said that it helps to consolidate classroom work. With regards to future improvements, she suggested providing ideas and words to assist the students in writing stories. She would like to check for verb endings and spellings and use of the possessive (e.g. *mo* + *'h'* (my)). Her main problem with the WCC was that she did not know enough about computers herself.

Summary

The WCC has language learning potential and is somewhat suitable for the target learners, given the problem of understanding the error messages. In terms of impact, the students were made aware of spelling and grammar errors. The teacher reported that the students' copybook writing improved, although no empirical data is available to support this. She also said that the children's comprehension and independent writing skills improved as did their general computer work ethic. The students had difficulties with the error messages but report that they enjoyed using the WCC. Although the WCC was designed with primary school students in mind, it would appear that the CLICI WCC still has some way to go in meeting these needs and this could be an area for future investigation. A summary of the Chapelle's judgemental evaluation criteria is shown in Table 10.29.

10.7.1.2 Writing Checker Component – Chapelle's Empirical Evaluation Criteria

Given the constraints in which the project operated, it would not have been possible to produce reliable results to compare data from students who used the WCC to those who had not used it. Therefore, the questions for empirical analysis of the WCC were the following:

- Can the students use the WCC to produce texts?
- Did usage vary according to student classification (good/medium/weak) in terms of?
    - the number of texts
    - the number of sentences per text
    - the number of words per text
    - the number of grammar errors per text
    - the number of spelling errors per text

Qualities	Judgemental Evaluation
Language learning potential	The very nature of a writing checker means that the focus is on form.
Learner fit	The WCC was suitable for the target users. They were able to use the resource as intended, with some reservations about their usage of the error messages.
Meaning focus	Not a focus of this CALL resource
Authenticity	Relevant to tasks the learner would be expected to do (mainly in the future)
Impact	The WCC was pedagogically sound as it enabled the students to try out language in a safe environment with feedback. The majority of the students reported that, although they had problems understanding the error messages, they enjoyed using the WC. Impact is difficult to assess. The students were made aware of spelling and grammar errors. The teacher reported that the students' copybook writing improved. A positive experience was reported both by the students and teachers. T1 intends to continue to use the WCC – an indication of her analysis of its impact on learning
Practicality	The WCC was usable in its intended environment without any technical problems, but there were pedagogical issues relating to the error messages.

Table 10.29 Chapelle's (2001) Judgemental Evaluation Criteria Applied to the Writing Checker Component

Empirical Data on WCC for Class 6

The data reported here is for Class 6 (C6) during the period January – March 2006 (obtained from the session logs) (see Table 10.30). Out of the 26 students in C6, 25 students submitted at least one text to the WCC. 8 students submitted between 1 – 3 texts, 10 students submitted between 4 - 5 texts and 6 students more than 5 texts. The average number of sentences per text was 4.07, with an average of 26.88 words per text. The average number of grammar errors/text was 1.54, while there was an average of 8.79 spelling errors per text. Analysing the texts by student type (i.e. good/medium/weak), as expected the good students wrote longer texts and, taking text length into account, had (relatively) fewer errors per text, than the other groups. The small number of weaker students (n=4) must be borne in mind when interpreting the data on the weaker students. The lower number of grammar errors per text for the weaker students (1) is probably due to the errors being reported as spelling errors rather than grammar errors. The empirical data suggests that the students were able to use the WCC and some of them were quite

adventurous in the stories that they wrote (e.g. they wrote stories that would be considered long for this peer group or invented new texts). The number of spelling errors is relatively high, in part, due to the attempts of phonetic spelling by the students. The high number of spelling errors probably masks underlying grammar errors.

Variable	Good	Medium	Weak	Total
Number of students	12	9	5	26
Submitted 0 texts	0	0	1	1
Submitted 1 – 3 texts	4	3	2	9
Submitted 4 – 5 texts	6	3	1	10
Submitted > 5 texts	2	3	1	6
Average no. of sentences/text	4.49	3.88	3.25	4.07
Average no. of words/text	30.45	21.88	28.31	26.88
Average no. of grammar errors/text	1.63	1.63	1.00	1.54
Average no. of spelling errors/text	8.80	7.66	11.13	8.79

Table 10.30 Empirical Data for the C6 Students' Texts

The empirical data on the texts produced by the students is quite interesting. Only 1 (weak) student failed to produce a text, all the other student managed at least one text. The average number of sentences per text ratio is highest for the good students, although this figure is somewhat questionable for all groups as occasionally the students forgot to put in a full stop at the end of a sentence. As would be expected, the good students produced more words per text than the medium students. However, the weak students wrote more words per text than the medium students. The students in general had many more spelling errors per text than grammar errors. In some sense, this vindicates the decision to separate out the spelling errors from the grammar errors, as in theory it allows the students to focus on the (more important) grammar errors. However, some of the spelling errors are, as yet, undetected grammar errors and thus, the real grammar error level is probably higher than reported here. Appendix O WCC Empirical Data provides more details.

Empirical Data on WCC for Class 9

The C9 students in S2 had access to the WCC during the school year September 2005 – March 2006. Only four students used the writing checker as these were the students that the teacher decided would benefit most from, or at least be able to use, the WCC to produce texts in Irish. However, given other demands on the students' and teachers time, they only got to use it in February 2006. Therefore the data is extremely small. The number of files submitted by the students in C9 was too limited to provide meaningful empirical analysis, but a summary is given

here in Table 10.31 for completeness sake. If one small text (words = 4) is removed from the data set, the average number of words per text is almost 39, which is high for this student group. Appendix P T5 Learner Corpus Examples shows portions of the students' texts. The responses to the WCC research questions are shown in Table 10.32.

Variable	Total
Number of students	4
Submitted 0 texts	0
Submitted 1 – 3 texts	4
Submitted 4 – 5 texts	0
Submitted > 5 texts	0
Average no. of sentences/text	4.8
Average no. of words/text	31.8
Average no. of grammar errors/text	2.00
Average no. of spelling errors/text	15.00

Table 10.31 Empirical Data for the C9 Students' Texts

Question	Reply
Can the students use the WCC to produce texts?	Yes, all but one student submitted a text
Did usage vary according to student classification (good/medium/weak)?	Yes
… in terms of number of texts	Good students wrote more texts
… in terms of the number of sentences per text	Good students wrote more sentences per text
… words per text	Good students wrote more words per text
… grammar errors per text	Weak students had least grammar errors
… spelling errors per text	Weak students had most spelling errors

Table 10.32 Writing Checker Component Research Questions

With regard to the research questions, the WCC contributed to language learning by providing the students with an opportunity for some experimental learning (the average number of words per sentence is good for this student group). In terms of learner fit, it would seem that the WCC is usable by the target user group, as all but one student submitted at least one text. The feedback on grammar and spelling errors was somewhat useful, but, combined with the subjective data from the students it seems that it fell short of what would be acceptable from a CALL researcher's point of view. The task was fairly authentic as the students have to write

texts in their copy. However, feedback from the students suggests that they would prefer to write in their copy over writing on the computer, so perhaps from a physical point of view, there were differences for the students. Table 10.33 provides a summary of the empirical (subjective) analysis.

Qualities	Empirical Evaluation
Language learning potential	The students were able to produce texts using the WCC.
Learner fit	Users could input texts with a level of difficulty commensurate with their ability (i.e. it was an open-ended task). Learners could choose to avail of the feedback or not, according to their individual preferences.
Meaning focus	Not a focus of the WCC
Authenticity	The teacher reported that students' work on the writing checker corresponds to the writing task that they would perform in class. The students reported that they would prefer to write by hand rather than on the computer.
Impact	Impact is difficult to assess. The students were made aware of spelling and grammar errors. The teacher reported that the students' copybook writing improved. A positive experience was reported both by the students and teachers. T1 intends to continue to use the WCC – an indication of its impact on learning.
Practicality	The empirical data would suggest that the WCC was usable by the students, but the pedagogical benefit of using it could not be established.

Table 10.33 Chapelle's (2001) Empirical Evaluation Criteria Applied to the Writing Checker Component

Table 10.34 provides an overview of the empirical evaluation (based on research design suggestions in Felix (2005)), while Table 10.35 provides details.

10.7.2 Writing Checker Component - ICT4LT Criteria

The ICT4LT criteria and the responses for the WCC are shown in Table 10.36. The User Interface (UI) of the WCC engine was basic but acceptable for the expected knowledgeable developer. The UI for the courseware was fine. Feedback was provided on spelling and grammar errors, along with suggestions where appropriate. Some error messages provided indirect explanations to the learner. There is a lot of mental processing required as writing is a language production activity.

Item	Information
Question	Can students use the WCC to write texts in Irish?
Summary	The students were able to use the WCC to write texts in Irish. The students wrote texts modified or copied from their textbook or original stories. Although they had difficulty understanding some of the error messages, a majority of the students (60%) reported that they found the WCC at least somewhat helpful (when writing texts).
Limitations	- self-reporting by young learners - small-scale study - lack of control group - irregular, uneven usage - no empirical monitoring of student corrections
Analysis	Students do not enjoy writing in Irish. The WCC provided immediate feedback to the students on their spelling and grammar errors. It was envisaged that the students would find this feedback helpful and encourage them in their writing, although the empirical data did not measure how helpful the students actually found the WCC.
Further investigation	- check for corrections - check for longer –term affect
Future improvements	- monitor corrections - monitor text type and complexity
Overall figures	Almost all the students (except for one) were able to write at least one story and some students were quite adventurous in the texts they produced. So the WCC can be said to be usable by students to write texts in Irish. However, it was only somewhat helpful to the students as some of them had difficulty understanding the error messages.
Details	See Table 10.35

Table 10.34 Empirical Evaluation of the Writing Checker Component – Summary

10.7.3 Writing Checker Component - Colpaert's Usefulness Criteria

Colpaert's usefulness criteria look at usability, usage, user satisfaction and didactic efficiency (see Table 10.37). The software met the usability criteria as it is usable by the target user group. The software was intended for students to practise their writing skills and they did indeed use the software to write original texts in Irish. The usage criteria were met and perhaps exceeded as the students stretched themselves from a pedagogical point of view when using the Writing Checker software. The user satisfaction criteria include acceptability, user-friendliness and software quality, as well as the question of continued usage and general user feelings toward the

software. T1 was very satisfied with the WCC and wants to continue to use it in future years. The students in C1 also responded positively to the software. Didactic efficiency has been covered by using Chapelle's criteria above.

Variable	Information – Writing Checker
Date	Oct 2005 – Mar 2006
No. of students	26 in class (25 submitted at least one text)
Measures	Objective and Subjective (online survey)
No. of sessions	Varies for each student
CALL experience	One primary school academic year, with fairly regular CALL usage
"Traditional" exp	Students would write a piece of text in class or for homework
Training:	Pedagogical: Students were shown what information the WCC provides (spelling and other errors, how to make corrections) Technical: Students were shown how to use the software in groups of 4
Intervention	No intervention took place, except to ensure that all students could use the system and one refresher training session.
Research design used (F) When, subj. sel, type	Post-test No control group – all students could input texts
Technology	PC, MS Windows, Apache web server, web pages (html, XML, Perl)
Setting	One PC located in the classroom
Language	Irish
Skill	Writing
Variable	Can the students use the Writing Checker to write texts in Irish?
Values	All students, except for one, were able to write texts (25/26). Students had only a few grammar errors (avg 1.54 per text) and many spelling errors (avg 8.79 per text), but grammar errors may be masked by the spelling errors. It would appear that students made few corrections and the WCC is not as helpful as it could be.

Table 10.35 Empirical Evaluation of the Writing Checker Component - Details

Criteria	Lessons
Language level indicated	Yes
User Interface	UI of the WCC engine is basic, but acceptable for expected knowledgeable developer. The UI for the courseware produced was fine.
Program navigation	Easy for the student to navigate
Feedback	Feedback is provided on spelling and grammar errors, with correction suggestions provided where appropriate (or available)
Explanations	Some error messages provide indirect explanations to the student. Students can ask the teacher if they have any difficulties.
Learner help	None provided (not deemed to be necessary for target users)
Remedial routines	No (better provided by the teacher in class)
Easy to quit	Yes
Mental processing	Language production activity, so a lot of mental processing required for this group of students
Pictures	No
Sound	No
Learner voice	No
Video	No
Scoring	Basic scoring information

Table 10.36 ICT4LT's (2005) Software Evaluation Criteria for the Writing Checker Component

Criteria	Summary
Usability	It is usable by the target audience.
Usage	Actual use corresponds with intended use.
User satisfaction	The user will continue to use the program and she is as satisfied as possible.
Didactic efficiency	See Chapelle's (2001) criteria above.

Table 10.37 Colpaert's (2004) Usefulness Criteria Applied to the Writing Checker Component

10.8 Software Evaluation

Software Engineering design principles include modularity, anticipation, generality and incrementality (Ghezzi et al., 2003). There are other general principles, but these ones are the most relevant to the CLICI project. Modularity refers to the degree of independence of different parts of a system. Anticipation of change is where a system takes into account that it will change over time and allows for this. Generality means that a system is not hard-coded to deal with a particular local case, but rather is built to cover more general cases. Incrementality implies that parts of the system can be available and usable before the system as a whole is ready. An evaluation of CLICI based on these principles is shown in Table 10.38. This shows that CLICI has tried to incorporate these principles in its design and development.

Principle	Use
Modularity	Separate modules for data extraction, integration and display.
Anticipation of Change	The CLICI design process took the current resource limitations into account, but also allowed for future improvements.
Generality	Can display various tenses and is (fairly) language independent.
Incrementality	Static information available before animated information, tenses released in succession (not simultaneously)

Table 10.38 Software Engineering Design Principles - CLICI Evaluation

Well-engineered software is easy to maintain, dependable, efficient and usable. Maintainability refers to the ability to make changes to the system relatively easily. Dependability refers to how stable and reliable the system is when it is being used. Efficiency considers how well the system uses the resources available, while usability refers to how usable the system is for the users (akin to Colpaert's usefulness criteria). The CLICI software has acceptable maintainability. The code files are small and are loosely coupled, which means that it is easy to make a change to one file without (negatively) impacting another file. There are many configuration files to limit the amount of hard-coded data in the code files. This is demonstrated by the fact that the software could be used to create CALL resources for Nawat without making major changes to the system. The system is dependable in the sense that there were no operation problems reported during its use by the students. However, reliability of content is dependent on the quality provided by the content producer and could be variable. One of the aims of the CLICI project was to try to reuse existing resources where possible. It was thought that reusing resources would be more efficient than developing new resources from scratch. While resource reuse may not always be practical or more efficient, the resources reused in the CLICI system provided enormous gains in efficiency over developing new resources, particularly *Gramadóir*. The usability question has been addressed in previous

sections, which reported that the system was indeed usable by the target users. A summary of the Software Engineering-focused evaluation is shown in Table 10.39.

Attribute	Explanation VC	Explanation WC
Maintainability	Can architecture be used for Nawat?	Can architecture be used for Nawat?
Dependability	No problems reported during use	No problems reported
Efficiency	Reuses existing resources where possible (Uí Dhonnchada's (2002) Irish FST Morphology Engine, Koller's (2004) animation software and the CALL Template (Ward, 2001))	Reuses Scannell's (2005) Grammar checker (*Gramadóir*) and enhances with target group error checking
Usability	Target users could use without any problems.	Usable, although pedagogical improvements could be made

Table 10.39 Software Engineering Design Attributes - CLICI Evaluation

10.9 CL/CALL Evaluation

The previous sections evaluated the CLICI resources from CALL and software engineering viewpoints. However, it is essential to evaluate the project from a CL/CALL integration viewpoint as well, as this was the primary objective of the project. The key questions to be considered here are:

- Can CL and CALL be integrated to develop useful CL/CALL artefacts for a language poorly-served by CL resources with limited developer resources?
- How hard is it to integrate CL resources in CALL?
- How language-independent are the resulting CL/CALL artefacts?
- How automatic is the process of developing the CL/CALL artefacts?
- Is it worthwhile using the Irish FS Morphology Engine?
- Is it worthwhile using *Gramadóir*?
- Is it worth the effort?

Integration

In relation to the first question, previous research (see Chapter 3) has shown that CL techniques and resources can be used in CALL artefacts. However, many of these systems have been built by multi-person teams, often interdisciplinary, for languages well-served by CL tools and resources, and with a large potential target learner group. The question for this project was, could a CL/CALL integrated system (albeit quite small) be built by just one person for a language poorly-served by CL resources and with a limited potential target audience. The

answer in this case is yes, as a system was built for Irish using wrapper technology around some of the limited CL resources that currently exist for Irish.

Difficulty

The next issue to consider is the degree of difficulty. Was it hard to develop the CLICI system? The LGC was very straightforward, especially given that no CL tools were used. For the VCC, the underlying engine and wrapper demanded some thought, but once it had been developed, it was not too difficult to extract the relevant information from the Irish Morphological Analyser (Uí Dhonnchadha, 2002) to provide the verb data for the system. The development of the WCC architecture was not particularly difficult, but the development of the actual error checking code and wrapper around *Gramadóir* integration were more challenging. The grammar error messages had to be caught and rephrased for the target learner group. The *Gramadóir* software had to be checked to see what false-negative and false-positive errors were reported. Local errors had to be identified and coded. This involved establishing a mini-learner corpus and analysing the errors. Coding involved detecting the error and reporting an appropriate message. Overall, quite a good deal of effort was required to build the WCC. From a technical viewpoint, it was not too difficult to develop the CLICI system. The challenge was to translate the pedagogical considerations into suitable CL/CALL resources.

Language Independence

In relation to the language independence question, the LGC is language independent for most languages. Only those languages with an unusual script (i.e. a script that is not Unicode compatible) would encounter difficulty. Now that the underlying engine exists for the VCC, it should not be too difficult to develop animated VCC pages for other languages. Developing a WCC for other languages would be more difficult, as the logic for error checking would have to be designed and specified by a teacher, pedagogical specialist or other knowledgeable person, and coded by a competent developer.

Automation

In terms of automation, the LGC is completely automatic. Once the VCC information is supplied to the system, the process is highly automatic. Once the data and the data extraction code are available the relevant VCC pages are automatically created. The WCC is also highly automated once the relevant components are in place. However, the development of the actual error checking code is highly manual and so the overall level of automation is low for the WCC.

Irish FST Morphology Engine

It was certainly worthwhile using the Irish FTS Engine (Uí Dhonnchadha, 2002) for the regular verbs. The difficulties involved in mapping and interpreting the conjugation changes for the

irregular verbs meant that more effort was required to process this data and in some respects it may have been easier to deal with the Irish irregular verbs separately, especially as there are only 11 of them. The FST Engine was not originally intended as a verb conjugation mechanism and it had to be used in white-box mode i.e. some internal knowledge of the software was required for use in the CLICI project. Uí Dhonnchadha (the developer) provided an internal intermediary format specifically for this project. There is currently no specific mechanism for extracting the data except via html files. However, overall the Irish FST Engine was a useful CL resource for the CLICI project.

Gramadóir

Gramadóir (Scannel, 2005) was definitely a useful CL resource for the CLICI project. It provided wide-coverage error checking for Irish and it was easy to integrate into the WCC architecture. It is robust and reliable. Although it was a little slow, none of the users commented on this fact. In their training session, they were warned that it would take a little while to check their texts and it seems that this was sufficient to prime their expectations in this regard. There were two options as to how *Gramadóir* could have been used in the CLICI project. One option was to use it in white-box mode, i.e. avail of the ability to look at the underlying software and data and make modifications directly. The second option was to use it in black-box mode, i.e. not to look or modify the system internals. The second option was chosen as, in general, CALL developers who would like to integrate CL resources in CALL materials will not have the white-box option available to them, and one of the aims of the CLICI project was to reuse existing CL resources (rather than developing new ones from scratch). The test suite provided with *Gramadóir* was useful when testing the WCC. Overall, *Gramadóir* made a significant contribution to the CLICI project.

Worthwhile

The final question to consider here is: was it worth the effort? For the LGC, the answer is definitely yes, as very little effort was required, and it is a useful resource for facilitating the use of the CALL Template. The LGC architecture is language independent and it was relatively easy to develop lessons in Irish using the LGC. The VCC architecture did not require a tremendous amount of development effort and as it can be used to produce learning material fairly flexibly, it is a useful CL/CALL resource. Once the Irish verb data extraction algorithm had been designed and implemented, it was easy to plug it into the VCC architecture. As the VCC has several presentation options, it can continue to be used to produce CALL resources for Irish. The cost benefit analysis for the VCC (see Table 10.40) indicates that the benefits outweigh the costs.

The development of the WCC architecture was relatively straightforward and was worth the effort, especially as it can be used for languages other than Irish. In the case of the WCC engine, the answer is not as straightforward and depends on the context. In this particular context, the existing CL tool (*Gramadóir*) was very useful. An adaptation process was required to catch and adapt its error messages for the target user group. Local errors had to be added, but, given the nature of the target learners, i.e. limited L1 and L2 knowledge, it was not too difficult. However, questions could be raised about the benefits. Although the students reported difficulties with understanding the messages, they still enjoyed using the WCC. As one of the aims of the project was to increase student motivation, this was a welcome finding. The teacher considered it beneficial and empirical evidence suggests that the students produced Irish texts that they would otherwise not have written. A summary of the costs and benefits is shown in Table 10.41 and the final analysis is that in the case of Irish, the development of the Writing Checker engine was worthwhile. Overall, the WCC was worth the effort, although future research would be needed to improve the error messages so that they are comprehensible for the target learners.

Costs	Benefits
• Locate verb conjugation information source (if available) • Development of information extraction mechanism or creation of verb information • Set display variables	• Automatic development of CALL resources • Students liked the animation presentation • Possibly pedagogically useful for regular verbs • Teacher considered it useful

Table 10.40 Costs and Benefits of the Verb Conjugation Component

Costs	Benefits
• Integration of *Gramadóir* • Error localisation • Splitting grammar and spelling errors • Creating learner corpus • Analysing learner corpus • Local error coding	• WCC available for primary school students • Students encouraged to produce texts in Irish • Teacher considered it worthwhile • Useful, but need to improve error messages • Creation of learner corpus for primary school Irish

Table 10.41 Costs and Benefits of the Writing Checker Component

Overall

The C6 students were asked for their opinions on Irish and the use of the computer for learning Irish. 11% of the students like Irish, 47% a little and 42% did not like it. When asked if they preferred learning Irish on the computer or in class, the students were almost evenly split (class 50%, computer 45%, both 5%). The students who preferred to learn in class reported that there was more help available and that the computer was boring. Those who preferred the computer said it was "more fun" and "easier work" and the fact that "the teacher doesn't shout at me". Responses on the individual components have been discussed in the relevant sections above and appear to indicate that CLICI resources were useful, enjoyable and beneficial for the students, although improvements could be made, especially in the WCC case. The teacher in C1 liked the CLICI software and felt that it was helpful and beneficial for the students. She believed that it was a useful resource to have for teaching Irish. Therefore, in this particular context, it was worthwhile to develop the CLICI resources. A summary is shown in Table 10.42.

Question	LGC	VCC	WCC
Can CL/CALL be integrated?	Not relevant	Yes	Yes
Degree of difficulty	Easy	Medium	Hard
Language independent	Yes	Architecture yes, modules no	Architecture yes, modules no
Level of automation	High	High	Low
Worth the effort	Yes	Relatively little effort required	Depends on context. In this context, existing tool was very useful, contextualisation required, addition of extra error checking not too difficult due to nature of target users

Table 10.42 CL/CALL Evaluation

10.10 Typical Pitfalls and Actions Taken

Felix (2005) identified several pitfalls in CALL effectiveness research reporting. This section reviews the pitfalls and outlines the actions taken in the CLICI project to try to overcome them. One pitfall is that researchers do not report all the relevant features. Where possible, all the relevant features have been reported in this thesis. For example, Chapter 9 clearly identified the deployment context and the technical and CALL experience of the students. Any research project has its limitations and it is important to state them clearly when reporting the research findings (see Section 10.11 for a summary of the limitations of the project). Sometimes projects

will measure the wrong variable. In the CLICI project, careful consideration was given to what was and could be measured. Occasionally, researchers will overstate their claims, so it is essential to be specific about any claims that are made. In the context of this project, the findings relate to English-medium primary schools only and cannot be assumed to hold for other deployment contexts, e.g. Irish-medium primary schools or English-medium secondary schools. Another weakness identified by Felix is that the research is not rigorous. In this regard, the CLICI project research has not been completely rigorous, but it aimed to avoid at least, some basic errors. For example, Fowler's (1995) guidelines were followed to limit questionnaire errors and empirical data was used to complement judgemental data, where possible. One other problem in CALL effectiveness research is that the students are exposed to just one session with the CALL artefact (Hubbard, 2005). This means that the findings often only pertain to novice CALL users, who may be either experiencing the 'smile coefficient' or alternatively, beginner frustration in dealing with the new software. In the case of the CLICI project, in theory, students had use of the CALL lessons for several weeks, the VCC software for at least 9 weeks and the WCC for several months. Admittedly, their usage of these resources was not systematic, but it still amounted to more than one session for nearly all students. Table 10.43 shows a summary of these pitfalls and the actions taken by this project to deal with them.

Pitfall	Action
Not reporting all relevant features	Try to report all relevant features
Not reporting limitations of findings	Report limitations
Measure the wrong variable	Careful consideration given to what to measure
Overstate claim	Be specific about claims
Not rigorous	Research not completely rigorous, but tried to avoid basic errors
Limited to one session	More than one session (6 weeks for VCC; more for WCC)

Table 10.43 Typical CALL Evaluation Pitfalls and CLICI Action Taken

10.11 Limitations

Any research project has limitations, but quite often, they are not mentioned in research reports. This may be due to researchers assuming that the limitations are obvious or that the researchers are not aware of them or that they are embarrassed about publicly stating them. However, it is important to state limitations so that the research and its findings can be properly understood. The limitations of this project are outlined here. One limitation was that the subjective data

involved self-reporting by young learners. One thing to be aware of in this context is the danger that they might try to please the researcher, rather than give honest answers. In order to overcome this, the students were specifically told to report what they really thought, like and did not like about the CLICI resources. The spread of answers from positive to negative seems to indicate that their responses were honest. Another limitation was the small-scale nature of the study. Each class is unique, but Class 6 (C6) in School 1 (S1) could be considered fairly typical of an English-medium primary school in an urban setting in Ireland. Although the findings must be interpreted in the context of this one specific class, its typicality should help to ensure that similar findings could apply in similar situations. Furthermore, as Hubbard (2005) noted, studies of this size are common not only in CALL but in similar fields.

Another limitation of the research findings was the lack of a pure control group. For pragmatic reasons, an intra-class control group was used rather than an inter-class control group. This was because an inter-class control group would introduce too many uncontrollable variables. A strategy of using a control group with switching was used for the evaluation of the VCC, while a control group was not used for the WCC. A further limitation to bear in mind is the irregular, uneven usage of the CLICI resources. This is obviously not desirable, but is probably fairly typical of real usage. One final limitation pertains specifically to the VCC. No monitoring of the actual use and viewing of the animation presentation took place, so it is not possible to determine if the students, who had access to this presentation format, actually used it. In hindsight, it would have been useful to do so, but the fact that the students were not forced to view the animation reflects real world usage of the software. A summary of the possible limitations of the research findings of the project and the actions taken to avoid them is shown in Table 10.44.

One weakness of the CLICI project was the lack of tracking software used in the system. This meant that empirical evidence was not gathered to determine how the learners actually used the software. For example, in the case of the VCC, the system does not record whether the learner actually activated the animation part of the display, so even though the learners report that they liked the animation part, there is not logged data to check whether or not they really looked at the animation. In the case of the WCC, there was no automated tracking of how long the learner took to produce a text, if a correction was made or how a correction was made. There is no mechanism to automatically analyse students' reaction to feedback to see if they really understood and responded to the type of feedback that was provided. The lack of empirical data gathered by the system weakens the evaluation findings and means that the overall findings are not quite as reliable as would be -desirable.

10.12 Concluding Comments

Bradin's (1999) CALL software evaluation steps were useful for evaluating the project as a whole. The CALL evaluation criteria suggested by Chapelle were useful for evaluating three components of the CLICI project. They imposed a structure and meant that key aspects of the software were evaluated. The separation of the judgemental and empirical data helped clarify what findings were subjective and which ones were objective. The ICT4LT software evaluation questions provided complementary criteria to Chapelle's, while Colpaert's usefulness criteria facilitated more basic evaluation. The reports by Felix (2005) and Hubbard (2005) helped to clarify the issues surrounding evaluation and they helped frame the writing-up of the evaluation, specifically in relation to the need to identify clearly the context and limitations of the research findings. Although the desirability of establishing a control group was identified early on in the project, it was actually quite difficult to do so, particularly due to the irregular and uneven usage of the software by the learners. It was also difficult to ask the right questions and to phrase them correctly. Although the teacher reviewed the questions and even though they improved over the duration of the project, this was one area that remained a challenge. Another problematic area was that of measuring the effectiveness of the WCC. Although both judgemental and empirical data were used to evaluate the WCC, further analysis and research would be required here.

Limitation	**Approach adopted**
Self-reporting by young learners, which might mean that they try to please the researcher.	The students were specifically told to say what they though, what they liked and what they did not like.
Small-scale study	Each class is different, but the School 1 class could be considered "fairly typical" of an Irish Primary School in an urban setting.
Lack of "pure" control group	For pragmatic reasons, the class was split into two balanced groups. Group 1 was the control group for 3 weeks and switched over with Group 2 becoming the control group for a further 3 weeks.
Irregular, uneven usage	Not desirable, but probably fairly typical of real usage.
No monitoring of actual use of animation	Students were not "forced" to view animation to reflect real world usage.

Table 10.44 Limitations of the CLICI Project

The software evaluation reported here was not particularly rigorous. Likewise, the CL/CALL evaluation was somewhat subjective but aimed to be an accurate reflection of the project's findings from various sources. The fact that the teacher T1 wants to continue to use the CLICI resources (with a different group of students at a more advanced level) is encouraging. It reflects positively on the CLICI materials and implies that she does not view them as prototypes only. The modular construction and open-ended nature of the components, especially the WCC means that there should not be any major difficulties adapting them to a different group of students. In summary, it can be concluded that although there were difficulties encountered especially during the Implementation Phase of the project, overall it was successful and provided useful insights into the integration of CL resources for CALL for Irish in English-medium primary schools in Ireland.

10.13 Summary

This chapter discusses the project evaluation. Section 10.2 gives a general overview of evaluation in CALL and notes the increasing interest being given to the topic in recent years. Section 10.3 looks at CALL evaluation criteria from three separate sources: Chapelle's (2001), ICT4LT (2005) and Colpaert's (2004) evaluation criteria. Section 10.4 discusses how the CLICI project was evaluated using their criteria and used Bradin's (1999) CALL software evaluation criteria to carry out a project-level evaluation. The Lesson Generator Component (LGC) is evaluated in Section 10.5 using the three sets of criteria. Section 10.6 evaluates the Verb Conjugation Component (VCC) using the same criteria and noted the difficulty in carrying out empirical evaluation. Section 10.7 describes the evaluation data for the Writing Checker Component (WCC). Section 10.8 outlines an evaluation of the project from a software engineering point of view, which involved looking at software engineering principles and attributes. Section 10.9 provides an evaluation from a CL/CALL integration perspective. The typical pitfalls that surround CALL evaluation, as highlighted by Felix (2005), and the action taken to try to avoid them, are shown in Section 10.10. The limitations of the research findings are identified in Section 10.11. Section 10.12 provides some concluding comments on the evaluation process and final analysis of the project.

Chapter 11 Conclusions

11.1 Introduction

This chapter provides an overall analysis of the CLICI project. Section 11.2 gives an overview of the project in terms of benefits and findings. It also looks at the difficulties encountered as well as suggestions for improvements and the project limitations. Section 11.3 reviews the conditions for successful deployment of CL/CALL resources for Irish in the primary school context. The contribution to knowledge is discussed in Section 11.4. Section 11.5 outlines some suggestions for future work on the CLICI components and in other related areas. Section 11.6 provides a summary of the chapter.

11.2 Project Summary

11.2.1 Positive and Negative Outcomes

NLP/CALL Resources for Irish

The CLICI project provided NLP/CALL resources for Irish that were enjoyable for a large part of the target learner group, although not all found the materials enjoyable and there was room for improvement. Using the Lesson Generator Component (LGC), 12 lessons were created for primary school students based on the class textbook. The Verb Conjugation Component (VCC) enabled production of animated verb lessons for Irish for the main tenses (i.e. past, present and future) studied by primary school students. The Writing Checker Component (WCC) provided a writing checker for young learners, and potentially other beginner level students, of Irish. Most of the students enjoyed learning Irish on the computer and many of them favoured using the CALL resources over learning in class. Leaving aside the (important) question of whether or not their learning was more effective, the fact that they enjoyed using the CLICI resources is welcome given the general lack of interest or enthusiasm for learning the language amongst the students in general. Even though the target user group were young, they were able to identify in their own way some of the benefits of CALL, including privacy ("The computer doesn't shout", "I won't get into trouble if I get it wrong"), self-pacing ("You can take your time") and non-traditional features ("Cause you can play games and get to know more Irish") (Appendix I Survey June 2005).

Lesson Generator Component

The Lesson Generator Component (LGC) and its wrapper technology make it easier to use the CALL Template (Ward, 2001) to develop CALL lessons. It also makes it easier to enter accented characters, as this was one area that was cumbersome in the CALL Template. The LGC significantly shortens the time required to produce a CALL lesson once the content had been decided from a pedagogical point of view. Although the LGC could be used by language teachers, the primary target user of the LGC was a content developer with some basic computer skills and from this point of view, it is a useful tool. However, there is room for further

automation of some parts of the LGC (e.g. the insertion of lesson-related image files). Also, further consideration (and modifications) would be required to the rudimentary LGC interface if a primary school teacher with minimal computer skills (rather than computer-literate content developer) were to use it to generate lessons.

Verb Conjugation Component

The Verb Conjugation Component (VCC) and its wrapper technology make it easy to generate CALL resources for verb conjugation information. It provides an architecture which receives the necessary data and produces animated verb lesson pages. The flexibility provided by the VCC means that it is possible to produce various combinations of verb data, depending on pedagogical requirements. For example, the teacher may want to display only the past tense at the start of the school year, but may wish to show past, present and future tense by the end of the school year. The students enjoyed using the VCC CALL materials as it provided verb information for the students in a new format. The VCC was only tested with a limited number of languages and it is quite possible that the information in the tag structure of the verb data files and the capabilities of the animation software may not meet the requirements of other languages.

Writing Checker Component

The Writing Checker Component (WCC) provides a grammar and spelling checker for students of Irish that, at least to some extent, is usable by young, beginner level learners. It demonstrates that it is possible to build such a CALL artefact using limited resources. It must be noted that the existence of Scannell's (2005) *Gramadóir* was very useful in the development of the WCC, as it provided the underlying engine of the WCC. The WCC provided a wrapper architecture that can be used to create a writing checker for other languages. It also facilitates the collection of learner texts for Irish in a Computer Learner Corpus. Out of the three components (LGC, VCC and WCC) the WCC is the component that would benefit most from further improvements, particularly in terms of how the errors are reported to the learners.

11.2.2 Findings

NLP/CALL

Previous research in the area of NLP/CALL has shown that it is possible to integrate CL techniques in CALL, but this has often been a complex process and usually requires a multidisciplinary team, or at least, multidisciplinary knowledge. Many NLP/CALL projects focus on text-based learning and on form rather than fluency, and the User Interface (UI) is often not given much attention. Beginner level adults are the principal target learner group. The main use of CL technologies in CALL is during-CALL usage (i.e. when the CALL artefact is actually being used by the students), although some projects have looked at pre-CALL usage

(e.g. using CL technologies to develop CALL resources) and a smaller group have investigated post-CALL usage (e.g. learner output analysis). As would be expected, most NLP/CALL artefacts are for the Most Commonly Taught Languages (e.g. English, French or Spanish), although systems do exist for other languages such as Arabic and Japanese. NLP/CALL artefacts seem to be most successful for independent, motivated, analytical learners.

Irish CALL and NLP/CALL

Very few CALL resources exist for Irish, and those that do exist are either aimed at adults or linguistically-aware learners. The quality and correctness of the information contained on some Irish CALL websites is questionable, as they are developed by motivated learners rather than native speakers. CALL is not used in primary schools in Ireland and the teachers are generally unaware of CALL and what it can and cannot contribute to the learning process. There are very few CL resources available for Irish, but some of them e.g. *Gramadóir* and Uí Dhonnchadha's (2002) Irish Finite State Morphology Engine are of a high quality and can be adapted for use in CALL resources. *Fios Feasa* (2003) is an entertaining, high-quality CALL resource for Irish that was financed by *An Gúm* (a state body that publishes Irish language resources). Despite the quality of the product, it has not been extensively deployed in primary schools for reasons of cost and lack-of-fit with the curriculum.

Given the dearth of Irish CALL and NLP/CALL resources, there are many possibilities for the development of suitable materials (e.g. pedagogically appropriate and inexpensive). Using Colpaert's (2004) GLDT grid to analyse the various players and considerations in this area, needs were identified for Learners, Teachers, Technology, Content and Other Actors (e.g. parents and Irish language organisations). However, the socio-cultural position of Irish means that careful consideration must be given to the development and deployment of CALL resources in this context. It appears that as students progress through the educational system, their positive attitude towards Irish diminishes, and if CALL resources are developed for Irish with the aim of increasing student motivation, then it is important to start in the primary school, because negative attitudes begin to harden in secondary school students.

Pilot Study

The pilot study was very useful and would be recommended for those starting to work in a new area of CALL deployment. In the context of the CLICI project, it showed that there was an opportunity to develop and use CALL resources in the primary school in Ireland, but that there was considerable time pressure on some classes due to external events (e.g. entrance examinations or preparations for religious events). Even if teachers were interested in using CALL resources, they did not have the time during the school day to devote to their design and development. Students were comfortable using the computer and were able to use the CALL

materials without any problems. Students particularly liked hearing recordings of themselves and their fellow students speaking Irish in the CALL materials. From a pedagogical point of view, knowing that their voice will be recorded helps to focus the students' attention on pronunciation and motivates them to pay more attention to pronunciation than usual and to reading correctly. Student ownership and participation in the development of course material can enhance the learning process. However, there are logistical issues involved and careful planning is required for this to be worthwhile.

ADDIE Model

Colpaert's ADDIE model (2004) is useful for designing and developing CALL resources in a structured manner. The General Local Differential Targeted (GLDT) grid for Learners, Teachers, Pedagogy, Technology, Content and Other Actors is especially useful for encouraging designers to look at analysis from various different perspectives. The conceptualisation stage of the Design Phase provides a good insight to developers as to why a particular piece of software is required. This provides a more holistic vision of the system to developers, rather than the provision of design specifications only.

CLICI Resources

NLP/CALL resources for Irish can be used in the primary school. However, it is important that students are assigned a specific timeslot during the school week, as otherwise, the materials will not be used on a regular basis. NLP/CALL resources that can be linked to the curriculum/syllabus are more likely to be used than those that are not. Teacher involvement is essential (but not necessarily sufficient) for successful deployment of NLP/CALL resources. Although the effectiveness of the resources in terms of learning outcomes could not be proven, the students generally liked using the resources and this is a helpful finding, especially given the socio-cultural position of Irish. See Section 11.3 below on the contribution to knowledge for a more detailed discussion of this topic.

Evaluation

Evaluation is complex and a multi-faceted approach is required to try to capture what happens when students interact with CALL software. Even if evaluation is considered at the design stage, it is still very challenging to carry it out appropriately. While researchers may be aware of the potential problems associated with good evaluation (e.g. using a control group), they may still have difficulties overcoming them. The various evaluation criteria provided by the CALL community are useful in carrying out structured evaluation.

Technical Findings

The use of the Apache server (Apache, 2006), along with the XML technologies and Perl provided a good environment for the software development aspect of the project. The Apache server was robust and no runtime problems were reported. The XML technologies and Perl were very modular and suited the software design goals. The development of the Flash animation code by Koller (2004) that can read in display information at runtime was extremely useful and facilitated the development of the VCC. It would have been possible to develop it with hard-coded data but it would have been extremely cumbersome and unwieldy.

11.2.3 Difficulties

Evaluation Difficulties

The main difficulty encountered in the CLICI project was in the area of deployment. Although careful consideration had been given to the use of the developed resources (by getting the teacher in C6 to allocate each student a particular timeslot for CALL study), the actual CALL usage differs significantly from the planned usage. This had implications for the evaluation of the CLICI resources and diluted the potential impact of these findings.

Technical Difficulties

There were some minor technical difficulties. These included the initial installation of the *Gramadóir* software on the classroom machines (as the machines were very basic and had only minimal software installed). There were also some very minor difficulties installing the correct version of Macromedia's Flash resources on the target machines. More annoyingly, there were problems copying data from the classroom machines. There were problems with the floppy disk drives, and as the PCs were not CD Read/Write-enabled nor had internet access, it was at times frustrating to take a copy of the students' data for off-site analysis.

11.2.4 Improvements

The User Interface (UI) of the LGC could be improved. Currently it assumes that the user is comfortable working with plain text files. While the format of the files is relatively straightforward, it could definitely be improved upon so that others could also use them. The VCC could be improved by using pictures that depict the action of the verb. A databank of images relating to the most common verbs would be required so that the relevant picture could automatically be associated with a given verb display page. It might also be useful to provide an authoring facility for the teacher to specify what verb information (e.g. tense and person) is required (currently this is specified in a plain text file).

First and foremost, the WCC could be improved by investigating why the students had problems understanding the error messages and amending the messages so that they are comprehensible

by them. The local error checking could be extended to cover typical errors from primary school learners that are not detected by *Gramadóir*. This would involve gathering a larger learner corpus and analysing it for errors. Although the students did not report it as a problem, the time required for *Gramadóir* (and hence the WCC) to report back to the students could be shortened. The WCC could also be improved by providing a facility to print out selected user texts in a suitable format so that the students could display their texts in an end-of-year scrapbook and retain them for future reference.

11.2.5 Limitations

Obviously, a small-scale project such as the CLICI project has several limitations. It only focused on a specific learner group and therefore its findings can only be considered relevant to this particular group, i.e. children in English-medium primary schools in Ireland. One of the main limitations of the project is that the CLICI resources were not used as extensively as initially planned. This means that the longitudinal aspect of the research was not as insightful as initially hoped. However, it could be interpreted as a realistic reflection of actual classroom usage where the students are not participating in a research project and the findings have some value in this regard.

The LGC is inherently linked with the CALL Template and in its current state cannot be used to feed into other CALL templates or authoring environments. The VCC only deals with three tenses (past, present and future), although it could be extended as required. The WCC only checks for those errors detected by *Gramadóir*, plus the locally specified errors.

11.3 Conditions for Successful Deployment of CL/CALL resources for Irish in Primary Schools

This section first reviews the necessary conditions for the successful deployment of CL/CALL resources for Irish in the primary school context and then looks at the desirable conditions.

Necessary Conditions

There are several necessary (but probably not sufficient) conditions for the successful deployment of CL/CALL resources for Irish in primary schools. The order in which these conditions are discussed is not significant. It is important that the learners have access to suitable hardware. Suitable hardware does not imply the fastest, most powerful machine available, but it means that the hardware should be able to run the CL/CALL resources adequately and that external devices (e.g. headphones) are in working order and comfortable to use.

The CL/CALL resources (software) should be pedagogically-driven, focused, reliable, interesting, flexible and varied. In theory, pedagogically-driven resources would have these

characteristics but it is worthwhile stating them explicitly. Focused implies that the resources have a learning goal. Reliable means that the resources must be correct, consistent and robust (i.e. the software does not crash). Flexible indicates that they should cater for students of different ability levels, while varied means that the resources should have different components or formats. The adjective "interesting" is hard to specify objectively and it is probably easier to identify a "boring" resource than an "interesting" one. However, within the context of this project, "interesting" resources implies resources that are enjoyable to use, engage the learner and encourage system interaction.

Another key component is the teacher. The teacher must be interested in and motivated to use CALL. S/he must believe in the potential benefits that CL/CALL materials offer learners and be willing to set aside time for the students to use these resources. Ideally, the teacher would have some CALL knowledge and have some basic computer skills.

If any of these three conditions are not met, it is highly unlikely that CL/CALL resources would/could be used successfully in the primary school context.

Desirable Conditions

Following on from the necessary conditions, there are several desirable conditions. These related to the school head, the Department of Education, parents and students. The school head plays a very important role in Irish primary schools. S/he sets the priorities for the school and these priorities permeate all aspects of school life. If the school head is interested in Irish and keen on technology, this creates a positive environment for CL/CALL deployment. However, if the head is not supportive of Irish and/or wary of technology, then it makes it harder for the individual teacher to use CL/CALL resources in the classroom.

The Department of Education, along with other bodies (e.g. the National Council for Curriculum and Assessment (NCCA)) specify the subjects and the curriculum for primary school students. They inspect schools and teachers and monitor students. As with the school head, if Irish and technology are a focus, then a favourable environment will exist for CL/CALL materials, otherwise, the use of these resources will be limited.

Another important but often invisible factor is enthusiastic, interested parents. If parents are interested in Irish, a positive attitude towards the language will be transmitted to their children. They may be interested in helping their children learn Irish and if they are computer literate, they could use CL/CALL resources to help and/or learn with their children. As the intended deployment context is actually in the school during school hours, interested parents are not a necessary condition for success. However, if they "buy in" to the use of CL/CALL materials

and these materials have resources specifically for parents, it contributes to the development of a good environment for CL/CALL material deployment.

Computer-literate students are another desirable condition. It is not necessary that the students are computer-literate before using CL/CALL resources, as they can be trained to use the computer and the intended resources. However, it is helpful if the students have some basic computer skills as this makes it easier for them to use the materials and limits the cognitive load on the students.

These are the necessary and desirable conditions for the successful deployment of CL/CALL resources for Irish in the primary school context. Even combined, they are probably not sufficient, but if they are met, they can foster a suitable environment for CL/CALL materials deployment.

11.4 Contribution to Knowledge

The main contribution to knowledge is that it is possible to successfully integrate and adapt CL resources in CALL artefacts for Irish for English-medium primary schools in Ireland. Using a wrapper-based approach, the CLICI project demonstrated that even with limited CL resources, it was possible to develop CALL materials that could be used and enjoyed by the target learners. It showed that intelligent (i.e. creative) use of existing CL resources (Uí Dhonnchadha's (2002) Irish Finite State Morphology Engine) could lead to the development of CALL resources, even if the motivation behind the development of the CL resource was not pedagogical in nature. It would seem that focusing on the needs of a particular learner group from the outset enhances the success of an NLP/CALL project. For example, if the fact that there were logistical issues involved in computer access or the lack of internet connectivity were not taken into consideration, unsuitable software may have been developed which would have proved unusable in the target environment.

The CLICI project developed a set of tools (in the non-CALL sense) and an architectural framework that can be used to develop NLP/CALL resources for languages other than Irish. Obviously, the language specific information would have to be provided and adapted by a content developer/software developer, but the basic framework can be used to produce materials for other languages. In this regard, the LGC and VCC are probably most useful. The relative effort required to develop a writing checker engine for a specific language, if one does not already exist, probably outweighs the potential benefits if resources are limited or the target user group is small. This project also compiled the first Computer Learner Corpus (CLC) for Irish. It is very small, but it is the first step on the way to gathering a larger, more comprehensive CLC for Irish. This CLC facilitated the testing and subsequent expansion of the WCC, and it

helped to identify items that were either reported as false-positives or false-negatives by *Gramadóir*.

There are several small contributions to knowledge specifically in the primary school context. The CLICI project showed that even with careful planning, it was unlikely that CALL artefacts would be used comprehensively on a regular basis by the students. Nevertheless, CALL materials have a role as an alternative learning environment for the students, where weaker students can learn at their own pace and the better students can be challenged. The importance of questionnaire design was reaffirmed by this project, especially the need to avoid potentially ambiguous questions. When administering a questionnaire to primary school students, it is important to have the teacher review the questions beforehand and to incorporate any changes suggested. It would also be recommendable to have the teacher present when the students are actually filling out the questionnaire, in order to ensure that the classroom behaviour does not become too boisterous.

Overall, the CLICI project has come up with an approach to the design and development of CL/CALL resources for minority languages in the primary school context that could potentially be used in other similar contexts (e.g. the teaching of Welsh in English-medium primary schools in Wales). It has shown that Colpaert's ADDIE model and in particular his General-Local-Differential-Targeted (GLDT) grid (Chapter 5, Section 5.3) is useful and usable in this context (Ward, 2006). The CLICI project demonstrates that by using Colpaert's GLDT grid and addressing the issues in the Conceptualisation Phase in the Design Phase (Chapter 7. Section 7.4), the CL/CALL designer is forced to consider all the relevant factors, particularly pedagogy, before commencing development. This is essential to the development of successful CL/CALL resources. The CLICI project demonstrates that it is not essential to specify a system in the level of detail outlined by Colpaert (2004), so long as the system is not too big and the design goals and pedagogical philosophy and motivation are clearly stated. The CLICI project reports on the conditions that must be met in order to foster a favourable climate for the deployment of CL/CALL resources in primary schools. CL/CALL researchers working in similar environments can try to ensure that these conditions are addressed in their own particular context when undertaking research and development in this area.

11.5 Suggestions for Future Work

Lesson Generator Component

The current implementation of the LGC is very basic. Initially, some consideration was given to the development of a framework to facilitate migration of existing Irish textbooks to CALL materials, either automatically or semi-automatically. One idea was to develop an intelligent component that would process the existing (electronic) texts and convert them into a format

similar to that of the LGC source files. Several parties in this area were contacted to gauge their level of interest, but they were not particularly interested at that point in time, and therefore, this research direction was not pursued. However, it would be interesting to investigate how this migration could happen and whether or not it would be feasible.

Verb Conjugation Component

It would be interesting to investigate actual student usage of the animated verb information by using student tracking (e.g. Romano-Hvid and Krabbe, 2002; Heift, 2005). Do students really look at the animated presentation? How long do they spend looking at it? It would also be helpful to check for improvement or differences in learning between students with access to the static presentation only, compared to those with access to the dynamic presentation.

Writing Checker Component

The WCC offers the richest area for future research work. Obviously, there is the need to improve the error messages. Heift (2003) has implemented an Error Priority Queue that decides what errors to report – it would be interesting to adapt this approach to the WCC. Also, it would be interesting to continue to expand the Computer Learner Corpus (CLC) for Irish. This could give further insights into what errors the students present in their writing and this information could be used to improve the actually error checking of the Irish Writing Checker. The analysis of the CLC has been very manual thus far, and so another future research direction would be to automate this analysis or, at the very least, establish a tagging system for marking-up the corpus. Granger (2003) outlines how a CLC can be tagged and used for analysis. Recently, Uí Dhonnchadha (2006) has developed a Part-Of-Speech (POS) tagger for Irish. It would be revealing to use this tool to analyse the CLC. Furthermore, it would also be insightful to use POS information to analyse current Irish textbooks to give a better profile of the vocabulary, verbs and general language covered by these textbooks.

Other CALL Resources

The teachers who participated in the CLICI project have come up with some ideas as to the resources that they would like to see for Irish. One is similar to the VCC in that it would involve the animation of other grammatical information e.g. possessives. In theory, this would not be too difficult to produce. A second idea is to have a Text-To-Speech conversion facility for the students. The idea here is that the students would be able to type in free text and have the option of hearing the system say the word or sentence in question. Students already use such a tool for English and, given the difficulties that students have with Irish phonetics, the T5 teacher felt that this would be a useful tool for her students. This would be quite difficult to develop given the lack of a good quality Text-To-Speech (TTS) tool for Irish, although one is in the planning stages (ITTS, 2006) by the Irish Speech Group (ISG, 2006). Advantage could be

taken of the fact that the language produced by the learners will be quite limited. Potential vocabulary could be obtained from analysis of textbooks and, if the system could speak these words, perhaps sufficient coverage could be achieved. This would be an interesting and challenging area of investigation.

The pilot study showed that the students particularly liked hearing their own voices in the CALL materials. It would be useful to develop a mechanism whereby the students could submit their reading of a text and hear those of other students. This would not be too challenging from a technical point of view, but there are logistical issues to be dealt with, including training all the students, deciding when to record, the problem of background noise and the pedagogical desirability of students hearing incorrect readings from other students. Should all students automatically have access to the recordings of all the other students? Or should the have access to the 'good' ones only? Would weaker students be teased about their reading? This demonstrates the point that although something is technically possible, it may not be pedagogically suitable.

Other Users

Colpaert's (2004) GLTD model identified Teachers and Other Actors and their needs as an important part of the Analysis Phase. Due to limited resources, this project focused on the needs of the learners. However, it would be interesting to investigate what CALL resources would be useful for teachers to help them in their lesson planning and to enhance current teaching. Under the umbrella of Other Actors, there are two groups in particular that merit attention when considering Irish language education: the parents and Irish language groups. Many parents have had a negative experience of studying Irish and even if they have a positive attitude towards the language, they are not confident in using it or to help their children with their Irish homework. Hickey (personal communication 2003) suggested that the provision of CALL materials that parents could also use to help their children with their homework would be welcome. There would be several logistical hurdles to be overcome, but it would be an interesting avenue of research and potentially a very valuable resource for the language as a whole. Irish language groups have somewhat disparate agendas but interest in the language and its continued existence and usage is something that unites all of them. Perhaps they would be interested in funding CALL research for Irish, especially outside the mainstream education domains.

Standardisation

Borin (2002) discussed how ICALL applications can be related to various international standards for educational content. These standards agencies include Instructional Management Systems Inc. (IMS), the IEEE's Learning Technology Standards Committee (LTSC), the

American Department of Defence Advanced Distributed Learning (ADL) and the European ARIADNE project. While noting that it may be difficult to attain standardisation goals, Borin points out that the application of educational metadata standards for ICALL applications should be considered. Such standards include Learning Objects Metadata (LOM – Anderson and Wason (2000)), Sharable Content Object Reference Model (SCORM - Dodds (2001)) and content packaging formats (Anderson (2000)). The application of these standards to the CLICI resources or the adaptation of the CLICI resources to these standards could be an avenue of future work.

11.6 Discussion

The objectives of the project were:

1. to investigate if CL resources can be integrated successfully into CALL resources for Irish in the primary school context,
2. to reuse (if possible) existing CL resources in the development of CL/CALL resources for Irish,
3. to find out what conditions are necessary for the successful deployment of CL/CALL resources in this context,
4. to determine if CL resources can be used in CALL for Minority (and Endangered) Languages,
5. to determine if the CL/CALL development template adopted in this project can be of use to these other languages.

With regard to the first objective, although the results are inconclusive, they are by and large positive. The CLICI project shows that CL resources can be integrated successfully into CALL resources for Irish in the primary school context using a wrapper-based approach. Chapter 10, Section 10.9 reviewed the sub-questions related to this main research question. It reports that CL and CALL can be integrated to develop useful CL/CALL artefacts for languages poorly-served by CL resources with limited developer resources. It is not technically difficult to integrate CL resource in CALL – the challenge arises from the translation of the pedagogical goals and objectives into useful (and usable) CL/CALL resources. The CL/CALL artefacts provided by the CLICI system are relatively language independent – at least for languages that use the (extended) Latin alphabet (there may be some issues in the VCC in animating non-Latin characters (e.g. Japanese characters)). The process of developing the CL/CALL artefacts is relatively automatic, with the teacher or content provider being able to specify particular options in the various components. It is worthwhile using quality, external resources, as they provide ready-made resources that can provide good-coverage and are usually robust, and a good deal of effort would required to develop similar resource from scratch. It is worth the effort to develop CL/CALL resources in this context, even if they have been used on a limited basis only. The

students' and teachers' overall positive feedback (T1 and C6), combined with the overall evaluation of the CLICI project, provide an incentive for more research in this area, and indicate that there is plenty of scope for further investigation in this particular context.

11.7 Summary

This chapter provides an overall analysis of the CLICI project. Section 11.2 gives an overview of the project in terms of benefits, findings, difficulties, suggestions for improvements and limitations. The benefits included the development of NLP/CALL resources for Irish, a lesson generation architecture, a system to produce verb animation lessons and a writing checker architecture. The findings included the fact that CALL could be useful for Irish in the primary school context but careful consideration must be given to the logistical issues to ensure their successful deployment. The difficulties mainly pertained to evaluation while the suggestions for improvement included improving the User Interface (UI) for the LGC, adding an image databank to the VCC and the need to improve the comprehensibility of the WCC error messages. The limitations were the fact that the research was carried out specifically in the primary school context and the small-scale nature of the project. Section 11.3 looks at the conditions required for the successful deployment of CL/CALL resources for Irish in the primary school context. The contribution to knowledge is discussed in Section 11.4. It notes that it is possible to integrate CL resources in useful CALL artefacts for Irish for English-medium primary schools in Ireland – the original research question posed by the CLICI project. Section 11.5 outlines some suggestions for future work both on the CLICI components and for other CALL resources and target groups.

Chapter 11 Conclusions

11.1 Introduction

This chapter provides an overall analysis of the CLICI project. Section 11.2 gives an overview of the project in terms of benefits and findings. It also looks at the difficulties encountered as well as suggestions for improvements and the project limitations. Section 11.3 reviews the conditions for successful deployment of CL/CALL resources for Irish in the primary school context. The contribution to knowledge is discussed in Section 11.4. Section 11.5 outlines some suggestions for future work on the CLICI components and in other related areas. Section 11.6 provides a summary of the chapter.

11.2 Project Summary

11.2.1 Positive and Negative Outcomes

NLP/CALL Resources for Irish

The CLICI project provided NLP/CALL resources for Irish that were enjoyable for a large part of the target learner group, although not all found the materials enjoyable and there was room for improvement. Using the Lesson Generator Component (LGC), 12 lessons were created for primary school students based on the class textbook. The Verb Conjugation Component (VCC) enabled production of animated verb lessons for Irish for the main tenses (i.e. past, present and future) studied by primary school students. The Writing Checker Component (WCC) provided a writing checker for young learners, and potentially other beginner level students, of Irish. Most of the students enjoyed learning Irish on the computer and many of them favoured using the CALL resources over learning in class. Leaving aside the (important) question of whether or not their learning was more effective, the fact that they enjoyed using the CLICI resources is welcome given the general lack of interest or enthusiasm for learning the language amongst the students in general. Even though the target user group were young, they were able to identify in their own way some of the benefits of CALL, including privacy ("The computer doesn't shout", "I won't get into trouble if I get it wrong"), self-pacing ("You can take your time") and non-traditional features ("Cause you can play games and get to know more Irish") (Appendix I Survey June 2005).

Lesson Generator Component

The Lesson Generator Component (LGC) and its wrapper technology make it easier to use the CALL Template (Ward, 2001) to develop CALL lessons. It also makes it easier to enter accented characters, as this was one area that was cumbersome in the CALL Template. The LGC significantly shortens the time required to produce a CALL lesson once the content had been decided from a pedagogical point of view. Although the LGC could be used by language teachers, the primary target user of the LGC was a content developer with some basic computer skills and from this point of view, it is a useful tool. However, there is room for further

automation of some parts of the LGC (e.g. the insertion of lesson-related image files). Also, further consideration (and modifications) would be required to the rudimentary LGC interface if a primary school teacher with minimal computer skills (rather than computer-literate content developer) were to use it to generate lessons.

Verb Conjugation Component

The Verb Conjugation Component (VCC) and its wrapper technology make it easy to generate CALL resources for verb conjugation information. It provides an architecture which receives the necessary data and produces animated verb lesson pages. The flexibility provided by the VCC means that it is possible to produce various combinations of verb data, depending on pedagogical requirements. For example, the teacher may want to display only the past tense at the start of the school year, but may wish to show past, present and future tense by the end of the school year. The students enjoyed using the VCC CALL materials as it provided verb information for the students in a new format. The VCC was only tested with a limited number of languages and it is quite possible that the information in the tag structure of the verb data files and the capabilities of the animation software may not meet the requirements of other languages.

Writing Checker Component

The Writing Checker Component (WCC) provides a grammar and spelling checker for students of Irish that, at least to some extent, is usable by young, beginner level learners. It demonstrates that it is possible to build such a CALL artefact using limited resources. It must be noted that the existence of Scannell's (2005) *Gramadóir* was very useful in the development of the WCC, as it provided the underlying engine of the WCC. The WCC provided a wrapper architecture that can be used to create a writing checker for other languages. It also facilitates the collection of learner texts for Irish in a Computer Learner Corpus. Out of the three components (LGC, VCC and WCC) the WCC is the component that would benefit most from further improvements, particularly in terms of how the errors are reported to the learners.

11.2.2 Findings

NLP/CALL

Previous research in the area of NLP/CALL has shown that it is possible to integrate CL techniques in CALL, but this has often been a complex process and usually requires a multidisciplinary team, or at least, multidisciplinary knowledge. Many NLP/CALL projects focus on text-based learning and on form rather than fluency, and the User Interface (UI) is often not given much attention. Beginner level adults are the principal target learner group. The main use of CL technologies in CALL is during-CALL usage (i.e. when the CALL artefact is actually being used by the students), although some projects have looked at pre-CALL usage

(e.g. using CL technologies to develop CALL resources) and a smaller group have investigated post-CALL usage (e.g. learner output analysis). As would be expected, most NLP/CALL artefacts are for the Most Commonly Taught Languages (e.g. English, French or Spanish), although systems do exist for other languages such as Arabic and Japanese. NLP/CALL artefacts seem to be most successful for independent, motivated, analytical learners.

Irish CALL and NLP/CALL

Very few CALL resources exist for Irish, and those that do exist are either aimed at adults or linguistically-aware learners. The quality and correctness of the information contained on some Irish CALL websites is questionable, as they are developed by motivated learners rather than native speakers. CALL is not used in primary schools in Ireland and the teachers are generally unaware of CALL and what it can and cannot contribute to the learning process. There are very few CL resources available for Irish, but some of them e.g. *Gramadóir* and Uí Dhonnchadha's (2002) Irish Finite State Morphology Engine are of a high quality and can be adapted for use in CALL resources. *Fios Feasa* (2003) is an entertaining, high-quality CALL resource for Irish that was financed by *An Gúm* (a state body that publishes Irish language resources). Despite the quality of the product, it has not been extensively deployed in primary schools for reasons of cost and lack-of-fit with the curriculum.

Given the dearth of Irish CALL and NLP/CALL resources, there are many possibilities for the development of suitable materials (e.g. pedagogically appropriate and inexpensive). Using Colpaert's (2004) GLDT grid to analyse the various players and considerations in this area, needs were identified for Learners, Teachers, Technology, Content and Other Actors (e.g. parents and Irish language organisations). However, the socio-cultural position of Irish means that careful consideration must be given to the development and deployment of CALL resources in this context. It appears that as students progress through the educational system, their positive attitude towards Irish diminishes, and if CALL resources are developed for Irish with the aim of increasing student motivation, then it is important to start in the primary school, because negative attitudes begin to harden in secondary school students.

Pilot Study

The pilot study was very useful and would be recommended for those starting to work in a new area of CALL deployment. In the context of the CLICI project, it showed that there was an opportunity to develop and use CALL resources in the primary school in Ireland, but that there was considerable time pressure on some classes due to external events (e.g. entrance examinations or preparations for religious events). Even if teachers were interested in using CALL resources, they did not have the time during the school day to devote to their design and development. Students were comfortable using the computer and were able to use the CALL

materials without any problems. Students particularly liked hearing recordings of themselves and their fellow students speaking Irish in the CALL materials. From a pedagogical point of view, knowing that their voice will be recorded helps to focus the students' attention on pronunciation and motivates them to pay more attention to pronunciation than usual and to reading correctly. Student ownership and participation in the development of course material can enhance the learning process. However, there are logistical issues involved and careful planning is required for this to be worthwhile.

ADDIE Model

Colpaert's ADDIE model (2004) is useful for designing and developing CALL resources in a structured manner. The General Local Differential Targeted (GLDT) grid for Learners, Teachers, Pedagogy, Technology, Content and Other Actors is especially useful for encouraging designers to look at analysis from various different perspectives. The conceptualisation stage of the Design Phase provides a good insight to developers as to why a particular piece of software is required. This provides a more holistic vision of the system to developers, rather than the provision of design specifications only.

CLICI Resources

NLP/CALL resources for Irish can be used in the primary school. However, it is important that students are assigned a specific timeslot during the school week, as otherwise, the materials will not be used on a regular basis. NLP/CALL resources that can be linked to the curriculum/syllabus are more likely to be used than those that are not. Teacher involvement is essential (but not necessarily sufficient) for successful deployment of NLP/CALL resources. Although the effectiveness of the resources in terms of learning outcomes could not be proven, the students generally liked using the resources and this is a helpful finding, especially given the socio-cultural position of Irish. See Section 11.3 below on the contribution to knowledge for a more detailed discussion of this topic.

Evaluation

Evaluation is complex and a multi-faceted approach is required to try to capture what happens when students interact with CALL software. Even if evaluation is considered at the design stage, it is still very challenging to carry it out appropriately. While researchers may be aware of the potential problems associated with good evaluation (e.g. using a control group), they may still have difficulties overcoming them. The various evaluation criteria provided by the CALL community are useful in carrying out structured evaluation.

Technical Findings

The use of the Apache server (Apache, 2006), along with the XML technologies and Perl provided a good environment for the software development aspect of the project. The Apache server was robust and no runtime problems were reported. The XML technologies and Perl were very modular and suited the software design goals. The development of the Flash animation code by Koller (2004) that can read in display information at runtime was extremely useful and facilitated the development of the VCC. It would have been possible to develop it with hard-coded data but it would have been extremely cumbersome and unwieldy.

11.2.3 Difficulties

Evaluation Difficulties

The main difficulty encountered in the CLICI project was in the area of deployment. Although careful consideration had been given to the use of the developed resources (by getting the teacher in C6 to allocate each student a particular timeslot for CALL study), the actual CALL usage differs significantly from the planned usage. This had implications for the evaluation of the CLICI resources and diluted the potential impact of these findings.

Technical Difficulties

There were some minor technical difficulties. These included the initial installation of the *Gramadóir* software on the classroom machines (as the machines were very basic and had only minimal software installed). There were also some very minor difficulties installing the correct version of Macromedia's Flash resources on the target machines. More annoyingly, there were problems copying data from the classroom machines. There were problems with the floppy disk drives, and as the PCs were not CD Read/Write-enabled nor had internet access, it was at times frustrating to take a copy of the students' data for off-site analysis.

11.2.4 Improvements

The User Interface (UI) of the LGC could be improved. Currently it assumes that the user is comfortable working with plain text files. While the format of the files is relatively straightforward, it could definitely be improved upon so that others could also use them. The VCC could be improved by using pictures that depict the action of the verb. A databank of images relating to the most common verbs would be required so that the relevant picture could automatically be associated with a given verb display page. It might also be useful to provide an authoring facility for the teacher to specify what verb information (e.g. tense and person) is required (currently this is specified in a plain text file).

First and foremost, the WCC could be improved by investigating why the students had problems understanding the error messages and amending the messages so that they are comprehensible

by them. The local error checking could be extended to cover typical errors from primary school learners that are not detected by *Gramadóir*. This would involve gathering a larger learner corpus and analysing it for errors. Although the students did not report it as a problem, the time required for *Gramadóir* (and hence the WCC) to report back to the students could be shortened. The WCC could also be improved by providing a facility to print out selected user texts in a suitable format so that the students could display their texts in an end-of-year scrapbook and retain them for future reference.

11.2.5 Limitations

Obviously, a small-scale project such as the CLICI project has several limitations. It only focused on a specific learner group and therefore its findings can only be considered relevant to this particular group, i.e. children in English-medium primary schools in Ireland. One of the main limitations of the project is that the CLICI resources were not used as extensively as initially planned. This means that the longitudinal aspect of the research was not as insightful as initially hoped. However, it could be interpreted as a realistic reflection of actual classroom usage where the students are not participating in a research project and the findings have some value in this regard.

The LGC is inherently linked with the CALL Template and in its current state cannot be used to feed into other CALL templates or authoring environments. The VCC only deals with three tenses (past, present and future), although it could be extended as required. The WCC only checks for those errors detected by *Gramadóir*, plus the locally specified errors.

11.3 Conditions for Successful Deployment of CL/CALL resources for Irish in Primary Schools

This section first reviews the necessary conditions for the successful deployment of CL/CALL resources for Irish in the primary school context and then looks at the desirable conditions.

Necessary Conditions

There are several necessary (but probably not sufficient) conditions for the successful deployment of CL/CALL resources for Irish in primary schools. The order in which these conditions are discussed is not significant. It is important that the learners have access to suitable hardware. Suitable hardware does not imply the fastest, most powerful machine available, but it means that the hardware should be able to run the CL/CALL resources adequately and that external devices (e.g. headphones) are in working order and comfortable to use.

The CL/CALL resources (software) should be pedagogically-driven, focused, reliable, interesting, flexible and varied. In theory, pedagogically-driven resources would have these

characteristics but it is worthwhile stating them explicitly. Focused implies that the resources have a learning goal. Reliable means that the resources must be correct, consistent and robust (i.e. the software does not crash). Flexible indicates that they should cater for students of different ability levels, while varied means that the resources should have different components or formats. The adjective "interesting" is hard to specify objectively and it is probably easier to identify a "boring" resource than an "interesting" one. However, within the context of this project, "interesting" resources implies resources that are enjoyable to use, engage the learner and encourage system interaction.

Another key component is the teacher. The teacher must be interested in and motivated to use CALL. S/he must believe in the potential benefits that CL/CALL materials offer learners and be willing to set aside time for the students to use these resources. Ideally, the teacher would have some CALL knowledge and have some basic computer skills.

If any of these three conditions are not met, it is highly unlikely that CL/CALL resources would/could be used successfully in the primary school context.

Desirable Conditions

Following on from the necessary conditions, there are several desirable conditions. These related to the school head, the Department of Education, parents and students. The school head plays a very important role in Irish primary schools. S/he sets the priorities for the school and these priorities permeate all aspects of school life. If the school head is interested in Irish and keen on technology, this creates a positive environment for CL/CALL deployment. However, if the head is not supportive of Irish and/or wary of technology, then it makes it harder for the individual teacher to use CL/CALL resources in the classroom.

The Department of Education, along with other bodies (e.g. the National Council for Curriculum and Assessment (NCCA)) specify the subjects and the curriculum for primary school students. They inspect schools and teachers and monitor students. As with the school head, if Irish and technology are a focus, then a favourable environment will exist for CL/CALL materials, otherwise, the use of these resources will be limited.

Another important but often invisible factor is enthusiastic, interested parents. If parents are interested in Irish, a positive attitude towards the language will be transmitted to their children. They may be interested in helping their children learn Irish and if they are computer literate, they could use CL/CALL resources to help and/or learn with their children. As the intended deployment context is actually in the school during school hours, interested parents are not a necessary condition for success. However, if they "buy in" to the use of CL/CALL materials

and these materials have resources specifically for parents, it contributes to the development of a good environment for CL/CALL material deployment.

Computer-literate students are another desirable condition. It is not necessary that the students are computer-literate before using CL/CALL resources, as they can be trained to use the computer and the intended resources. However, it is helpful if the students have some basic computer skills as this makes it easier for them to use the materials and limits the cognitive load on the students.

These are the necessary and desirable conditions for the successful deployment of CL/CALL resources for Irish in the primary school context. Even combined, they are probably not sufficient, but if they are met, they can foster a suitable environment for CL/CALL materials deployment.

11.4 Contribution to Knowledge

The main contribution to knowledge is that it is possible to successfully integrate and adapt CL resources in CALL artefacts for Irish for English-medium primary schools in Ireland. Using a wrapper-based approach, the CLICI project demonstrated that even with limited CL resources, it was possible to develop CALL materials that could be used and enjoyed by the target learners. It showed that intelligent (i.e. creative) use of existing CL resources (Uí Dhonnchadha's (2002) Irish Finite State Morphology Engine) could lead to the development of CALL resources, even if the motivation behind the development of the CL resource was not pedagogical in nature. It would seem that focusing on the needs of a particular learner group from the outset enhances the success of an NLP/CALL project. For example, if the fact that there were logistical issues involved in computer access or the lack of internet connectivity were not taken into consideration, unsuitable software may have been developed which would have proved unusable in the target environment.

The CLICI project developed a set of tools (in the non-CALL sense) and an architectural framework that can be used to develop NLP/CALL resources for languages other than Irish. Obviously, the language specific information would have to be provided and adapted by a content developer/software developer, but the basic framework can be used to produce materials for other languages. In this regard, the LGC and VCC are probably most useful. The relative effort required to develop a writing checker engine for a specific language, if one does not already exist, probably outweighs the potential benefits if resources are limited or the target user group is small. This project also compiled the first Computer Learner Corpus (CLC) for Irish. It is very small, but it is the first step on the way to gathering a larger, more comprehensive CLC for Irish. This CLC facilitated the testing and subsequent expansion of the WCC, and it

helped to identify items that were either reported as false-positives or false-negatives by *Gramadóir*.

There are several small contributions to knowledge specifically in the primary school context. The CLICI project showed that even with careful planning, it was unlikely that CALL artefacts would be used comprehensively on a regular basis by the students. Nevertheless, CALL materials have a role as an alternative learning environment for the students, where weaker students can learn at their own pace and the better students can be challenged. The importance of questionnaire design was reaffirmed by this project, especially the need to avoid potentially ambiguous questions. When administering a questionnaire to primary school students, it is important to have the teacher review the questions beforehand and to incorporate any changes suggested. It would also be recommendable to have the teacher present when the students are actually filling out the questionnaire, in order to ensure that the classroom behaviour does not become too boisterous.

Overall, the CLICI project has come up with an approach to the design and development of CL/CALL resources for minority languages in the primary school context that could potentially be used in other similar contexts (e.g. the teaching of Welsh in English-medium primary schools in Wales). It has shown that Colpaert's ADDIE model and in particular his General-Local-Differential-Targeted (GLDT) grid (Chapter 5, Section 5.3) is useful and usable in this context (Ward, 2006). The CLICI project demonstrates that by using Colpaert's GLDT grid and addressing the issues in the Conceptualisation Phase in the Design Phase (Chapter 7. Section 7.4), the CL/CALL designer is forced to consider all the relevant factors, particularly pedagogy, before commencing development. This is essential to the development of successful CL/CALL resources. The CLICI project demonstrates that it is not essential to specify a system in the level of detail outlined by Colpaert (2004), so long as the system is not too big and the design goals and pedagogical philosophy and motivation are clearly stated. The CLICI project reports on the conditions that must be met in order to foster a favourable climate for the deployment of CL/CALL resources in primary schools. CL/CALL researchers working in similar environments can try to ensure that these conditions are addressed in their own particular context when undertaking research and development in this area.

11.5 Suggestions for Future Work

Lesson Generator Component

The current implementation of the LGC is very basic. Initially, some consideration was given to the development of a framework to facilitate migration of existing Irish textbooks to CALL materials, either automatically or semi-automatically. One idea was to develop an intelligent component that would process the existing (electronic) texts and convert them into a format

similar to that of the LGC source files. Several parties in this area were contacted to gauge their level of interest, but they were not particularly interested at that point in time, and therefore, this research direction was not pursued. However, it would be interesting to investigate how this migration could happen and whether or not it would be feasible.

Verb Conjugation Component

It would be interesting to investigate actual student usage of the animated verb information by using student tracking (e.g. Romano-Hvid and Krabbe, 2002; Heift, 2005). Do students really look at the animated presentation? How long do they spend looking at it? It would also be helpful to check for improvement or differences in learning between students with access to the static presentation only, compared to those with access to the dynamic presentation.

Writing Checker Component

The WCC offers the richest area for future research work. Obviously, there is the need to improve the error messages. Heift (2003) has implemented an Error Priority Queue that decides what errors to report – it would be interesting to adapt this approach to the WCC. Also, it would be interesting to continue to expand the Computer Learner Corpus (CLC) for Irish. This could give further insights into what errors the students present in their writing and this information could be used to improve the actually error checking of the Irish Writing Checker. The analysis of the CLC has been very manual thus far, and so another future research direction would be to automate this analysis or, at the very least, establish a tagging system for marking-up the corpus. Granger (2003) outlines how a CLC can be tagged and used for analysis. Recently, Uí Dhonnchadha (2006) has developed a Part-Of-Speech (POS) tagger for Irish. It would be revealing to use this tool to analyse the CLC. Furthermore, it would also be insightful to use POS information to analyse current Irish textbooks to give a better profile of the vocabulary, verbs and general language covered by these textbooks.

Other CALL Resources

The teachers who participated in the CLICI project have come up with some ideas as to the resources that they would like to see for Irish. One is similar to the VCC in that it would involve the animation of other grammatical information e.g. possessives. In theory, this would not be too difficult to produce. A second idea is to have a Text-To-Speech conversion facility for the students. The idea here is that the students would be able to type in free text and have the option of hearing the system say the word or sentence in question. Students already use such a tool for English and, given the difficulties that students have with Irish phonetics, the T5 teacher felt that this would be a useful tool for her students. This would be quite difficult to develop given the lack of a good quality Text-To-Speech (TTS) tool for Irish, although one is in the planning stages (ITTS, 2006) by the Irish Speech Group (ISG, 2006). Advantage could be

taken of the fact that the language produced by the learners will be quite limited. Potential vocabulary could be obtained from analysis of textbooks and, if the system could speak these words, perhaps sufficient coverage could be achieved. This would be an interesting and challenging area of investigation.

The pilot study showed that the students particularly liked hearing their own voices in the CALL materials. It would be useful to develop a mechanism whereby the students could submit their reading of a text and hear those of other students. This would not be too challenging from a technical point of view, but there are logistical issues to be dealt with, including training all the students, deciding when to record, the problem of background noise and the pedagogical desirability of students hearing incorrect readings from other students. Should all students automatically have access to the recordings of all the other students? Or should the have access to the 'good' ones only? Would weaker students be teased about their reading? This demonstrates the point that although something is technically possible, it may not be pedagogically suitable.

Other Users

Colpaert's (2004) GLTD model identified Teachers and Other Actors and their needs as an important part of the Analysis Phase. Due to limited resources, this project focused on the needs of the learners. However, it would be interesting to investigate what CALL resources would be useful for teachers to help them in their lesson planning and to enhance current teaching. Under the umbrella of Other Actors, there are two groups in particular that merit attention when considering Irish language education: the parents and Irish language groups. Many parents have had a negative experience of studying Irish and even if they have a positive attitude towards the language, they are not confident in using it or to help their children with their Irish homework. Hickey (personal communication 2003) suggested that the provision of CALL materials that parents could also use to help their children with their homework would be welcome. There would be several logistical hurdles to be overcome, but it would be an interesting avenue of research and potentially a very valuable resource for the language as a whole. Irish language groups have somewhat disparate agendas but interest in the language and its continued existence and usage is something that unites all of them. Perhaps they would be interested in funding CALL research for Irish, especially outside the mainstream education domains.

Standardisation

Borin (2002) discussed how ICALL applications can be related to various international standards for educational content. These standards agencies include Instructional Management Systems Inc. (IMS), the IEEE's Learning Technology Standards Committee (LTSC), the

American Department of Defence Advanced Distributed Learning (ADL) and the European ARIADNE project. While noting that it may be difficult to attain standardisation goals, Borin points out that the application of educational metadata standards for ICALL applications should be considered. Such standards include Learning Objects Metadata (LOM – Anderson and Wason (2000)), Sharable Content Object Reference Model (SCORM - Dodds (2001)) and content packaging formats (Anderson (2000)). The application of these standards to the CLICI resources or the adaptation of the CLICI resources to these standards could be an avenue of future work.

11.6 Discussion

The objectives of the project were:

1. to investigate if CL resources can be integrated successfully into CALL resources for Irish in the primary school context,
2. to reuse (if possible) existing CL resources in the development of CL/CALL resources for Irish,
3. to find out what conditions are necessary for the successful deployment of CL/CALL resources in this context,
4. to determine if CL resources can be used in CALL for Minority (and Endangered) Languages,
5. to determine if the CL/CALL development template adopted in this project can be of use to these other languages.

With regard to the first objective, although the results are inconclusive, they are by and large positive. The CLICI project shows that CL resources can be integrated successfully into CALL resources for Irish in the primary school context using a wrapper-based approach. Chapter 10, Section 10.9 reviewed the sub-questions related to this main research question. It reports that CL and CALL can be integrated to develop useful CL/CALL artefacts for languages poorly-served by CL resources with limited developer resources. It is not technically difficult to integrate CL resource in CALL – the challenge arises from the translation of the pedagogical goals and objectives into useful (and usable) CL/CALL resources. The CL/CALL artefacts provided by the CLICI system are relatively language independent – at least for languages that use the (extended) Latin alphabet (there may be some issues in the VCC in animating non-Latin characters (e.g. Japanese characters)). The process of developing the CL/CALL artefacts is relatively automatic, with the teacher or content provider being able to specify particular options in the various components. It is worthwhile using quality, external resources, as they provide ready-made resources that can provide good-coverage and are usually robust, and a good deal of effort would required to develop similar resource from scratch. It is worth the effort to develop CL/CALL resources in this context, even if they have been used on a limited basis only. The

students' and teachers' overall positive feedback (T1 and C6), combined with the overall evaluation of the CLICI project, provide an incentive for more research in this area, and indicate that there is plenty of scope for further investigation in this particular context.

11.7 Summary

This chapter provides an overall analysis of the CLICI project. Section 11.2 gives an overview of the project in terms of benefits, findings, difficulties, suggestions for improvements and limitations. The benefits included the development of NLP/CALL resources for Irish, a lesson generation architecture, a system to produce verb animation lessons and a writing checker architecture. The findings included the fact that CALL could be useful for Irish in the primary school context but careful consideration must be given to the logistical issues to ensure their successful deployment. The difficulties mainly pertained to evaluation while the suggestions for improvement included improving the User Interface (UI) for the LGC, adding an image databank to the VCC and the need to improve the comprehensibility of the WCC error messages. The limitations were the fact that the research was carried out specifically in the primary school context and the small-scale nature of the project. Section 11.3 looks at the conditions required for the successful deployment of CL/CALL resources for Irish in the primary school context. The contribution to knowledge is discussed in Section 11.4. It notes that it is possible to integrate CL resources in useful CALL artefacts for Irish for English-medium primary schools in Ireland – the original research question posed by the CLICI project. Section 11.5 outlines some suggestions for future work both on the CLICI components and for other CALL resources and target groups.

Publications Associated with the CLICI Research Project

Journal Articles

Ward, M., 2006. Using Software Design Methods in CALL. Computer Assisted Language Learning, Vol. 19, No. 2-3, Special edition of CALL: Software Design and Development (Hemard, D., and Cushion, S. pp.129-147. Apr 2006 (Invited Paper)

Ward, M, 2004. The Additional Uses of CALL in the Endangered Language Context. *ReCALL, Vol. 16, No. 2,* November 2004.

Book Reviews

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Presentations

Ward, M., 2005. Guided Autonomy in the Primary School Context. EuroCALL Conference 2005, Cracow, Poland, August 2005.

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Ward, M., 2004. Integrating methodologies from other fields into CALL. 11th International CALL Conference, Antwerp Belgium, September 2004.

Other

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Appendix A Ethics Information

DUBLIN CITY UNIVERSITY
Plain Language Statement

This project aims to see if students enjoy and benefit from learning Irish on the computer. The researcher, Monica Ward, works in the School of Computing, in Dublin City University.

The student will use the computer to learn Irish. There will be lessons, some information on verbs and a part to help him write stories in Irish. There will be games and quizzes and sometimes he will be asked to write what he thinks about the system.

Students may enjoy learning Irish on the computer as they can learn at their own pace, in private and do the games and quizzes as many times as they like. They will be able to hear some of the lesson and also get help with writing stories in Irish.

During the school year, the student's work will be saved using their name. Afterwards, with consent, it will be stored anonymously (subject to legal limitations).

If consent is not provided, the relevant data will be destroyed.

All student participation is voluntary and a student can withdraw from the study at any time.

If participants or their parents/guardian have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Office of the Vice-President for Research, Dublin City University, Dublin 9. Tel 01-7008000

DUBLIN CITY UNIVERSITY
Informed Consent Form

Project title: Computer Assisted Language Learning for Irish in the Primary School
Researcher: Monica Ward, Dublin City University

The purpose of this project is to find out how a computer can help students learn Irish. The Plain language Statement (separate page) explains more about the project.

Do you understand the information provided? Yes/No

Participants may withdraw from the Research Study at any point. There will be no penalty for withdrawing before all stages of the Research Study have been completed.

The data will be stored anonymously once the school year is over. Note that the confidentiality of information provided is subject to legal limitations.

I have read and understood the information in this form. My questions and concerns have been answered by the researcher, and I have a copy of this consent form.

Therefore, I consent that (child's name) _____ takes part in this research project.

Parent's/Guardian's Signature: _____

Name in Block Capitals: _____

Child's Signature: _____

Name in Block Capitals: _____

Date: _____

Appendix B Colpaert's Functionalities Table

	Functionality	Definition
Application Level		
System Processing	System saves tracking information	All quantitative and qualitative data about student behaviour and performance are analysed and summarized before closing the application so that they can be saved, printed or sent)
	System upgrades software	At program startup, a program can check through FTP whether a new version of the software or the database is available on the vendor's server.
	System retrieves/saves Modus	While closing, a program can save - or at startup, reload – information on: • the situation of the learner so that (s)he can resume where (s)he temporarily left the program • the selections made by the system, the teacher, or the learner on the Modus level
	System adapts learner Modus	A program can also modify its own behaviour based on an analysis of frequent learner actions and on student performance. Examples are self-adapting menu systems in Office programs.
	System applies administrative rules	Administrative routines (in software engineering called "business rules") check the user's identity, determine whether he/she is authorized to use the program, how the program should be used, and for how long.
User Input	Learner logs in/off	Applications may require the learner to log in, use an ID, apply administrative rules, store tracking information, and load and save the modus. A similar application may identify where the learner last left off and allow him/her to resume at that point if desired.
	Learner sends/prints/saves learner report	The program can automatically save and/or send reports and tracking information, but designers can also allow the learner to determine when and for/to whom this information should be saved or forwarded.
	Learner chooses Modus	The user can select a particular modus previously saved by the system, the learner, or the teacher.
	Learner gives feedback to software and content	Learners can input their comments, suggestions, and corrections for the designer, content provider, and developer.
	Learner asks general help	On the application level, the user should be able to ask for information about the program itself, on the rationale behind it, and on the development team.
	Teacher defines modus	These functionalities allow teachers to adapt and save the modus for particular students or groups of students. Examples are restricted menu systems, tailor-made lessons, etc.
	Designer adapts modus	Designers should be able to adjust the behaviour of a program without having to recompile it or upload it again to the server.
	Content provider updates content	Content providers should be able to update content without have to recompile the program or convert the database.

	Functionality	Definition
System Output	System generates learning report for learner	This learning report can be shown on a separate window or saved in a text file.
	System generates learning report for teacher	The learning report for the teacher may contain other information than learner reports. In some cases, it might be useful that the report is uploaded on a server or sent to the teacher, without the learner having access to it.
	System generates learning report for designers	Designers may (rather should) be interested in information on the actual learning process.
	System generates usage report for designers	The usage report may contain information on actual usage (duration, moment, paths followed …)
	System generates learner feedback for designers	The system transmits learner feedback to designers in a separate file or by e-mail.
	System generates learning report for content providers	The system transmits a learning report to content providers in a separate file or by e-mail.
	System generates usage report for content providers	The usage report may contain information on the actual usage of specific parts of the content.
	System generates learner/teacher feedback on content	The system transmits learner feedback to designers in a separate file or by e-mail.
	System generates learning report for parents	The system can allow parents to track the learner's progress through a detailed overview of all exercises made, indicating potential learning problems.
Modus Level		
System Processing	System tracks Modus	Tracking of user-initiated or system-initiated selections during program execution
	System loads Modus	Preparation by the system of the selection system based on system parameters and rules, or previously saved information
User Input	Learner makes choices	The learner makes selections through the use of pop-up or pull-down menu systems, toolbars, and option windows.
System Output	System presents Modus to learner	Through pop-up or pull-down menu systems, toolbars, option windows.
Document Level		
System Processing	System stores tracking information	The system can analyse and store tracking information on Document level.
	System retrieves data	Before loading the document itself, the system should retrieve the data.
	System generates items	The system transforms the data in a sequence of items as tasks.
	System formats document	The system formats the series of items into an interactive document. This functionality includes the sequencing (random, adaptive, fixed) of items.

	Functionality	Definition
User Input	Learner asks context-sensitive help (CSH)	Context-sensitive help on Document level applies to information about the task or exercise type, grammar and manual. The user can access this information by using a menu system, pressing F1 or clicking on a toolbar button.
	Learner navigates between items	In some circumstances, there may be reasons for not allowing the user to navigate between items (e.g. adaptive testing). In case the designer wishes to allow the user to skip items or to jump to another item at will, this possibility should be clearly indicated.
	Learner exists document temporarily	The possibility to leave the program temporarily can also be clearly indicated in the menu system or in the toolbar, and even made accessible through a shortcut.
	Learner prints, saves, sends document	These are standard functionalities that should be represented in the interface in a way comparable to most software applications.
System Output	System shows document	After retrieving and loading data, and after formatting the document (loading the data onto objects and applying the appropriate sequencing), the system calculates the position and size of every object according to the screen size and resolution.
	System shows score and evaluation	During exercise completion or when the exercise has been completed, the program can show the score, an analysis of the results and some kind of general feedback.
Item Level		
System Processing	System tracks item	Tracking of number of attempts, given answers, errors, and actions on items.
	System processes input	The system processes user input, both spoken and written.
	System evaluates input	The system analyses the learner's input by comparing it with a set of acceptable answers. This analysis can be parsing, string matching or spectral analysis.
User Input	Learner asks context-sensitive help (CSH)	Context-sensitive help on item level, considered as "enhanced input" (Chapelle 2003, 40) consists in providing translation, simplification, grammatical explanation or pronunciation for the item. This type of help can be provided by a pop-up menu system, which appears when right-clicking on a particular word.
	Learner navigates	Navigation on item levels is based on a number of degrees of freedom for the user to open and explore additional resources such as a browser, dictionary or grammar, while remaining on the same active item.
	Learner inputs answer	Answer input can be performed through typing, clicking, dropping, speaking, classifying, rearranging and so forth.
System Output	System presents item	The presentation of items is not only a question of font and colours. It is also a matter of determining the sequence of item elements, and whether words should be visible or not (hidden acceptable answers, gaps, etc.).
	System generates feedback	Feedback is the most frequently mentioned functionality in CALL literature. Several researchers emphasise the importance of feedback steps, sequences, and layers, and insist on its form. The ultimate goal is intelligent feedback.

Table B.1 Colpaert's (2004) Functionalities Table with Explanations

Appendix C Corpora Analysis and Comparison

This appendix provides some data on the learner corpus and compares it with data from other corpora. Table C.1 shows a comparison of the top 10 words in various Irish corpora. Table C.2 provides information on the abbreviations in Table C.2.

Parameter	TB	LC	CLC	NCI
Avg S length	6	4	6	
Shortest S	3	1	4	
Longest S	14	20 (10)	19	
No. of S	114	223	41	
No. of words	697	847	256	
No. of distinct words	274	237*	126	
No. of lemmas	225	202*	119	
Ave. text size	8	*	6	
Top 10 words	*an, ag, sé, Bhí, agus, ar, D, Is, arsa, Eoin*	*an, tá, mé, ar, Sa, ag, sé, Ní, mbord, Is/Chonaic/Bhí*	*mé, an, Bhí, Mo, lá, agus, Tá, ag, a, go*	*a, an, ar, agus, na, go, i, ag, le, is*
No. in NCI Top 10	5	4	5	
Words not in Top 10 and place	*sé* (11) , *Bhí* (12), *D*, *arsa* (110), *Eoin*	*Tá* (18), *mé* (38), *sa*, *sé* (11), *ní*, *mbord*, *chonaic*, *Bhí* (12)	*mé* (38), *Bhí* (12), *mo* (57), *lá* (73), *tá* (18)	

Table C.1 Comparison of Top 10 Words in Irish Corpora

* The LC corpus does not contain all the sentences of each text (see below). It contains the correct and one or more incorrect versions of given sentences, so there is a lot of repetition. Therefore, the data must be understood in this context.

Legend:

Parameter	Meaning
TB	Textbook
LC	Learner Corpus
CLC	Computer Learner Corpus
NCI	National Corpus of Irish (ITÉ, Uí Dhonnchadha (2002))
Ave S length	Average sentence length over entire corpus
Shortest S	Shortest sentence in the corpus
Longest S	Longest sentence in the corpus
No. of S	The number of sentences in the corpus
No. of words	The number of distinct words in the corpus
No. of lemmas	The number of lemmas in the corpus
Ave. text size	The average size of each text
Top 10 words	The 10 most frequent words in the corpus

Table C.2 Legend for Table C.1

Notes:

Textbook

The textbook was *Inis Dom* 3 (Breatnach, L., 2001), lessons 4 – 16.

Learner Corpus

The learner corpus was gathered from sentences copied from the students' copybooks (3rd class students, academic year 2004-5). The texts mainly consisted of sentences copied either from the blackboard or the textbook. There were very few student-produced sentences. Therefore, most of the student texts were very similar in content. Correct and incorrect sentences were entered by the researcher into the corpus. The sources were kept anonymous. Out of the class of 29, 26 students study Irish, 10 distinct student copybooks were used.

Computer Learner Corpus

This corpus was gathered from the pilot phases of the Writing Checker Component (WCC). It consists of texts that were submitted by the students to the Writing Checker. The students were 4th class students and the texts were entered between Feb and June 2005. The students were free to write whatever they wished, and although they wrote original texts, naturally there is some influence from textbook and classroom materials.

Observations:

- "*an*" (the definite article) is the most frequent word in the TB and LC corpora. "*mé*" (me) is the most frequent word in the CLC corpus, closely followed by "*an*". This is probably due to the fact that the texts in the CLC corpus were student compositions, in which they could write whatever they wanted.
- In the student learner corpus, the sentences tend to be longer than in the LC (from copybooks).

Appendix D Mapped Error Messages
This appendix shows the *Gramadóir* error messages and their CLICI equivalent.

Gramadóir Msg	CLICI Msg
	Humm, there might be an error here
Comparative adjective required	You need a word for comparison here
Definite article required	'an' required
Eclipsis missing	You need a letter at the start of the word
Initial mutation missing	You need a letter at the start of the word PHRASE
Lenition missing	You might be missing a 'h' here
Often the preposition	Often the word xxx means that you should add a 'h', but I'm not sure here
Prefix \/d'\/ missing	You need a 'd' here
Prefix \/h\/ missing	You need a 'h' at the start of the word
Prefix \/t\/ missing	You need a 't' at the start of the word
Repeated word	Repeated word
Subjunctive	The word is not correct
The dative is used only in special phrases	This form of the word is only used in special phrases.
The dependent form of the verb	The verb is not correct
The genitive case	You need to add something here
The singular form	???
The word \/Dé\/ is not needed	You don't need the word \/Dé\/ here
Unnecessary eclipsis	You do not need a letter before the word here
Unnecessary initial mutation	You don't need the letter at the start of the word PHRASE
Unnecessary lenition	You do not need a 'h' here
Unnecessary prefix \/d\'\/	You don't need a d' at the start of the word
Unnecessary prefix \/h\/	You don't need a 'h' at the start of the word
Unnecessary prefix \/t\/	You don't need a 't' at the start of the word
Unnecessary use of the definite article	You don't need an here
Unnecessary use of the dependent form	The verb is not correct
Unnecessary use of the genitive case	You don't need a letter at the start of the word
Unusual combination	Unusual combination
You should use \/na\/ here instead	You should use \/na\/ here instead

Table D.1 *Gramadóir* Error Messages and their CLICI Equivalent

Appendix E Errors Detected
This appendix shows the error corrections offered by the CLICI system.

Error Corrections in CLICI

Error	Error Type	Example/Correction	*Gramadóir*	CLICI	How
Ar	NH	*An bhfuil hata tú.*			
Ar an	AC	*D'fhéach sé ar an biachlár ar an mbord.*	`Initial mutation missing`		
Ar an	FN	*Cheannaigh mé **ar** an tolg inné.* *Cheannaigh mé an tolg inné.*		Maybe the word **ar** is not needed here	If the word after the verb part is "ar", report error
Ar an	AC	*Chonaic sé ar an biachlár ar an mbord.*	`Initial mutation missing`	Maybe the word **ar** is not needed here	If the word after the verb part is "ar", report error
Ar an – extra	FN	*Chuir mé **ar** an spúnóg ar an mbord.* *Chuir mé an spúnóg ar an mbord.*		Maybe the word **ar** is not needed here	If "ar an" found (and not mbord), report error
Ar an – extra	AC	*Bhris mé **ar** an cathair.* *Bhris mé an cathair.*	`Initial mutation missing`	Maybe the word **ar** is not needed here	If "ar an" found (and not mbord), report error
Ar an – missing	AC	*Tá trí gloine atá an mbord.* *Tá trí gloine atá **ar** an mbord.*	`Unnecessary eclipsis`	Maybe you should have **ar an mbord**	Suggest "ar an mbord" when "an mbord" found
Ar an – missing	AC	*Tá dhá mhasc mbord.* *Tá dhá mhasc **ar an** mbord.*	`Unnecessary eclipsis`	Maybe you should have **ar an mbord**	Suggest "ar an mbord" when "an mbord" found
Article	NH	*Chonaic mé teilifís inné.* *Chonaic mé **an** teilifís inné.*			
Article	FN	*Ní dheachaigh Sé go dtí Sorcas.* *Ní dheachaigh Sé go dtí **an** Sorcas.*		Maybe you should have **an** after the words **go dtí**	If "go dtí" and no "an" after, report error

Error	Error Type	Example/Correction	*Gramadóir*	CLICI	How
Ca	FN	*Tá fhios agam cá an milseán.* *Tá fhios agam cá **bhfuil** an milseán.*		You might be missing **bhfuil** here	If "fhois" and "ca" and no "bhfuill", report error
Capital	PC	*Tá ciara ag léamh.* *Tá **Ciara** ag léamh.*		**ciara** should start with a capital letter	If word in list of proper nouns and not upper case, report error
Capital	PC	*Shuigh ciara agus Maire sa suite ar an tolg.* *Shuigh **Ciara** agus Maire sa suite ar an tolg.*	`It seems unlikely that you intended to use the subjunctive here (Maire)`	**ciara** should start with a capital letter	If word in list of proper nouns and not upper case, report error
False – *Aoine*	AC	*Bhí sé ceonmúr dé hAoine.* *Bhí sé ceonmúr **D**é hAoine.*	`Unnecessary prefix /h/`	You need a capital letter **D** at the start of the word **dé** .	Check for "Aoine" in error message
False – *bhfuil*	FP	*Tá fhios agam cá **bhfuil** na milseán.* *(Original correct)*	`Unnecessary use of the genitive case`		Check for "bhfuil" in error message
False – lenition	FP	*Fuair **Ríona** páipéar.* *(Original correct)*	`Unnecessary use of the genitive case`		Check for "Fuair" in error message
Isteach	FN	*Shuil Eoin isteach seomra folctha.* *Shuil Eoin isteach **sa** seomra folctha.*		Maybe you should have **sa** after the word **isteach**	If "isteach" and not "sa", report error
Missing	NH	*Bhí na simpson's.*			
Missing	NH	*Bhí na simpson's ar súil.*			

Error	Error Type	Example/Correction	*Gramadóir*	CLICI	How
Na	MC	*Ní Seán an trí úll.*	You should use /na/ here instead	You should use **na** here instead	
Nios	MM	*Tá liathroid bheag aige ach tá liathroid níos beag aici.* *Tá liathroid bheag aige ach tá liathroid níos **lú** aici.*	`Comparative adjective required`	You need a word for comparison here.	Message mapped
Níos	MC	*Tá bosca beag agam ach tá níos bosca lú agat..*	`Usually used in the set phrase /níos lú, is lú/`	Usually used in the set phrase /níos lú, is lú/	Copy original message
Níos	MC	*Tá bosca beag agam ach agat tá níos bosca lú.*	`Usually used in the set phrase /níos lú, is lú/`	Usually used in the set phrase /níos lú, is lú/	Copy original message
Sa	FN	*Bhí Luas seomra codlata.*		Maybe you should have **sa** before the word **seomra**	
Sa	XX	*Bhí sa bainne sa chrúiscín.*	`Lenition missing`	Are you sure the word **sa** is OK here? You might be missing a **'h'** here.	????
Sa	XX	*Ithi mo caloga sa gach maidin.*	`Lenition missing`	Maybe you are missing a word between **sa** and **gach**You might be missing a **'h'** here.	???
Sa	NH	*Chuaigh Ciara sa bhialann inné.*			
Verb - *Chonaic*	NH	*Chonaic sé fearg.*			
Verb - *Chonaic*	FN	*Chonaic cití **ar** an chrúiscín.* *Chonaic cití an chrúiscín.*		Maybe the word **ar** is not need here	If the word after the verb part is "ar", report error
Verb - *Feach*	FN	*Féach mé cartún ar an teilifís.*		You need a word like **orm, ort, air, uirthi, ar** here	???

Error	Error Type	Example/Correction	*Gramadóir*	CLICI	How
Verb - *Feidir*	FN	*Ní féidir rith.*		You need a word like **liom, leat, leis, lei** here	If "féidir" and no "le" word, report error
Verb – missing person	FN	*Cuireann calóga isteach sa bhabhla.* *Cuireann **mé** calóga isteach sa bhabhla.*		You are missing the person (i.e. **mé, tú, sé, sí)** after the word **Cuireann**	If "..ann" and no person, report error
Verb - Negative	NH	*Ní shuil Eoin sa chistin.* ***Níor** shuil Eoin sa chistin.*			
Verb – Negative	XX	*Ní bhfaca Luas cupán.* ***Níor** bhfaca Luas cupán.*	`You should use /ní-or/ here instead`		
Verb - *Thaitin*	FN	*Thaitin mé an béile.* *Thaitin an béile **liom**.* *Note: "Thaitin mé leis" is valid*		You need a word like **liom, leat, leis, lei, le** in this sentence	If "thaitin" and no "le" word, report error
Verb -*Bionn ag* missing	FN	*Bionn sibh múineadh gach la.* *Bionn sibh **ag** múineadh gach la.*		You are missing the word **ag** before the word **múineadh**	If "bíonn" and no "ag", report error *****
Verb combi	NH	*Tá Mamaí go dtí an siopa.*			
Verb conjugation	FN	*Rinne amar.*	`Unknown word`	You should not have a space here **Rinne amar**	If verb followed by "amar", report error
Verb double	FN	*Tá fuair sé Daidí idir na cúisíní.*		You should only have one verb here **Tá fuair**	If two verbs, report error
Verb double	FN	*Tá bhfuil tú cinnte.*	`Unnecessary eclipsis`	You should only have one verb here **Tá bhfuil**	If two verbs, report error
Verb missing	FN	*Ní Seán na trí úll.*		You should have a verb here **Ní Seán**	If no verb, report error
Verb misspelling	FN	*Ní d'feachaigh sí an liathróid ar an mbothar.*	`Unknown word`	You should have a verb here **Ní d'feachaigh**	???
Verb misspelling	FN	*Ní fhacaigh sí an liathróid ar an mbóthar.*	`Unknown word`	You should have a verb here **Ní fhacaigh**	???
Verb person – extra	FN	*Ithim **mé** calóga.* *Ithim calóga.*		You should not have a person word (i.e. **mé)** after the word **Ithim**	If "..im" and person, report error

Error	Error Type	Example/Correction	*Gramadóir*	CLICI	How
Verb -*Thaitin*	FN	*Thaitin an béile.* *Thaitin an béile* ***liom.***		You need a word like **liom, leat, leis, lei, le** in this sentence	If "thaitin" and no "le" word, report error
Verb -*Thosaigh*	FN	*Ansin thosaigh sé peann luaidhe arís.*		You might be missing **ag** here	If "thosaigh" and no "ag", report error
Verb -*Thug*	FN	*Níor thug an síopadoir úll.* *Níor thug an síopadoir úll* ***dom.***		You need a word like **dom, duit, do, dí** in this sentence	If "thur" and no "do" word, report error

Table E.1 Errors Detected by the CLICI Writing Checker

Appendix F Spelling Error Messages
This appendix shows the spelling errors reported by the CLICI system.

Spelling Errors in CLICI (11/08/05)

Error Phrases	Example/Correction	Source	*Gramadóir*	CLICI
Do you mean	*Nior tharraing sé*	Learner	Do you mean /níor/ ?	**Níor**
extremely rare	*haoine*	Learner	Valid word but extremely rare in actual usage	**hAoine???**
Unknown word	*Torraing*	Learner	Unknown word	**???**
Unknown word	*aghaid*	Learner	Unknown word	**aghaidh**
foreign word	*candh*	Learner	Possibly a foreign word (the sequence /ndh/ is highly improbable)	**canadh**
Not in database	*pictúr*	Learner	Not in database but may be a compound /pic+túr/?	**???**
Not in database	*Chití*	Learner	Not in database but apparently formed from the root /Cití/	**???**
Derived from a non	*chomhtharlúint*	*Gramadóir*	Derived from a non-standard form of /tharlá/	**tharlú?**
Derived form of	*droch-chinéal*	*Gramadóir*	Derived form of common misspelling /cinéaal (cineál)/?	**Cineál?**
Non-standard	*scaifte*	*Gramadóir*	Non-standard form of /scata/	**Scata**

Table F.1 Spelling Error Messages in the CLICI Writing Checker

Appendix G Overview of Irish

This Appendix provides an overview of the linguistic and orthographic features of Irish. The information is based on the description of the language provided in New Irish Grammar (CB, 2004). Despite the section title, the information should be considered as a brief introduction to the language. For reasons of space, some simplifications have been made and not all exceptions are listed. The reader is referred to the original source for a more complete description of Irish. Apart from providing a synopsis of the language, this section also aims to show some of the complexity of the language and raise awareness of the potential pedagogical difficulties with Irish.

G.1 Letters, Vowels, Stress, Hyphen and Apostrophe

The letters *a, b, c, d, e, f, g, h, i, l, m, n, o, p, r, s, t* and *u* are used for Irish words, while *j, k, q, v, w, x, y* and *z* occur in loan-words. A vowel (*a, e, i, o* and *u*) can either be short or long. An acute accent over the vowel indicates that it is long e.g. *mór* (big). There are also long-sounding combinations e.g. *ae* (e.g. *Gael* (Irish)), *i* before *ó* (e.g. *sióg* (fairy)) and *a* before *rd* (e.g. ***ard*** (high)). Broad vowels are: a, *o, u á, ó, ú* while *e, i, é, í* are slender vowels. Table G.1 shows a summary of Irish vowels. In general, the stress is placed on the first syllable of a word if no long vowel or diphthong occurs in any other syllable (e.g. ***athair*** (father)). Some words have the stress on the second syllable (e.g. ***anois*** (now)), while a few words have primary stress and a secondary stress on any other syllable that contains a long vowel (e.g. ***fuinneog*** (window)). A hyphen is used in several situations. The most common usages are between the prefixes *n, t* and a vowel which is not a capital letter (e.g. *an* ***t-athair*** (the father)), between prefixes (e.g. *sin-seanathair* (a great-grandfather)), in titles (e.g. *an Ard-Scoil* (the High School)) and after the emphatic *an* (very) (e.g. *an-bheag* (very small)). Note that a hyphen is never used after the prefix h (e.g. *go hÉireann* (to Ireland)). An apostrophe is used with the verbal particle ***d'*** (e.g. ***d'ól*** *sé* (he drank)), with ***mo*** (my), ***do*** (your), ***de*** (from), ***do*** (to) before nouns beginning with a vowel (e.g. ***m'aintín*** (my aunt); *thit sé d'asal* (he fell off a donkey)) and with the verb ***ba*** in certain cases (e.g. ***b'fhéidir*** (perhaps)).

Vowel Type	Letters
Short	*a, e, i, o, u*
Long	*á, é, í, ó, ú*
Long-sounding combinations	*ae, ao, omh, umh, eo; i* or *u* before *á, ó; a* before *rd, rl, rn* and before *rr* at the end of a word
Broad	*a, o, u, á, ó, ú*
Slender	*e, i, é, í*

Table G.1 Summary of Irish Vowels

G.2 The Article

Irish only has the definite article. The singular form is ***an*** (except with feminine nouns in the genitive case) and the plural form is ***na***. The article combines with certain words (*cé, do, de, faoi, i, ó*) to form compounds (e.g. *cé* + article = *cén áit*? (where)). The article is used with demonstrative adjectives (*seo, sin, úd* (this, that, yonder)) and in phrases referring to price and rate (e.g. *uair sa bhliain* (once a year)). It is also used before surnames, titles, with many place-names, seasons, days of the week, certain months and feasts, with the names of languages, abstract nouns, certain illnesses, with the adjective *uile* (every) and certain phrases. An example of each of these cases is shown in Table G.2. In general, the article is not used with a definite noun when it governs a definite noun in the genitive case (e.g. *fear an tí* (the master of the house)) and in certain adverbial phrases (e.g. *fan go Satharn* (wait until Saturday)).

Usage	Example	Translation
Demonstrative adjectives	*An fear sin*	That man
Rate, price	*Punt an duine*	A pound a person
Surnames	*An Búrach*	Mr. Burke
Titles	*An Sagart Ó Dónaill*	Father O'Donnell
Place-names	*An Afraic*	Africa
Seasons	*An Samradh*	The Summer
Days of the week	*An Luan*	Monday
Months and feasts	*An Nollaig*	Christmas
Languages	*Tá an Laidin marbh*	Latin is dead
Abstract nouns	*Tá an óige agat*	You have youth.
Illnesses	*An bhruitíneach*	Measles
Every (*uile*)	*An uile lá*	Every day
Phrases	*An iomad cainte* *Na mílte fear*	Too much talk Thousands of men

Table G.2 Examples of the Article in Irish

G.3 Inflexion

Irish is an inflected language i.e. changes are made to noun, adjective, pronoun and verb forms to express different meanings. For example, ***gúna deas*** (a nice dress) becomes ***gúnaí deasa*** (nice dresses) in the plural. Irish has attenuation (where broad consonants are made slender), broadening (where a slender consonant is made broad) and syncopation (where a short unaccented vowel is omitted from the last syllable from a word of more than one syllable, whenever the word is lengthened by an inflection beginning with a vowel). Table G.3 shows an example of attenuation, broadening and syncopation along with their Irish names.

Inflection Type	Irish Term	Original Form	Changed Form	Translation
Attenuation	Caolú	*Bás*	*Báis*	Death
		Fear	*Fir*	Man/men
Broadening	Leathnú	*Rith*	*Reatha*	Run
		Cuid	*Coda*	Some
Syncopation	Coimriú	***Imir***	*Imrím*	Play/I play
		Coinneal	*Coinnle*	A candle/candles

Table G.3 Examples of Irish Inflection

The Modern Irish case system is simpler than the case system in Latin. The common (base) form covers the nominative, accusative and dative. Irish also has the genitive and vocative forms. There are five noun-classes (or declensions) in Irish, with the class of each noun being determined by how it is inflected to form the genitive singular. There are two genders in Irish - masculine and feminine – with nouns designating male items being masculine and nouns designating female items being feminine. (Note: the gender of an item may not be immediately obvious to a non-native speaker, e.g. *bád* (boat) is masculine, while *fuinneog* (window) is feminine). Two exceptions include *cailín* (a girl) which is a masculine noun, while *gasóg* (a scout) is a feminine noun. Male personal names are masculine (e.g. *Seán beag* (little Seán)) and female ones are feminine (e.g. *Nuala bheag* (little Nuala)). Generally, foreign place-names ending with a slender vowel or consonant, names of languages, nouns of two or more syllables ending in *–acht*, all nouns ending in *–óg* and abstract nouns formed from the genitive singular feminine of adjectives are feminine. Table G.4 shows some examples of the feminine noun types mentioned above.

Type	Example	Translation
Foreign place-name	*Beirlin*	Berlin
Names of languages	*Araibis*	Arabic
Polysyllabic nouns ending in –acht	*beannacht*	blessing
Nouns ending in –óg	*bróg*	shoe
Abstract nouns	*binneas*	sweetness

Table G.4 Examples of Feminine Nouns in Irish

G.4 Aspiration/Lenition

Aspiration or lenition (known as *séimhiú* in Irish) occurs when the breath is not completely stopped in the formation of a consonant and therefore the consonantal sound is continuous and usually fricative (e.g. the aspirated *c* in *loch* (lake)). The consonants *b, c, d, f, g, m, p, s* and *t* are liable to aspiration. Aspiration is denoted by placing a ***h*** after the aspirated consonant (e.g. *bh*).

G.4.1 Aspiration and Nouns

The article causes the initial consonant of nouns to be aspirated (except those beginning with *d, s* and *t*). The vocative particle ***a*** also causes aspiration. Nouns are aspirated after certain adjectives, after *uile* (every), *aon* (one, any), *chéad* (first) (except those beginning with *d, s* and *t*), after *dhá* (with some exceptions), *beirt* (two people), and some numbers. Table G.5 shows examples of adjectives that cause aspirated nouns.

Type	Exception	Adjective	Example	Translation
Certain adjectives		*Mo* (my), *do* (your), *a* (his)	*Mo mhac*	My son
Uile (every)		*Uile*	*An uile* ***dhuine***	Everyone
Aon	Nouns beginning with *d, s, t*	*Aon*	*Aon* ***bhó*** *amháin*	One cow
Chéad	Nouns beginning with *d, s, t*	*Chéad*	*An chéad* ***bhliain***	The first year
Dhá	When *dhá* is preceded by *a* (her), *a* (their), *ár* (our), *bhur* (your)	*Dhá*	*A dhá* ***shúil*** *A dhá súil*	His two eyes Her two eyes
Beirt		*Beirt*	*Beirt* ***fhear***	Two men
Numbers		*Trí* (3), *ceithre* (4), *cúig* (5), *sé* (6)	*Trí bhád*	Three boats

Table G.5 Examples of Adjectives Causing Aspirated Nouns

Nouns are aspirated after certain simple prepositions and some examples are shown in Table G.6. Both definite and indefinite nouns are aspirated in the genitive case (with some exceptions). Nouns are also aspirated after past and conditional forms of the verb ***is*** (e.g. *ba dhuine mór é* (he was a big man)).

Preposition	Translation	Example	Translation
Faoi	Under	*Faoi chrann*	Under a tree
Ar	To	*Ar chlé*	To the left
Gan	Without	*Gan mhaith*	Without good
Idir	Both (but it does not aspirate when it means between)	*Idir* ***fhir*** *agus* ***mhná***	Both men and women
Thar	Than	*Ní rabih thar* ***chúigear*** *acu ann*	There weren't more than five of them there

Table G.6 Examples of Simple Prepositions Causing Aspirated Nouns

G.4.2 Aspiration and Adjectives

An attributive adjective is aspirated when it qualifies a feminine singular noun in any case except the genitive, a masculine noun in the genitive or vocative case and a plural noun which ends in a slender consonant. Adjective aspiration also occurs with nouns qualified with *beirt* (both) and any number from 2 to 19. *Idir* (when it means both), some adjectives (e.g. *sa* (in)) with a feminine noun and adjectives following certain compounds (e.g. ar an (on)) with a feminine noun also cause aspiration. Some examples are shown in Table G.7. A predicative adjective is aspirated after the past and conditional forms of the verb **is** (e.g. *ba **dheas** uait é* (it was nice of you)).

Adjective Type	Example	Translation
Qualified feminine singular noun (not genitive)	*Bean mhaith*	Good woman
Qualifies masculine singular noun in genitive or vocative	*Teach Sheáin Mhóir*	Big John's house
Qualifies plural noun which ends in a slender consonant	*Leis na capaill **bhána***	With the white horses
When *beirt* precedes the noun qualified	*Beirt fhear **mhóra***	Two big men
Numbers 2 – 19 qualifying a noun in singular form	*Trí chapall **mhóra***	Three big horses
After *idir* when it means both	*Páistí idir **bheag** agus **mhór***	Children both big and small
Den, don, sa, san following a feminine noun	*Don bhean **bheag***	Of the small woman
Following *ar an, ag an, leis* an with a masculine noun	*Ag an fhear mhór*	With the big man
Déag when preceded by a vowel	*Dó dhéag*	Twelve

Table G.7 Examples of Aspirated Adjectives

G.4.3 Aspiration and Verbs and Compound Words

In general, the initial consonant of a verb is aspirated in the simple past (e.g. ***bhris** mé* (I broke)), the imperfect (***bhrisinn*** (I used to break)) and the conditional (***bhrisfinn*** (I would break)). The past autonomous forms are aspirated for some verbs (e.g. *feicim* (I see), *téim* (I go)). Verbs are also aspirated after certain verbal particles such as *ní*, the negative particle (e.g. *ní **thuigim*** (I do not understand)) and *ar*, the question particle (e.g. *ar **tháinig** sé*? (did he come?)). The initial consonant of the second part of a compound word is aspirated except

where a pair of the letters *d, l, n, s, t* come together (e.g. *ainm**fh**ocal* (noun), *fíor**dh**eas* (really nice)).

G.5 Eclipsis, Prefix t, Prefix h

G.5.1 Eclipsis

Eclipsis refers to the change that occurs to the beginning of a word. There are three circumstances in which it occurs. Eclipsis occurs when an initial voiceless consonant (*p, t, c, f*) is changed to the corresponding voiced one (*b, d, g, v* (*bh*)) or when an initial voiced consonant (*b, d, g*) is changed to the corresponding nasal one (*m, n, ng*). It also occurs when *n* is prefixed to words beginning with a vowel. The eclipsis is written before the initial consonant. Eclipsis can occur with the following consonants: *p, t, c, f, b, d* and *g*. Table G.8 shows examples for each of these consonants.

Letter	Eclipsis	Example (pre-eclipsis)	Example (with eclipsis)	Translation
p	*b*	*páirc*	*i bpáirc*	in a field
t	*d*	*tír*	*ár dtír*	our country
c	*g*	*cairde*	*bhur gcairde*	your friends
f	*bh*	*fiacha*	*ár bhfiacha*	our debts
b	*m*	*bád*	*i mbád*	in a boat
d	*n*	*Doire*	*i nDoire*	in Derry
g	*n*	*grá*	*i ngrá*	in love
vowel	*n*	*Athair*	*ár nAthair*	our Father

TableG.8 Consonants and their Eclipsis with Examples

A noun can be eclipsed by a possessive adjective, after the preposition *i* and other prepositions and the article. Examples are shown in Table G.9. In general, the same eclipsising rules that apply to a noun apply to an attributive adjective which precedes it (e.g. *ár **gcéad** mhac* (our first son)). Attributive adjectives which follow the noun are not eclipsed (e.g. *scoil na gcailíní **óga*** (school for young girls)). Verbs are eclipsed after certain particles. These are shown in Table G.10.

G.5.2 Prefix t

The article prefixes *t* to masculine singular nouns in the Common form (which covers nominative, accusative and dative cases) beginning with a vowel, to feminine singular nouns in the Common form beginning with s followed by a vowel or by *l, n, r* and to masculine singular nouns in the Genitive case beginning with *s* followed by a vowel or by *l, n, r*. Examples are shown in Table G.11.

G.5.2 Prefix h

The prefix *h* is added before nouns, adjectives, pronouns and verbs. It is usually added with words that do not aspirate nor eclipse and which end in a vowel. Examples are shown in Table G.12.

Type	Instance	Example	Translation
Possessive adjective	*ár* (our)	*ár gcairde*	our friends
Possessive phrases	*ár dhá*	*ár dhá* ***mbád***	our two boats
7, 8, 9, 10	*seacht*	*seacht gcapall*	7 horses
Preposition *i*	*i*	*i dteach*	In a house
Other prepositions	*Ar*	*ar dtús*	At first
Article	*An*	*ar an gcrann*	on the tree

Table G.9 Examples of Eclipsed Nouns

Particle	Meaning	Example	Translation
A	Whatever	*D'ól sé a bhfuair sé*	He drank whatever he got
An	Interrogative	*An dtagann sé gach lá?*	Does he come every day?
Cá	Where	*Cá bhfuil Seán?*	Where is John?
Go	Conjunction	*Dúirt sé go dtiocfadh sé*	He said he would come
Nach	Conjunction	*Dúirt sé nach dtiocfadh sé*	He said he would not come
Mura	Conditional	*Mura bhfuil tú sásta*	If you are not happy
Sula	Before	*Sula ndeachaigh an ghrian a luí*	Before the sun goes down
Dá	Conditional	*Dá mheadh a fhios agam*	If I know

Table G.10 Examples of Eclipsed Verbs

Type	Example	Translation
Masculine singular in Common form	*Tá an t-uisce sin te*	That water is hot.
Feminine singular in Common Form	***An tsláinte***	Health
Masculine singular in Genitive case	*In aice an tséipéil*	Near the chapel

Table G.11 Examples of Prefix t

Type	Example	Translation
Before noun	*A haois*	Her age
Before noun	*Cá* ***haois*** *tú?*	How old are you?
Before adjective	*A haon*	One
Before adjective	*Chomh* ***hard*** *le caisleán*	As tall as a castle

Before pronoun	*Cé **hé**?*	What is?
Before verb	*Ná **himigh** uaim*	Do not leave me

Table G.12 Examples of Prefix h

G.6 Nouns

G.6.1 General

Irish has five kinds of nouns. These are: proper nouns (e.g. *Seán*), common nouns (e.g. *fear* (man)), material nouns (e.g. *bainne* (milk)), collective nouns (e.g. *foireann* (a team)) and abstract nouns (e.g. *áthas* (happiness)). A definite noun denotes a particular person, place or thing. Examples are shown in Table G.13. The Common form of a noun corresponds to the nominative, accusative and dative cases in other languages. Table G.14 shows some examples of the Common form. The Genitive case is used when one noun governs another (e.g. *hata an **fhir*** (the man's hat)). Some examples are shown in Table G.15.

The Vocative case is used to name a person that is addressed (e.g. *a Sheáin* (John)). The Genitive case is used when one noun directly follows another noun, a compound preposition, a quantity word, or one of a few special prepositions. The Common Form is used instead of the Genitive for some nouns and such a noun is said to be common in form but genitive in function. Examples include a noun which governs a definite noun in the genitive case (e.g. *cóta **mhac** Sheáin* (John's son's coat)), a noun which denotes quantity (e.g. *ag déanamh mo **chuid** oibre* (doing my work)) and a noun which is qualified by a number (e.g. *spas dhá **lá*** (a space of two days)). The Partitive Genitive denotes the whole of which some part is mentioned (e.g. *cuid **den airgead*** (some of the money)).

Type	Example	Translation
Preceded by the article	*An fear*	The man
A proper noun	*Ar neamh*	In heaven
Qualified by a possessive adjective	*Mo mhac*	My son
Qualified by *gach* (every)	*Gach lá*	Every day
Vocative case	*A chara*	His/her? Friend
Qualified by a numeral which functions as an ordinal	*Bus a dó*	Bus number two
Noun governed by genitive noun in the genitive	*Hata an fhir*	The man's hat

Table G.13 Examples of Definite Nouns

Type	Example	Translation
Subject of the sentence	*Tá an **cat** ag ól.*	The cat is drinking.
Object of the sentence	*Bhris Seán an **fhuinneog**.*	John broke the window.

Phrases expressing time	*D'imigh sé **bliain** ó shin.*	He left a year ago.
After *cá mhéad* (how many)	*Cá mhéad **teach** a tógadh?*	How many houses were built?
After prepositions	*Gach duine ach an t-athair*	Everyone except the father

Table G.14 Examples of Common Form Nouns

Type	Example	Translation
Origin	*Mac Sheáin*	John's son
Possession	*Teach Thomáis*	Thomas's house
Material	*Fáinne **óir***	Gold ring
Rank	*Mac léinn*	Student
Description	*Lá Nollag*	Christmas day
Use	*Seomra codlata*	Bedroom
Titles	*Scoil Mhuire*	Mary's school
After *timpeall* (around)	*Timpeall an **domhain***	Around the world
After compound preposition	*Ar chúl an **dorais***	Behind the door

Table G.15 Examples of Genitive Case Nouns

G.6.2 The Declensions

There are five declensions or noun-classes in Irish. They are classified according to how they form the Genitive singular. Table G.16 shows how noun-endings vary in the Common and Genitive singular, along with gender information.

Type	Common Singular ending	Genitive Singular ending	Examples	Translation	Gender
First	Broad consonant	Slender consonant	*Bád, báid*	Boat/boat's	masculine
Second	Consonant	*-e, -í*	*Cos, coise* *Girseach, girsí*	Foot/foot's Girl/girl's	Feminine
Third	Consonant	*-a*	*Am, ama* *Bliain, bliana*	Time/time's Year/year's	Masculine and feminine

Fourth	Vowel, *ín*	No inflexion	*Rí, rí* *Trá, trá*	King/king's Beach/beach's	Masculine and feminine
Fifth	Vowel or slender consonant	Broad consonant	*Pearsa, pearsan* *Litir, litreach*	Person/person's Letter/letter's	Feminine (mostly)

Table G.16 Noun Declensions

The plural form of a noun is strong when the form for all cases in the plural is the same (e.g. *na ríthe* (the kings)) or if syncopation, broadening or vowel-change takes place in its formation (e.g. *sceana/scian* (knives/a knife)). The plural form of a noun is weak if the Common plural form ends in a consonant (e.g. *báid/bád* (boats/boat)) or by adding *–a* to the common singular form (e.g. *cosa/cos* (feet/foot)). Table G.17 shows an example of a noun of each declension type.

First Declension				
	Singular	**Translation**	**Plural**	**Translation**
Common	***an cat***	the cat	***na cait***	the cats
Genitive	*bia an chait*	the cat's food	*bia na gcat*	the cats' food
Vocative	***a chait***	cat	***a chata***	Cats
Second Declension				
	Singular	**Translation**	**Plural**	**Translation**
Common	***an ghirseach***	the girl	***na girseacha***	the girls
Genitive	*ainm na girsí*	the girl's name	*scoil na girseach*	the girls' school
Vocative	***a ghirseach***	girl	***a ghirseacha***	Girls
Third Declension				
	Singular	**Translation**	**Plural**	**Translation**
Common	***an bádóir***	the sailor	***na bádóirí***	the sailors
Genitive	*mac an bhádora*	the sailor's son	*saol na mbádóirí*	the sailors' life
Vocative	***a bhádóir***	Sailor	***a bhádóirí***	Sailors
Fourth Declension				
	Singular	**Translation**	**Plural**	**Translation**
Common	***an coinín***	the rabbit	***na coiníní***	the rabbits
Genitive	*bia an choinín*	the rabbit's food	*bia na gcoiníní*	the rabbits' food
Vocative	***a choinín***	rabbit	***a choiníní***	Rabbits
Fifth Declension				
	Singular	**Translation**	**Plural**	**Translation**
Common	***an traein***	the train	***na traenacha***	the trains

Genitive	*tiománaí* ***na traenach***	the train's driver	*stáisiún* ***na traenacha***	the trains' station
Vocative	***a traein***	train	***a traenacha***	Trains

Table G.17 Examples of the Five Noun Declensions

G.6.3 Irregular Nouns

There are some common nouns in Irish that are irregular. Table G.18 shows an example of an irregular noun.

	Singular	**Translation**	**Plural**	**Translation**
Common	*an bhean*	the woman	*na mná*	the women
Genitive	*hata na mná*	the woman's hat	*hataí na mban*	the women's hats
Vocative	*A bhean!*	Woman!	*A mhná*	Women!

Table G.18 Examples of Irregular Nouns

Note that many verbal nouns (i.e. deverbal nouns) are declined according to one of the five declensions (e.g. *an réitleach* (the solution) – first declension), but most verbal nouns are not declined according to any of the five declensions and Table G.19 lists some of these.

Common Singular	**Genitive Singular**	**Plural – all cases**	**Translation**
moladh	*Molta*	*moltaí*	praise
baisteach	*Baiste*	*baistí*	rain
scrúdú	*scrúdaithe*	*scrúduithe*	exam

Table G.19 Example of Verbal Noun Declensions

G.7 Adjectives

There are seven main classes of adjectives. Some adjectives are placed before the noun, while others are placed after the noun. Information on adjectives is shown in Table G.20. Nearly all descriptive adjectives can be used predicatively i.e. when it qualifies a noun directly or indirectly via a copula (e.g. *tá sé* ***fuar*** (it is cold)) and attributively i.e. when it qualifies the noun directly (e.g. *tá bean* ***bhocht*** *ag an doras* (there is a poor woman at the door)). In general, when an adjective is used predicatively it is not declined, eclipsed or aspirated (i.e. it stays in the base form).

In general, a descriptive adjective used attributively is declined according to the gender, number and case of the noun which it qualifies. Table G.21 shows the eight main declensions of adjectives (excluding those which become syncopated by inflexion).

There are three types of comparison of adjectives. Comparison of equality is achieved via the use of *chomh* (as) (e.g. ***chomh láidir*** le capall (as strong as a horse)). English distinguishes between comparison between two things (e.g. taller) and more than two things (e.g. the tallest). Irish does not have this distinction. *An fear níos airde* (the taller man) and *An fear is airde* (the tallest man) both mean the same thing – only the point of view is different i.e. the first example is used when comparing only two men while the second example is used when comparing more than two men. The comparative form of the adjective is the same as the genitive singular feminine form. Table G.22 shows two examples. Some common adjectives are irregular, as shown in Table G.23.

Type	Adjective	Translation	Position relative to noun	Example	Translation
Descriptive	*bán*	white	After	*an bhó* ***bhán***	the white cow
Possessive	*mo*	my	Before	***mo*** *chara*	my friend
Numeral	*chéad*	first	Before	*an* ***chéad*** *bhó*	the first cow
Indefinite	*amháin*	one	before, after	*lá* ***amháin*** ***gach*** *lá*	one day every day
Interrogative	*cén*	which	Before	***cén*** *fear?*	which man?
Demonstrative	*seo*	this	after	*an fear* ***seo***	this man
The article	*an*	the	before	***an*** *fear*	the man

Table G.20 Example Adjectives

Common Singular	Translation	Genitive Singular Masculine	Genitive Feminine Singular	Common plural
bán	white	*báin*	*báine*	*bána*
díreach	straight	*Dírigh*	*dírí*	*díreacha*
bacach	lame	*bacaigh*	*bacaí*	*bacacha*
leisciúil	lazy	*leisciúil*	*leisciúla*	*leisciúla*
mall	slow, late	*Mall*	*maille*	*malla*
maith	good	*Maith*	*maithe*	*maithe*

buíoch	grateful	*Buíoch*	*buíthí*	*buíocha*
gnách	usual	*Gnách*	*gnáthaí*	*gnácha*

Table G.21 Eight Main Declensions of Adjectives

Adjective	Meaning	Níos	Is
capall bán	white horse	*capall* ***níos báine*** (whiter horse – out of two horses)	*an capall* ***is báine*** (the whitest horse – out of more than two horses)
tamall gear	short time	*tamall* ***níos giorra*** (shorter time – out of two times)	*an tamall* ***is giorra*** (the shortest time – out of more than two times)

Table G.22 Regular Comparative Adjectives

Adjective	Meaning	Níos	Is
capall beag	small horse	*capall* ***níos lú*** (smaller horse)	*an capall* ***is lú*** (the smallest horse)
fear maith	good man	*fear* ***níos fearr*** (better man)	*an fear* ***is fearr*** (the best man)
fear olc	bad man	*fear* ***níos measa*** (worse man)	*an fear* ***is measa*** (the worst man)

Table G.23 Irregular Comparative Adjectives

Ná (than) is used with the copula, the verb *is* (e.g. *Is airde Seán ná mise* (John is taller than me)). There are also other degrees of comparison (e.g. *Tá sé róláidir agam* (He is too strong for me)); *Tá sé an-bhocht* (He is very poor)).

G.8 Numerals

There are two kinds of cardinal numbers in Irish: those without nouns (when counting) and those with nouns. Table G.24 shows the numbers 1 – 29 which are used for counting, in basic arithmetic (e.g. *a haon is a haon sin a dó* (1 + 1 = 2)), stating the time (*a dó a chlog* (2 o'clock)), in naming telephone numbers (e.g. *a sé, náid, a trí* (603)) and as ordinals after nouns (e.g. *bus a trí déag* (bus 13)).

Cardinal numbers are generally followed by the singular form of the noun (e.g. *dhá chat* (two cats)). The numbers 1 – 6 cause aspiration (e.g. *dhá theach* (two houses)), while the numbers 7 – 10 cause eclipsis (e.g. *ocht gcrann* (eight trees)). Special forms of some words are used after *dhá* (2) (e.g. *dhá bhróig mhóra* (two big shoes)) and *trí* to *deich* (3 – 10) (e.g. *trí bliana* (three years)). Some examples of cardinals with nouns are shown in Table G.25.

0 – 9	10 – 19	20 - 29

0. náid	10. *a deich*	20. *fiche*
1. a haon	11. *a haon déag*	21. *fiche a haon*
2. *a dó*	12. *a dó dhéag*	22. *fiche a dó*
4. *a trí*	14. *a trí déag*	24. *ficha a trí*
4. *a ceathair*	14. *a ceathair déag*	24. *fiche a ceathair*
5. *a cúig*	15. *a cúig déag*	25. *fiche a cúig*
6. *a sé*	16 *a sé déag*	26. *fiche a sé*
7. *a seacht*	17. *a seacht déag*	27. *fiche a seacht*
8. *a hocht*	18. *a hocht déag*	28. *fiche a hocht*
9. *a naoi*	19. *a naoi déag*	29. *fiche a naoi*

Table G.24 Cardinal Numbers 0 – 29

Number	Example	Translation
1	*aon chapall amháin*	1horse
4	*ceithre chapall*	4 horses
9	*naoi gcapall*	9 horses
11	*aon chapall déag*	11 horses
17	*seacht gcapall déag*	17 horses
22	*dhá chapall is fiche*	22 horses

Table G.25 Cardinal Numbers with Nouns

In general, personal numerals (numbers used to count people) are used for 1 to 12 people and the cardinal numbers are used thereafter (see Table G.26). The singular form of the noun is used after the personal numerals 2 to 12 (e.g. *beirt* ***fhear*** (two men)), while the singular form of the adjective is used for 3 to 12 (e.g. *ochtar fear* ***mór*** (eight big men)). *Beirt* (2) causes the plural form of the adjective to be used (e.g. *beirt fhear* ***mhóra*** (two big men)). Note that the word *ban* (woman) is irregular (e.g. *beirt ban, triúr ban* (two women, three women)). Ordinal numbers are used with *gach* (every) (e.g. *gach dara teach* (every second house)) and fractions (e.g. *ceathrú* (¼)). Table G.27 shows some Irish ordinal numbers.

Number	Personal Numeral	Example	Translation
1	*duine, duine amháin*	*duine amháin*	one person
2	*beirt*	*beirt fhear*	two men
3	*triúr*	*triúir banaltra*	three nurses
4	*ceathrar*	*ceathrar duine*	four people
5	*cúigear*	*cúigear páiste*	five children
6	*seisear*	*seisear gasúr*	six boys

7	*seachtar*	*seachtar aspal*	seven bishops
8	*ochtar*	*ochtar páiste*	eight children
9	*naonúr*	*naonúr fhear*	nine men
10	*deichniúr*	*deichnúr duine*	ten people
11	*aon duine dhéag*	*don duine dhéag*	eleven people
12	*dáréag*	*dáréag fhearr*	twelve men

Table G.24 Personal Numerals 1 - 12

G.9 Pronominals

Irish pronominals include personal pronouns, prepositional pronouns, possessive pronouns and synthetic forms of the verb. Table G.28 shows the personal pronouns, along with their emphatic form. *Sé, sí* and *siad* are used when they immediately follow a predicative verb as its subject, otherwise *é, í* and *iad* are used. Prepositional pronouns are formed by combining simple prepositions with the personal pronouns. Table G.29 shows some of the common prepositional pronouns.

Ordinal	Example	Translation
1st	*an chéad bhád*	the first boat
2nd	*an dara bád*	the second boat
3rd	*an tríú bád*	the third boat
4th	*an ceathrú bád*	the fourth boat
5th	*an cúigiú bád*	the fifth boat
6th	*an séú bád*	the sixth boat
7th	*an seachtú bád*	the seventh boat
8th	*an t-ochtú bád*	the eight boat
9th	*an naoú bád*	the ninth boat
10th	*an deichiú bád*	the tenth boat
11th	*an t-aonú bád déag*	the eleventh boat
17th	*an seachtú bád déag*	the seventeenth boat

Table G.27 Ordinal Numbers

Person	Pronoun	Emphatic
1st person singular	*mé*	*mise*
2nd person singular	*tú*	*tusa*
3rd person singular (masc.)	*sé, é*	*seisean, eisean*

3rd person singular (fem.)	*sí, í*	*sise, ise*
1st person plural	*sinn*	*sinne*
2nd person plural	*sibh*	*sibhse*
3rd person plural	*siad, iad*	*siadsan, iadsan*

Table G.28 Personal Pronouns

Preposition	1 Sing	2 Sing	3 Sing (M)	3 Sing (F)	1 Pl.	2 Pl.	3 Pl.
ag (at)	*agam*	*agat*	*aige*	*aici*	*again*	*agaibh*	*acu*
Ar (on)	*orm*	*ort*	*air*	*uirthi*	*orainn*	*oraibh*	*orthu*
do, (to)	*dom*	*duit*	*dó*	*di*	*dúinn*	*daoibh*	*dóibh*
Le (with)	*liom*	*leat*	*leis*	*léi*	*linn*	*libh*	*leo*

Table G.29 Prepositional Pronouns

The possessive adjectives are *mo* (my), *do* (your), *a* (his), *a* (her), *ár* (our), *bhur* (your), *a* (their). *Mo*, *do* and *a* (his) aspirate (e.g. *mo chara* (my friend), *a chara* (his friend)). *A* (her) neither aspirates not eclipses but prefixes *h* to vowels (e.g. *a chara* (her friend), *a hathair* (her father)). *Ár*, *bhur* and *a* (their) eclipse (e.g. *ár gcara* (our friend), *a gcara* (their friend)).

Synthetic forms of the verb are those in which both person and number are expressed in the verb itself (e.g. *brisim* (I break)). The pronominal order is that the first person is given first place and the third person is given last place (e.g. *mise agus an rí* (the king and I)). Analepsis is the use of a pronominal to stand for a noun which occurs earlier in the sentence. For example, *Bhain Seán de **a** hata sula ndeachaigh **sé** isteach* (John took off **his** hat before **he** went in). In this example, both *a* (his) and *sé* (he) refer back to John. An analeptic (anaphoric) pronoun is sometimes used for emphasis or balance (e.g. ***Na fir a bhí anseo inné** tháinig **siad** ar ais inniu = Tháinig na fir a bhí anseo inné ar ais inniu* (The men who were here yesterday came back today)). Prolepsis (cataphora) is the use of a pronominal to stand for a noun or phrase which occurs later in the sentence (e.g. *Is glas **iad na conic i bhfad uainn*** (The far away hills are always greener)).

G.10 Verbs

G.10.1 General

Irish verbs are inflected for mood, tense, person and number. There are four moods: the imperative, the indicative, the conditional and the subjunctive. The imperative only has the present tense. The indicative has five tenses: the present, the habitual present, the past, the habitual past and the future. The conditional tense can express past, present or future time. The subjunctive has two tenses: the present and the past. The simple tenses in Irish are divided into primary tenses (present indicative, future indicative and present subjunctive) and historic tenses (past indicative, imperfect indicative = habitual past, the conditional and the past subjunctive). A summary is provided in Table G.30. The compound tenses are phrases consisting of the verb

bí (to be) used as an auxiliary verb + a verbal noun or verbal adjective used to express the action. There are three kinds of compound tenses: continuous tenses, perfect tenses and periphrastic tenses. Examples are shown in Table G.31.

G.10.2 Conjugations

Verbs are divided into two main classes according to the form of the verb in the third person, future tense. The verb belongs to the First Conjugation if the third person future ends in *–fidh, faidh.* If the third person future ends in *–eoidh, óidh* the verb belongs to the Second Conjugation. For reasons of space, only the present, past and future tenses will be shown for each conjugation, as these are the most commonly used and taught tenses. Table G.32 shows the conjugations for *mol* (to praise), a broad verb and *bris* (to break), a slender verb. Note that only the third person singular masculine form is shown (i.e. *sé*) as the feminine form (i.e. *sí*) is identical.

The Second Conjugation consists of verbs of two or more syllables ending in *–aigh, -igh.* Table G.33 shows example conjugations for *beannaigh* (to bless) and *bailigh* (to gather).

G.10.3 Irregular Verbs

There are 11 irregular verbs in Irish and some of them are among the most commonly used verbs. Some of these verbs are almost regular (e.g. *clois* (to hear)) and some are highly irregular (e.g. *téigh* (to go); *bí* (to be)). Table G.34 shows a list of these verbs in the present, past, past negative and future tenses for the third person singular.

Mood	Tense	Class	Example	Translation
Imperative	Present	Primary	*Lean mise*	Read me
Indicative	Present	Primary	*Cluinim anois é.*	Now I understand it.
	Habitual present	Primary	*Téim ar scoil gach lá.*	I go to school every day.
	Past	Historic	*Tháinig sé isteach.*	He went inside.
	Habitual past	Historic	*Théinn mé gach lá.*	I used to go every day
	Future	Primary	*Rachaidh mé leat*	I will go with you
Conditional	Past, present, future	Historic	*Dúirt Seán go dtiocfadh sé inné/anois/amárach.*	John said he would come yesterday/now/tomorrow
Subjunctive	Present	Primary	*Fan go dtaga an bus*	Wait until the bus comes
	Past	Historic	*Dá dtéinn ann inné ...*	(... had I gone there yesterday ...)

Table G.30 Verb Moods and Tenses

Type	Formation	Example	Translation
Continuous	*Bí* + *ag* + verbal noun	*Tá Seán ag obair.*	John is working.
Perfect	*Bí* + verbal noun/adjective	*Tá an bád díolta.*	The boat is sold.
Periphrastic	Expresses what is about to take place	*Bhí mé ar tí an bád a dhíol.*	I was about to sell the boat.

Table G.31 Compound Tenses

Person	Present		Past		Future	
	Broad	Slender	Broad	Slender	Broad	Slender
1 sing.	*Molaim*	*Bris**im***	*Mhol mé*	*Bhris mé*	*Mol**faidh** mé*	*Bris**fidh** mé*
2. sing.	*Mol**ann** tú*	*Bris**eann** tú*	*Mhol tú*	*Bhris tú*	*Mol**faidh** tú*	*Bris**fidh** tú*
4. sing.	*Mol**ann** sé*	*Bris**eann** sé*	*Mhol sé*	*Bhris sé*	*Mol**faidh** sé*	*Bris**fidh** sé*
1 pl.	*Molaimid*	*Brisimid*	*Mholamar*	*Bhriseamar*	*Molfaimid*	*Brisfimid*
2 pl.	*Mol**ann** sibh*	*Bris**eann** sibh*	*Mhol sibh*	*Bhris sibh*	*Mol**faidh** sibh*	*Bris**fidh** sibh*
3 pl.	*Mol**ann** siad*	*Bris**eann** siad*	*Mhol siad*	*Bhris said*	*Mol**faidh** siad*	*Bris**fidh** siad*

Table G.32 First Conjugation Verbs

Person	Present		Past		Future	
	Broad	Slender	Broad	Slender	Broad	Slender
1 sing.	*Beannaím*	*Bailím*	*Beannaigh mé*	*Bailigh mé*	*Beannóidh mé*	*Baileoidh mé*
2. sing.	*Beannaíonn tú*	*Bailíonn tú*	*Beannaigh tú*	*Bailigh tú*	*Beannóidh tú*	*Baileoidh tú*
4. sing.	*Beannaíonn sé*	*Bailíonn sé*	*Beannaigh sé*	*Bailigh sé*	*Beannóidh sé*	*Baileoidh sé*
1 pl.	*Beannaímid*	*Bailímid*	*Beannaíomar*	*Bailíomar*	*Beannóimid*	*Baileoimid*
2 pl	*Beannaíonn sibh*	*Bailíonn sibh*	*Beannaigh sibh*	*Bailigh sibh*	*Beannóidh sibh*	*Baileoidh sibh*
3 pl.	*Beannaíonn siad*	*Bailíonn siad*	*Beannaigh siad*	*Bailigh siad*	*Beannóidh siad*	*Baileoidh siad*

Table G.33 Second Conjugation Verbs

G.10.4 Defective Verbs

The copula (*is*) is both irregular and defective (it only has two forms). It has no imperative nor synthetic forms. There is no verbal noun nor verbal adjective for the copula. The copula is used in main clauses (e.g. ***is*** *fear maith é* (he is a good man)), relative direct clauses (e.g. *an gasúr* ***is*** *fearr* (the best boy)), relative indirect clauses (e.g. *an duine* ***ar*** *leis é* (the person who owns it)) and dependent clauses (e.g. *deir sé* ***gur*** *maith an fear é* (he says that he is a good man)). Table G.35 shows basic information on the copula. The forms ending in *b* (e.g. *arb, gurb, darb*) are in the present tense before vowels, but *gur* is often used before nouns, prepositions, prepositional pronouns beginning with a vowel (e.g. *deir sé* ***gur*** *amadán é* (he says he is a fool)). Note *is ea* (it is) is sometimes written *sea*.

Verb	Translation	Present	Past	Past Negative	Future
Abair	To say	*Deir sé*	*Dúirt sé*	*Níor dúirt sé*	*Déarfaidh sé*
Beir	To catch	*Beireann sé*	*Rug sé*	*Níor rug sé*	*Béarfaidh sé*
Clois	To hear	*Cloiseann sé*	*Chuala sé*	*Níor chuala sé*	*Cloisfidh sé*
Dean	To make, do	*Déanann sé*	*Rinne sé*	*Níor dhein sé*	*Déanfaidh sé*
Faigh	To get	*Faigheann sé*	*Fuair sé*	*Níor fuair sé*	*Gheobhaidh sé*
Feic	To see	*Feiceann sé*	*Chonaic sé*	*Ní fhaca sé*	*Feicfidh sé*
Ith	To eat	*Itheann sé*	*D'ith sé*	*Níor ith sé*	*Íosfaidh sé*
Tabhair	To give	*Tugann sé*	*Thug sé*	*Níor thug sé*	*Tabharfaidh sé*
Tar	To come	*Tagann sé*	*Tháinig sé*	*Níor tháinig sé*	*Tiocfaidh sé*
Téigh	To go	*Téann sé*	*Chuaigh sé*	*Ní dheachaigh sé*	*Rachaidh sé*
Bí	To be	*Tá sé*	*Bhí sé*	*Ní raibh sé*	*Beidh sé*

Table G.34 Irregular Conjugation Verbs

Type	Past and Future Tense				Past and Conditional Tenses			
	Statement		Question		Statement		Question	
	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Principal	*Is*	*Ní*	*An*	*Nach*	*Ba, b'*	*Níor, níorbh*	*Ar, arbh*	*Nár, nárbh*
Relative direct	*Is*	*Nach*			*Ba, b'*	*Nár, nárbh*		
Relative	*Ar,*	*Nach*			*Ar, arb*	*Nár,*		

indirect	*arb*					*nárbh*		
Dependent	*Gur, gurb*	*Nach*	*An*	*nach*	*Gur, gurbh*	*Nár, nárbh*	*Ar, arbh*	*Nár, nárbh*

Table G.35 Copula Information

G.10.5 Other Verb Information

This section contains some observations on verbs and tenses. The verb *bí* (to be) is used to express existence (e.g. ***Bhí rí ann fadó*** (Once upon a time there lived a king)), position (e.g. ***Tá*** *Seán ar scoil* (John is at school)) and state or condition (e.g. ***Tá*** *sé fuar inniu* (It is cold today)). It is also used as an auxiliary verb in compound tenses (e.g. ***Tá*** *Seán ag obair* (John is working)). There are five main uses of the subjunctive mood in Irish. The present subjunctive is used to express a wish (e.g. *Go raibh maith agat* (Thank you)). The subjunctive is also used to express purpose (*Fan go dtaga an bus* (wait until the bus comes)), indefinite time (e.g. *Ní fada go dtaga sí* (It won't be long until she comes)), uncertainty (e.g. *Mura gcreide sibh mé* (If you don't believe me)) and conditions with if (e.g. *Dá dtéinn ann gheobhainn an t-airgead* (If you go you'll get the money)).

The copula, the verb *is*, is used in classification (e.g. *Is fear é* (He is a man)), identification (e.g. *Is é Seán an dochtúir* (John is the doctor)), to express ownership (e.g. *Is le Máire an leabhar* (It's Mary's book)) and to mark emphasis (e.g. *Is anseo atá sé* (He is here)). As Irish has no indefinite mood nor a present participle, the verbal noun carries out these functions. The English infinite "He told me to go" becomes *Dúirt sé liom imeacht* in Irish. *Ag* and the verbal noun are used to translate the present participle (e.g. *Tá Seán ag obair* (John is working)). Irish has several verbal particles and these are shown in Table G.36.

G.11 Prepositions

Prepositions in Irish are used for modal meaning (e.g. desire or possibility), purpose, time, origin, cause, sale, place, manner, state and ownership. Table G.37 shows an example of each case. Some nouns subcategorise for certain preposition (e.g. *Tá ceist agam ort* (I have a question for you)), as do some adjectives (e.g. *bródúil as* (proud of)) and verbs (e.g. *Ná trácht air* (Don't mention it)).

G.12 Adverbs

Adverbs may be used to qualify verbs, verbal nouns, verbal adjectives, adjectives, other adverbs, simple prepositions, compound prepositions and conjunctions. Examples are shown in Table G.38. Irish has interrogative adverbs (e.g. ***Cathain*** *a tháinig sé?* (When did he come?)) (it also has interrogative pronouns and adjectives), directional adverbs (e.g. *ag dul* ***síos*** (going down)) and adverbs relating to time (e.g. *Níor tháinig sé* ***riamh*** (He never came)). Note that direction in Irish is given in term of the direction from which a person is coming, rather than the

direction in which a person is coming as in English (e.g. *ag teacht* ***aduaidh*** (coming from the north e.g. southwards)).

G.13 Other Information

The relative particles (*a, nach, nár*) are used in affirmative sentences instead of the relative pronoun (e.g. *Sin é an leanbh* ***a chuaigh*** *ar strae* (That is the child who went astray)). In negative sentences *nach* and *nár* are used (e.g. *Sin rud* ***nach dtuiguim*** (That is something I don't understand)). When reporting speech (i.e. using indirect speech) certain verb changes are necessary and these are shown in Table G.39.

Word	Usage	Example	Translation
a , ar	Relative conjunction	*Bean ar maraíodh a mac*	The woman killed by her son
	Relative pronoun	*An crann ar a bhfásann na húlla*	The tree on which the apples grow
An, ar	Interrogative adverb	*Ar éirigh sé?*	Did he get up?
Cá, cár	Interrogative adverb	*Cá n-imíonn sé gach lá?*	Where does he go every day?
Go, gur	Conjunction – positive	*Deir sé go dtógfaidh sé*	He says he will give
	Adverb	*Go dté tú slán*	Safe journey
	Conjunction – purpose	*Fág ann é go mbrisfidh mé é*	Leave it there so that I can break it
	Conjunction – time	*Fan go n'eirí an ghrian*	Wait until the sun comes up
Ní, níor	Adverb – negative	*Ní chaitheann sé*	He doesn't spend
Mura, murar	Conjunction – conditional negative	*Mura bhfana sé go bhfóire Dia air*	If he doesn't wait, God help him
Sula, sular	Conjunction – purpose	*Rith leat sula bhfeicfear tú*	Run before they see you
	Conjunction – time	*D'éag sé sular tháinig an sagart*	He left before the priest came

Table G.36 Verbal Particles

Type	Prepositions	Example	Translation
Material	*de*	*Lán d'uisce*	Full of water
Purpose	*ar, chun, do, mar*	*Chun grá a thabhairt do*	To give him love
Time	*ar, faoi, de, um, go, le*	*Ar a trí a chlog*	At 3 o'clock
Origin	*as, ó*	*Is as an Spáinn é*	He is from Spain

Cause	*de, le, ó*	*Fuair sé bás den ocras*	He died of hunger
Sale	*ar, as, le*	*Dhíol sé an bhó le Tadhg*	He sold the cow to Tadhg
Place	*ar, faoi, i, idir, os, as, de, ó, chun, chuig, go, go dtí*	*Go dti a theach féin*	To his own house
Manner	*as, de*	*Abair as Gaeilge é*	Say it in Irish
State	*ar, faoi, i, le, as*	*Ina chónaí*	Living
Ownership	*do, le*	*Is liom é*	It's mine

Table G.37 Prepositions

Modifies	Example	Translation
Verb	*D'imigh sé* ***inné***	He left yesterday
Verbal noun	*Abair leis teacht* ***anseo***	Tell him to come here
Verbal adjective	*Tá sin déanta* ***go maith*** *agat*	You've done that well
Adjective	*Tá sé* ***measartha*** *fuar*	It is rather cold
Adverb	*Ní thagann sé minic* ***go leor***	He doesn't come often enough
Simple preposition	***Beagnach*** *faoi uisce*	Almost under water
Compound preposition	***Go luath*** *tar éis bháis dó*	Soon after he died
Conjunction	***Go díreach*** *sular tháining tú*	Just before you came

Table G.38 Adverbs

Direct Speech	Indirect Speech	Direct Example	Indirect version	Meaning
Present indicative	Past indicative	***Tá*** *sí caoga bliain d'aois*	Dúirt Seán **go raibh** sí caoga bliain d'aois	John said she was 50 years of age.
Present habitual	Conditional	*Má thagann tú ...*	*Dúirt Seán dá dtiocfadh sí*	John said that if she came
Future indicative	Conditional	*Déanfaidh mise é*	*Dúirt Seán go ndéadfadh sé féin é*	John said he would do it himself
Present subjunctive	Conditional or past subjunctive	*Fan go* ***dtaga*** *an bus*	*D'iarr sé orm fanacht go dtiocfadh an bus*	He asked me to wait until the bus came

Table G.39 Verb Change for Indirect Speech

Abstract nouns denote a quality, state of action considered in itself, and apart from anything in which it exists. Most abstract nouns are formed from adjectives and these are shown in Table G.40.

Abstract Noun	Adjective	Meaning
ábaltacht	*ábalta*	ability
clisteacht	*cliste*	cleverness
olcas	*olc*	badness
lagachar	*lag*	weakness
gile	*geal*	brightness
deirge	*dearg*	redness

Table G.40 Abstract Nouns

Appendix H Pilot Study

This appendix shows the pre- and post-CALL surveys used in the Pilot Study.

The results are given in Chapter 5 on the Pilot Study.

Pre-CALL Survey

1. Do you like Irish? Yes No Sometimes

2. Do you enjoy your Irish class? No Sometimes Always

3. I like Irish because ....

4. I don't like Irish because ...

5. What do you think about Irish?

6. I would like to learn Irish by doing ...

7. When we are doing Irish, I would like more ...

8. Would you like to have more Irish classes

9. What is your favourite class?

10. Any other comments?

Go Raibh Maith Agat!

Post-CALL Survey

Rang:

1. Do you like Irish? No Not Really Sometimes A Lot

2. Do you enjoy your Irish class? Never Sometimes Always

3. Do you enjoy using Irish on the Computer? No A little Yes

4. Would you like to learn more Irish on the Computer? No A little Yes

5. Which do you prefer for learning Irish? Classroom Computer

6. I like learning Irish on the computer because .....

_____

_____

_____

7. I do not like learning Irish on the computer because .....

_____

_____

_____

8. Comments:

_____

_____

_____

Go raibh maith agat!

Appendix I Survey June 2005

This appendix gives the results of a questionnaire-based survey administered to Class 6 (C6), in School 1 (S1) with Teacher T1 in June 2005. The actual questionnaire used is shown at the end of this appendix.

Feature	Value
Number of students	25
Missing students	1
Method of administration	Questionnaire distributed in class
Comment	Not all students answered all the questions

Table I.1 Questionnaire data (June 2005)

Summary

- Part 1: although most students did not like Irish, most enjoyed it on the Computer
- Part 2: the students do some activities even thought they do not really like them; the gap fill was not that popular
- Part 3: Some students did not get to use the verbs, it has potential but needs to be improved
- Part 4: Most students would like to do something similar next year but not at home

Part 1

The focus of Part 1 of the questionnaire was to ascertain the students' attitudes towards studying Irish on the computer. Table I.2 shows a summary of the students' feedback on Irish on the computer. Table I.3 provides a review of their comments (open-ended) about Irish on the computer.

- Most students only like Irish a little to not at all (82%)
- Only a small minority did not enjoy Irish on the computer at all (4%)
- The vast majority of students (84%) preferred the computer to class
- Most students said that the Irish program helped them at least a little (68%)

Question	No	A Little	Yes
Do you like Irish?	40%	48%	12%
Did you enjoy Irish on the computer?	4%	36%	60%
Would you prefer to spend time on the computer rather than in class?	16%		84%
Do you think the Irish program on the computer helped you?	32%	12%	56%

Table I.2 Student Feedback on Irish on the Computer

- The students liked and disliked almost all aspects of the CLICI resources e.I. there were students who liked the Championship game and others who disliked it.
- The students who preferred learning in class said that it was "more fun" or "better". Those who preferred the computer said that "it's fun", it facilitates self-paced learning ("You can take your time"), privacy ("I wont' get into trouble if I get it wrong"; "The computer doesn't shout") and the fact that they missed some general class time ("I hate maths").
- Those who did not find it helpful said ("it wrong"), no new information ("No new words"; "already in the book"), that they knew it already or they didn't understand it. Those that found it helpful cited learning opportunities ("Learnt new words"; "Improve Irish skills") and learner choice ("Because if you understand you don't have to read it").

Question	
What did you like about Irish on the computer? Championship Everything Lessons Mixed-up sentence The verbs Putting words into a sentence Games and stories	**What did you not like about Irish on the computer?** Multiple-choice Matching Mixed-up sentence Gap-fill Typing Lessons There were too many lessons Verbs Championships
Would you prefer to spend time on the computer or in class? Why? **Class:** Everything The class is better I like class More fun	**Would you prefer to spend time on the computer or in class? Why?** **Computer:** The computer doesn't shout It's fun I would get more time on it I hate maths/English Because you do more work in class I won't get into trouble if I get it wrong You can take your time It's better teaching I prefer the learning Cause you can play games and get to know more Irish
Do you find it helpful? **No:** It wrong No new words Already in the book Because I learn it in class I do not think it is as good as class Because I can't understand Irish Because I know all the Irish	**Do you find it helpful?** **Yes:** Easier to type Learnt new words It is very good on the computer Improve Irish skills Because I am getting better Because of the reading It teaches you Because if you understand you don't have to read it

Table I.3 Student Comments about Irish on the Computer

Part 2

The focus of Part 2 of the questionnaire was to find out if the students used the lessons generated by the Lesson Generator Component (LGC), and if so, how they used the lessons. Table I.4 shows a summary of their responses, while Table I.5 provides a selection of their comments on the lessons.

- Most students listen to the entire spoken text at least sometimes (92%)
- Most students listen to each line at least sometimes (76%)
- Only a few students do not do the multiple-choice game (4%)
- Only a few students do not do the matching game (8%)
- Only a few students do not do the mixed-up sentence game (4%)
- Quite a few students do not do the gap game (32%)

- The spoken text of the whole story is at least sometimes enjoyable (64%)
- The spoken text of each line is at least sometimes enjoyable (64%)
- Most students enjoy the multiple-choice game at least sometimes (76%)

- Most students enjoy the matching game at least sometimes (88%)
- Most students enjoy the mix-up sentence game at least sometimes (88%)
- Most students did not enjoy the gap game (56%)

- A sizeable minority of students do not listen to the entire spoken story first (40%)
- Nearly half the students do not read the story each line at a time before the games (44%)
- Most students do not return to the story when doing the games (76%)

Question	No	Sometimes	Yes
Did you ....?			
... listen to the whole story?	8%	52%	40%
... listen to each line?	24%	32%	44%
... do the multiple choice game?	4%	13%	83%
... do the matching game?	8%	8%	84%
... do the mixed-up sentence game?	4%	28%	68%
... to the missing words game?	28%	40%	32%
Did you enjoy ...?			
... listening to the whole story?	36%	32%	32%
... listening to each line?	36%	44%	20%
... the multiple choice game?	24%	8%	78%
... the matching game?	12%	8%	80%
... mixed-up sentence game?	12%	22%	66%
... missing words game?	56%	20%	24%
Did you listen to the sound of the whole story first?	40%	24%	36%
Did you read all the story before doing the games?	44%	16%	40%
When you were doing the games, did you go back to read the story?	76%	12%	8%

Table I.4 Student Feedback on the CLICL Irish Lessons

- The desire to play the games was one reason why students did not listen to the whole story first, while the help it provided motivated some students to listen to it before doing the games.
- The desire to play the games and the fact that they already listened to it meant some students did not read the story first. Those that did read it cited that fact that they liked it or that it helped them for the games.
- Most students did not go back to the story as they wanted to keep going with the games. A few students returned to the story if they need help with the answers.

Did you listen to the whole story first? No:	**Did you listen to the whole story first? Yes:**
Because I didn't hear the sound and I didn't understand	Because I liked it
Because I forgot	Because you would know the answer of the questions
Because I want to play the games first because they are more fun	Because it wouldn't be bored
Because it was boring	Because it helped me
Because I didn't want to	Because you learn it quicker
I didn't like it that much	So I can game last
	Because it helps you on the games
	I wanted to hear all of it together first

Table I.5 Student Comments on the CLICI Irish Lessons Part 1

Did you read all of the story first? **No:** I didn't know you had to read the story Because I listen to it I wanted to play the game I do not like Irish I did not know where it was The games are easy I didn't want to I already heard it	**Did you read all of the story first?** **Yes:** I liked it It looked good It helps your understanding skills in Irish I needed to know the sentences for the games I get to know what it means The story is good So I can play the game last
Did you go back to the story? **No:** I wanted to keep going I know the answer Then I would have to start again I wanted to play the game instead, more fun I forgot I didn't want to I already read the story It is a waste of time My time is up	**Did you go back to the story?** **Yes:** If I needed the answers To spend more time It would help me

Table I.5 Student Comments on the CLICI Irish Lessons Part 2

Part 3

The focus of Part 3 was to learn about what the students thought of the pages relating to verbs (generated by the Verb Conjugation Component (VCC)). Table I.6 shows a summary of their response, while Table I.7 provides an overview of their comments.

- Quite a few students (28%) did not get to use the verbs
- Only a minority (16%) did not like the verb part.
- A minority did not find it helpful (24%)

Question	No	A Little	Yes	No Answer
Did you like the Verb part?	16%	28%	28%	28%
Do you think it helped you to learn the verbs?	24%	16%	24%	36%

Table I.6 Student Feedback on the Verb Part

- Those that did not like the verb part said it was boring, they preferred other things ("I wanted to play games") or that they will learn in class. Those that did like it said they liked learning on the computer ("It's a good way to learn").
- Those who said it was not helpful said that knew the verbs already, while those who liked it said that it helped them remember ("It helps me remember what they mean").

Did you like the Verb part? **No:** I just did not like it I only got to the middle I wanted to play games It was boring I liked the other things and I was in a rush We will learn them in school	Did you like the Verb part? **Yes:** Shorter I learnt from it They helped me a lot It was better It's a good way to learn
Did you think it helped you to learn the verbs? **No:** It just shows you It just didn't help We will learn them in school I didn't know some verbs I knew them already	**Do you think it helped you to learn the verbs?** **Yes:** The sheet helped you I didn't know some of the words I kind of liked it It helps me remember what they mean

Table I.7 Student Comments on the Verb Part

Part 4

The purpose of Part 4 was to get student feedback on the possibilities of using Irish on the computer either at home or next year. Table I.8 gives a summary of their response, while Table I.9 provides a list of their comments.

- Most students would like to do something similar next year
- Although nearly all the students have a computer at home (96%), only a small minority (16%) said they would really use the Irish program at home

Question	No	Maybe	Yes
Would you like to do something similar next year?	24%	20%	56%
Do you have a computer at home?	4%		96%
Would you like to have the Irish program at home?	45%	24%	28%
Would you really use it?	40%	44%	16%

Table I.8 Student Feedback on Future Use

- The main things the students would like to see are games ("Wordsearch and a crossword")

What else would you like to see for Irish on the computer?
Wordsearch and a crossword
Robots
No, it's enough
TV on Irish and only on Irish
More games and less Irish
Maybe car racing in Irish, or a wrestling game
More questions
More games and more colour

Table I.9 Student Suggestions for CLICI

Student Survey on the Irish Program

Name: _____ Date: _____ Group: _____

********** **Part 1** **********

1. Do you like Irish? Yes A little No
2. Did you enjoy on the computer? Yes A little No

3. What did you *like* about Irish on the computer?

_____
_____
_____

4. What did you *not like* about Irish on the computer?

_____
_____
_____

5. Would you prefer to spend the time on the Computer or in Class? Computer Class
Why?

_____
_____
_____

6. Do you think the Irish program on the computer helped you? Yes A little No
Why?

_____
_____
_____

********** **Part 2** **********

Using the Irish Program:

7. Did you

a) listen to the whole story Yes Sometimes No
b) listen to each line Yes Sometimes No
c) do the multiple choice game Yes Sometimes No
d) do the matching game Yes Sometimes No
e) do the mixed-up sentence game Yes Sometimes No
f) do the missing words game Yes Sometimes No

8. Did you enjoy

g) listening to the whole story Yes Sometimes No
h) listening to each line Yes Sometimes No
i) doing the multiple choice game Yes Sometimes No
j) doing the matching game Yes Sometimes No
k) doing the mixed-up sentence game Yes Sometimes No
l) doing the missing words game Yes Sometimes No

9. Did you listen to the sound of the whole story first?
Why?

_____
_____
_____

10. Did you read all the story before doing the games?
Why?

_____
_____
_____

11. When you were doing the games, did you go back to read the story?
Why?

_____
_____
_____

********** **Part 3** **********

Verbs:
12. Did you like the Verb part of the Irish program? Yes A little No
Why?

_____
_____
_____

13. Do you think it helped you to learn the Verbs? Yes A little No
Why?

_____
_____
_____

********** **Part 4** **********

14. Would you like to do something similar next year? Yes A little No
15. Do you have a computer at home? Yes No
16. Would you like to have the Irish program at home? Yes Maybe No
17. Would you really use it? Yes Maybe No
18. Is there anything else you would like to see on the Irish program?

_____
_____
_____

****

19. Any other comments:

_____
_____
_____

Go raibh maith agat!

Appendix J Survey November 2005

This appendix shows a summary of the results of a questionnaire-based survey administered to Class 6 (C6) students in School 1 (S1) with Teacher T1 in November 2005. The actual questionnaire used is shown at the end of this appendix.

Feature	Value
Number of students	20
Missing students	6
Method of administration	Questionnaire distributed in class
Comment	Not all students answered all the questions

Table J.1 Questionnaire Data (November 2005)

Part 1: Irish on the Computer

The aim of Part 1 was to find out what the students thought about learning Irish on the computer. Table J.2 shows a summary of their responses, while Table J.3 provides a selection of their comments.

- Most students (85%) liked Irish on the computer.
- A minority of student (25%) did not find it at all helpful.
- Half the students (50%) preferred learning in class over learning on the computer (this is considerably more than the 16% for the same question in June 2005 – see Appendix G).
- Half the students (50%) did not enjoy Irish on the computer

Question	Yes	No	A Little/Both
Did you like Irish on the computer?	85%	15%	
Did you find it helpful?	55%	25%	20%
Did you prefer learning on the computer over the class?	45%	50%	5%
Did you enjoy Irish on the computer?	35%	50%	15%

Table J.2 Student Feedback on Irish on the Computer

- Some students liked the lessons, the games, while others disliked them.
- Students preferred learning in class because they learnt new material and there was more help available. Some students preferred the computer because it was more enjoyable.
- The verb pages were not helpful for some students as they already knew the verbs or they learn enough Irish in class. The fun aspect as well as the ability to see an improvement and revise their verbs, were reported by some students to be helpful.

What do you like about Irish on the computer?	**What do you dislike about Irish on the computer?**
Story, verbs, championship Games Mixed-up sentence Not as hard as normal	Story Matching Championship Games, verbs
Do you prefer Irish on the computer or in class? **Class:** Need to know different things, check improvement More help Know everything on the computer Learn more More of a challenge Computer is boring	**Do you prefer Irish on the computer or in class?** **Computer:** Easier work More fun Faster Could learn verbs

Table J.3 Student Comments about Irish on the Computer Part 1

Did you find it helpful?	Did you find it helpful?
No:	**Yes:**
Know verbs	See improvement
No new stuff	Verbs on computer teach you
Not good	Tells you Irish, have fun
Learn enough in class	Revise
	Made me know more
	Helped me
	I didn't know some things

Table J.3 Student Comments about Irish on the Computer Part 2

Part 2: Lesson Generation Component
The aim of Part 2 was to find out what the students thought of the Lessons Generation Component (LGC)-generated lessons. However, the wording of the question (using the word 'story') was confusing to the students, and the responses did not make sense (in terms of the information sought).

Part 3: Verb Conjugation Component
The focus of Part 3 was to ascertain the students' feedback on the verb lessons (generated by the Verb Conjugation Component (VCC). Table J.4 provides a summary of their responses, while Table J.5 gives an overview of their comments.

- Only a small minority (15%) did not like the verb lessons at all.
- Only a small minority (20%) did not find them at all helpful.
- The majority of students (60%) preferred the animated mode of presentation.

Question	Yes	No	A Little/Both	Didn't See
Did you like the verb lessons?	40%	15%	45%	
Did you find them helpful?	45%	20%	35%	
Do you prefer the animated mode?	60%	15%	10%	15%

Table J.4 Student Feedback on the Verb Conjugation Component

- Some students did not find the verb part helpful as it was boring or they knew the verbs already. Other found it helpful as it "shows and tells what it means" and cleared up confusion ("I was always getting confused and now I'm not").
- Students who preferred the static presentation said they had more time ("Learn it longer") or found the animated mode annoying. Those who preferred the animated mode said it was "more fun" and it helped understand ("It will get you used to putting in silent letters"; "makes me understand").

Did you find the Verb part helpful?	Did you find the Verb part helpful?
No:	Yes:
Know already	Shows and tells what it means
Too boring	Tells you how to spell them and more
	Helps me with my spellings
	I was always getting confused and now I'm not
	I remember them

Table J.5 Student Comment on the Verb Conjugation Component Part 1

Which mode do you prefer?	Which mode to you prefer?
Static:	**Animated:**
I get it when my teacher tells me	You would know more past tense verbs
Gives more help	More fun
It's annoying	Makes me understand

Learn it longer	It helps It's better I kept on forgetting the h It will get you used to putting in silent letters You learn more
What was the best part and why? Championship: helped, fun, easy, a bit of a challenge Games: learn stuff in games, fun Learning the verbs: helps a lot	**What was the least enjoyable part and why?** Championship: too hard Moving verb: doesn't help a lot

Table J.6 Student Comment on the Verb Conjugation Component Part 2

Part 4: Writing Checker

The aim of Part 4 was to get the students' feedback on the Writing Checker Component (WCC). A summary of their responses is shown in Table J.6, while Table J.7 shows a selection of their comments.

- Only a minority (20%) really liked the WCC.
- Only a minority (20%) really found it helpful.

Question	Yes	No	A Little/Both
Did you like the writing checker?	20%	30%	50%
Did you find it helpful?	20%	40%	40%

Table J.6 Student Feedback on the Writing Checker Component

- Students did not enjoy using the WCC because it was hard, they do not like writing stories in Irish and have difficulty typing. Those that did enjoy using it said it helped them and they need to be able to write in Irish, although one student noted that "after a while it was hard to think of a different story every time")
- Students preferred writing in their copy as there was more help available ("If you are stuck you can ask your friend").

Did you enjoy using the Writing Checker? **No:** Hard Very hard to write in Irish I don't like writing stories It was boring Not really because I don't like typing	**Did you enjoy using the Writing Checker?** **Yes:** In future, need to know how to do Irish stories It helped me go over my stories It's a good idea But after a while it was hard to think of a different story every time It was my favourite thing to do When I get stuck on words I don't know and I find out what they are
Did you find it helpful? **No:** If you are stuck you can ask your friend Class helps more than the computer I didn't know how to write some Irish words Because the work in class is harder than on the computer Class is more fun and learn more	**Did you find it helpful?** **Yes:** It is just the same It was helpful It was the same as learning

Table J.7 Student Comment on the Writing Checker Component

Student Survey on the Irish Program

********** **Part 1** **********

Did you like Irish on the computer?
What did you like about Irish on the computer?

_____
_____
_____

What did you not like about Irish on the computer?

_____
_____
_____

Would you prefer to spend the time on the Computer or in Class?
Why?

_____
_____
_____

Do you think it helped you?
Why?

_____
_____
_____

********** **Part 2** **********

Using the Irish Program:
Did you enjoy the Irish story?
Why?

_____
_____
_____

How did it compare to doing the lesson in class? ☐ Same ☐ Better ☐ Worse
Why?

_____
_____
_____

********** **Part 3** **********

Verbs:
Did you like the Verb part of the Irish program? ☐ Yes ☐ No ☐ A Little

Do you think it helped you to learn the Verbs? ☐ Yes ☐ No ☐ A Little
Why?

_____
_____
_____

Which would you prefer the moving verbs or the still verbs? ☐ Moving ☐ Still
Why?

_____
_____
_____

What did you like best? _____
Why?

_____
_____
_____

What did you like least? _____
Why?

_____
_____
_____

********** **Part 4** **********

Writing:
Did you like the Writing part of the Irish program? ☐ Yes ☐ No ☐ A little
Do you think it helped you to write? ☐ Yes ☐ No ☐ A little
Why?

_____
_____
_____

What did you like best? _____
Why?

_____
_____
_____

What did you like least? _____
Why?

_____
_____
_____

****

Go raibh maith agat!

Appendix K Verb Conjugation Component Online Feedback

This appendix provides a summary of the online feedback provided by the Class 6 (C6) students in School 1 (with Teacher T1) during the period September – December 2005. A screen shot of the feedback form is shown in Figure K.1.

Feature	Value
Number of students	22
Missing students	4
Number of questionnaires	68
Method of administration	Questionnaire administered after each Championship exercise
Comment	Not all students answered all the questions

Table K.1 Questionnaire Data (Online September - December 2005)

- Most students (84%) found the verb pages at least somewhat helpful, with little variation between the presentation modes.
- Most students like the Championship exercise.
- More static mode students (26%) than animation mode students (10%) found the Championship exercise hard.

Question	No	A Little	Yes
Did you find the verb lessons helpful?	16%	35%	49%
Static:	17%	35%	48%
Animated:	15%	35%	50%
Did you like the Championship?	12%	19%	70%
Static:	13%	13%	65%
Animated:	10%	25%	74%
Did you find the Championship hard?	46%	36%	18%
Static:	35%	39%	26%
Animated:	57%	33%	10%

Table K.2 Student Online Feedback on the Verb Conjugation Component

- Most students liked the Championship and the other games.
- The gap-fill exercise was not popular with the student.

What did you like?	What did you dislike?
The Championship (because it was hard and challenging for me) The verb The matching game The mixed-up sentences	Gap-fill Championship Verbs

Table K.3 Student Online Comments on the Verb Conjugation Component

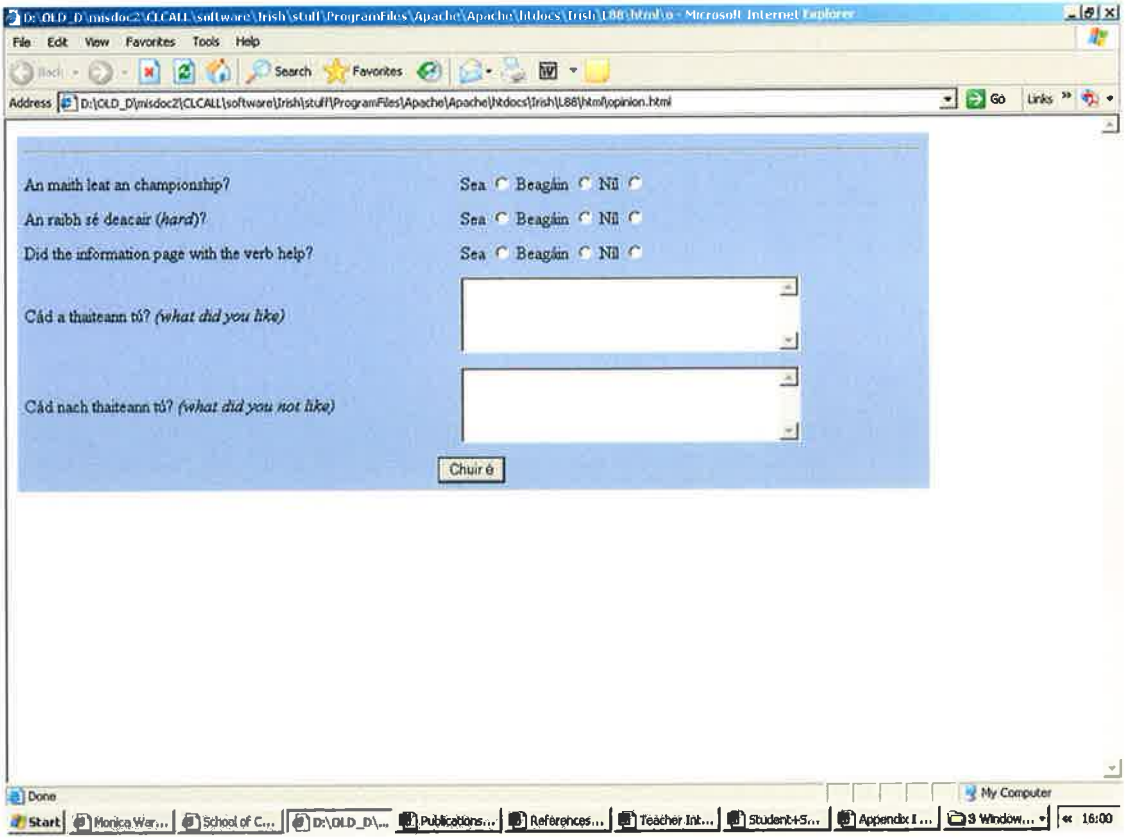


Figure K. 1 Screen shot of Online Feedback on the Verb Conjugation Component

Appendix L Verb Conjugation Component Empirical Data

This appendix shows the empirical data for the Verb Conjugation Component (VCC). It comes from data with Class 6 (C6), in School 1 with Teacher T1. The figures shown are the students' test scores for the Championship exercises, which is a mix of multiple-choice and gap-fill questions.

Note:

Only exercises with at least one data component are reported. Some students submitted exercises with no attempt at any of the questions and these have been excluded from the figures.

Figure L.1 shows an overall summary of the students' test scores for the Championship exercise. The figure in brackets indicates the number of test scores that contributed to the figures.

Variable	N	Static		Animated	
		Regular	Irregular	Regular	Irregular
Good	(6, 6, 8, 14)	3.17 (n=6)	8.17 (n=6)	7.13 (n=8)	6.21 (n=14)
Medium	(5, 5, 1, 6)	5.00(n=5)	4.40 (n=5)	1.00 (n=1)	4.17 (n=6)
Weak	(3, 1, 3, 4)	7.33(n=3)	1.00 (n=1)	3.33 (n=3)	1.00 (n=4)
Overall	(14, 12, 12, 24)	4.71(n=14)	6.00 (n=12)	5.67 (n=12)	4.83 (n=24)

Table L.1 Overall Summary

Note:

- Round 1 refers to the second 3 weeks of the experiment, while Round 2 refers to the third 3 weeks of the experiment. In the first 3 weeks, both groups only had access to the static presentation mode.
- The results of the static mode improved, while it decreased for the animated mode. It is not clear why this should be the case, although the greater number of weak students and their lower scores decrease the average value for animated mode in Round 2.

A summary of the students' results by Round is shown in Table L.2, while L.3 shows the accompanying number of student tests in each section.

Variable	Static			Animation		
	Round 1	Round 2	Average	Round 1	Round 2	Average
Good	5.50	6.00	5.67	5.67	7.60	6.55
Medium	4.25	5.00	4.70	4.33	3.25	3.71
Weak	4.00	7.50	5.75	4.50	1.00	2.00
Overall	4.93	5.75	5.31	5.29	4.95	5.11

Table L.2 Student Results by Round

Variable	Static			Animation		
	Round 1	Round 2	Average	Round 1	Round 2	Average
Good	8	4	12	12	10	22
Medium	4	6	10	3	4	7
Weak	2	2	4	2	5	7
Overall	14	12	26	17	19	36

Table L.3 Number of Students for Table L.2

Note:

- It would appear that students benefited most from the static presentation mode (even though the majority prefer the animated mode).

Variable	Static			Animation		
	Regular	Irregular	Average	Regular	Irregular	Average
Good	3.17	8.17	5.67	7.13	6.21	6.55
Medium	5.00	4.40	4.70	1.00	4.17	3.71
Weak	7.33	1.00	5.75	3.33	1.00	2.00
Overall	5.30	5.78	5.30	5.67	4.83	5.11

Table L.4 Student Results by Round

Variable	Static			Animation		
	Regular	Irregular	Average	Regular	Irregular	Average
Good	6	6	12	8	14	22
Medium	5	5	10	1	6	7
Weak	3	1	4	3	4	7
Overall	14	12	26	12	24	36

Table L.5 Number of Students for Table L.4

Table L.6 shows the ANOVA analysis for the data, comparing the static mode test scores with those of the animated mode. As the F value (0.053928) is less the than the F critical value (4.001194), the test result differences between the two groups can be explained by chance.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Static	26	138	5.307692	8.461538		
Animated	36	184	5.111111	12.50159		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.583402	1	0.583402	0.053928	0.817155	4.001194
Within Groups	649.094	60	10.81823			
Total	649.6774	61				

Table L.6 ANOVA Data for Static vs Animated Mode

Figure L.7 shows the results of a t-test comparing static and animated modes. The null hypothesis is rejected if $t > 2.000297$ of if $t < -2.000297$. As the t value (t Stat) is 0.232223, the null hypothesis is not rejected. Thus there is no statistical difference between the test scores for static and animated mode.

Table L.8 shows the ANOVA analysis for the data, comparing the static mode test scores with those of the animated mode for regular verbs. As the F value (0.0697979) is less the than the F critical value (4.259675), the test result differences between the two groups can be explained by chance. Figure L.9 shows the results of a t-test comparing static and animated modes. The null hypothesis is rejected if $t > 2.063898$ of if $t < -2.063898$. As the t value (t Stat) is -0.83545, the null hypothesis is not rejected. Thus there is no statistical difference between the test scores for static and animated mode for regular verbs.

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	5.307692	5.111111
Variance	8.461538	12.50159
Observations	26	36
Pooled Variance	10.81823	
Hypothesized Mean Difference	0	
Df	60	
t Stat	0.232223	
P(T<=t) one-tail	0.408577	
t Critical one-tail	1.670649	
P(T<=t) two-tail	0.817155	
t Critical two-tail	2.000297	

Table L.7 t Test for Static vs Animated Mode

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Static Regular	14	66	4.714286	6.21978
Animated Regular	12	68	5.666667	10.9697

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.860806	1	5.860806	0.697979	0.411704	4.259675
Within Groups	201.5238	24	8.396825			
Total	207.3846	25				

Table L.8 ANOVA Data for Static Regular vs Animated Regular

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4.714286	5.666667
Variance	6.21978	10.9697
Observations	14	12
Pooled Variance	8.396825	
Hypothesized Mean Difference	0	
Df	24	
t Stat	-0.83545	
P(T<=t) one-tail	0.205852	
t Critical one-tail	1.710882	
P(T<=t) two-tail	0.411704	
t Critical two-tail	2.063898	

Table L.9 t Test for Static Regular vs Animated Regular

Table L.10 shows the ANOVA analysis for the data, comparing the static mode test scores with those of the animated mode for regular verbs. As the F value (0.85832) is less the than the F critical value (4.130015), the test result differences between the two groups can be explained by chance.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Static	12	72	6	10.90909
Animated	24	116	4.833333	13.53623

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.88889	1	10.88889	0.85832	0.360739	4.130015
Within Groups	431.3333	34	12.68627			
Total	442.2222	35				

Table L.10 ANOVA Data for Static Irregular vs Animated Irregular

Figure L.11 shows the results of a t-test comparing static and animated modes. The null hypothesis is rejected if $t > 2.032243$ of if $t < -2.032243$. As the t value (t Stat) is 0.926456, the null hypothesis is not rejected. Thus there is no statistical difference between the test scores for static and animated mode for irregular verbs.

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	6	4.833333
Variance	10.90909	13.53623
Observations	12	24
Pooled Variance	12.68627	
Hypothesized Mean Difference	0	
Df	34	
t Stat	0.926456	
P(T<=t) one-tail	0.18037	
t Critical one-tail	1.690923	
P(T<=t) two-tail	0.360739	
t Critical two-tail	2.032243	

Table L.11 t Test for Static Irregular vs Animated Irregular

Appendix M Class 6 Learner Corpus Examples

This appendix shows some sample texts from the Class 6 (C6) students in School 1 (S1) with Teacher T1.

ID	Type	Text	Comment
117	Weak	*chonaic ciara sá teilifis gach lá. feicfidh eoín sá teilifis inné. feicaim maímí agus daídí sá teilifis amarcach. dol ciara in icce an teilifis. dol eoín in icce an teilifis. dol maímí agus daídí in icce sá teilifis. d,ith ciara in icce sá teilifis inné. d,ith eoín in icce sá teilifis gach lá. d,ith maímí agus daídí in icce sá teilifis amarach.*	Long text with a lot of repetition.
120	Weak	*mamie agus dadie sa phork chonamar an chock ar an bhi eickamar mamie agus dadie ta atus*	Invented text
126	Weak	*conaic ar an soipa agus biuideal chuig do cola agus an sin chuig me an sun car 2 ag tranan*	Invented text
104	Medium	*Chuir brecfasta ar madin. Faigham an caprey agus diloga. Tá acus orum.*	Text probably based on known phrase (with many spelling errors)
119	Medium	*bhí mé sá síopa inne. chuir mé an mílsean agus an ull bhí mé ag shiul sá tech. chuir mé an telifís an spórt agus an cátun. díth mé an diner. bhi mé ar an laba.*	Story about his day yesterday.
121	Medium	*Chonaic mé agus Dadaí an telifés inne. Cheannaigh Dadaí an telifés inne. Chonaic mé an Simsons inne. Chonaic Mamaí Fair City inne. Chonaic Dadaí an nuctáin inne.*	Story about the TV programmes he and his parents saw yesterday.
101	Good	*Chonaic mé dhaidí sa soiapí. Cheanaigh sé an seampú agus cheanaigh sé an tuillía. Chuir sé tuillía agus seampú ar an mbord. Ndaeaigh dhaidí sa choc taibhne.*	Probably based on text from a booM.
107	Good	*Tá eagla orm dadio. Cen faith a eagla. Eagla mé a monster faoin leaba.Ní monster faion leaba tá t-leana glas.Go raibh maith agat dadio beidh mé saobh areir*	Invented story (about a monster under the bed)
121	Good	*Chuaigh Daídí an charr glas. Tá sé athás ort. Chuaigh daídí a aochair. Cheannaigh daídí go dtí an teach.*	Invented text

Table M.1 Sample of C6 Students' Texts

Appendix N Class 6 Writing Checker Component Survey June 2006

This appendix reports on the results of a questionnaire-based survey administered to Class 6 (C6) students from School 1 with Teacher T1 in June 2006. The aim of the survey was to find out their attitudes to Irish writing and the Writing Checker Component. The actual survey is shown at the end of this appendix.

Table N.1 shows a summary of questionnaire itself.

Feature	Value
Number of students	19
Missing students	7
Method of administration	Questionnaire distributed in class
Comment	Not all students answered all the questions

Table N.1 Questionnaire data (June 2006)

Table N.2 shows a summary of the students' responses along with an analysis of these responses.

Do you like Irish?

Only a small minority (11%) like Irish, with the good students disliking it less than the other groups.

Like Irish?	Yes	A Little	No
Good	0%	63%	38%
Medium	25%	38%	38%
Weak	0%	33%	67%
Total	11%	47%	42%

Do you like writing in Irish?

Only a small minority (11%) like writing in Irish.

Like Writing?	Yes	A Little	No
Good	13%	25%	63%
Medium	14%	57%	29%
Weak	0%	0%	100%
Total	11%	33%	56%

Did you understand the error messages?

A sizeable minority (42%) did not understand the error messages, with only a small minority (16%) reporting that they understood them. The good students reported a better understanding than the other groups.

Understand Err?	Yes	A Little	No
Good	25%	38%	38%
Medium	13%	50%	38%
Weak	0%	33%	67%
Total	16%	42%	42%

Were they helpful?

The error messages were somewhat helpful (53%). The good students said they were more helpful (43%) than other groups.

Err Help?	Yes	A Little	No
Good	43%	43%	14%
Medium	25%	13%	63%
Weak	0%	0%	100%
Total	29%	24%	47%

Did you correct your errors?

The majority of the students (75%) said that they made corrections (although the empirical data does not back this up).

Correct Err?	Yes	No
Good	75%	25%
Medium	71%	29%
Weak	100%	0%
Total	75%	25%

Table N.2 Student Feedback on the Writing Checker (June 2006) Part 1

Did you understand the spelling errors?
A sizeable minority (32%) did not understand the spelling error messages. However more students (68%) reported some understanding of the spelling error messages over the grammar error messages (58%).

Understand SErr?	Yes	A Little	No
Good	25%	38%	38%
Medium	13%	50%	38%
Weak	0%	33%	67%
Total	26%	42%	32%

Were they helpful?
A majority reported that the spelling error messages were somewhat helpful (70%).

Spell Err Helpful?	Yes	A Little	No
Good	38%	38%	13%
Medium	29%	14%	71%
Weak	0%	0%	100%
Total	35%	35%	30%

Did you correct your spelling errors?
A majority (59%) reported that they corrected their spelling errors, which is less than that for grammar errors (75%). However, the empirical data does not confirm this.

Correct Spell Err?	Yes	No
Good	75%	25%
Medium	71%	29%
Weak	50%	0%
Total	59%	41%

Did you enjoy using the Writing Checker?
Only a minority (22%) actually enjoyed using the WC, while half (50%) somewhat enjoyed it. Only a minority (28%) did not enjoy it.

Enjoy?	Yes	A Little	No
Good	25%	38%	38%
Medium	14%	57%	43%
Weak	0%	33%	67%
Total	22%	50%	28%

Did you find the Writing Checker helpful?
A sizeable minority (44%) reported that the WC was helpful, with only a minority (28%) saying that it was not helpfuN. Although, given the lack of understanding of the error messages, this is slightly surprising.

Helpful?	Yes	A Little	No
Good	33%	33%	33%
Medium	50%	25%	25%
Weak	100%	0%	0%
Total	44%	28%	28%

Did you have enough time to write your stories?
A large majority of the students (80%) had enough time to write their stories.

Time	Yes	No
Good	86%	29%
Medium	83%	33%
Weak	50%	0%
Total	80%	20%

Would you prefer to write in the WC or your copy?
The majority of students (63%) would prefer to write stories in their copy than using the WC. Only the good students would prefer to use the WC (63%).

Comp/Copy	Comp	Copy
Good	63%	38%
Medium	25%	75%
Weak	0%	100%
Total	37%	63%

Table N.2 Student Feedback on the Writing Checker (June 2006) Part 2

What did you not like about writing in Irish?	What do you like about writing in Irish?
Because I can't spell it, I can't write it Because it is hard I just don't It's boring It's not very fun You forget fadas (accents)	Because I learn from it but it's tiring It's good to learn our own language I think it is good
Why would you prefer to write in your copy?	**Why would you prefer to write in the Writing Checker?**
Easier Because on the computer I don't know where the keys are Faster Because it would be a challenge	It tells you your mistakes I hate writing It helps It's easier to understand
What problems did you have with the Writing Checker?	**What changes would you like?**
A few A lot Everything I couldn't use it It was confusing None Some The spellings	Games and help It changes the writing for you Make it more understandable More story writers None The spelling errors
What type of stories do you write?	
Short ones Long ones Good ones Bad ones Stories that follow from the textbook Ones about sport Fun adventures Toy shop A doctor About anything	

Table N.3 Student Comments on the Writing Checker (June 2006)

Name: _____ Date: _____ Class: _____

1. Do you like Irish? Yes A Little No

2. Do you like writing in Irish? Yes A Little No

3. Why? _____
_____
_____

4. Did you use the Irish Writing Checker on the computer? Yes No

5. What type of stories do you write? _____
_____

6. Did you understand the error messages? Yes A Little No

7. Were they helpful? Yes A Little No

8. Did you correct your errors? Yes No

9. Did you understand the spelling errors? Yes A Little No

10. Were they helpful? Yes A Little No

11. Did you correct your spelling errors? Yes No

12. Did you enjoy using the Writing Checker? Yes A Little No

13. Did you find the Writing Checker helpful? Yes A Little No

14. Did you have enough time to write your stories? Yes No

15. What problems did you have with the Writing Checker? _____
_____
_____
_____

16. If you had to write a story in Irish, would you prefer to use the Writing Checker or write it in your copy? Writing Checker Irish

17. Why? _____
_____
_____

18. What changes would you like in the Writing Checker? _____
_____
_____
_____

Go Raibh Maith Agat!

Appendix O Writing Checker Empirical Data

This appendix provides empirical data on the Writing Checker Component (WCC). Table O.1 shows an overall summary of the number of texts, lines and words written by the three levels of students (good, medium and weak).

	No. Stu.	No. Texts	No. Texts				No. Lines				No. Words			
			Av	Md	Mn	Mx	Av	Md	Mn	Mx	Av	Md	Mn	Mx
Good	12	51	3.04	3	1	8	4.49	4	1	16	30.45	26	4	115
Med	9	41	3.22	3	1	8	3.88	4	1	10	21.88	22	1	57
Weak	4	16	2.94	2.5	1	7	3.25	1	1	12	28.31	19	5	83
All	25	108	3.09	3	1	8	4.07	4	1	16	26.88	24	1	115

Table O.1 Summary Data for Writing Checker Component

Legend:

Abbreviation	Meaning
No	Number
Av	Average
Md	Median
Mn	Minimum
Mx	Maximum

Table O.2 List of Abbreviations for Table O.1

General Analysis

Table O.1 shows a summary of the empirical data from the Writing Checker Component. The medium students wrote slightly more texts than the other students. The range was almost the same for all groups. The good students wrote most sentences, followed by the medium students and then the weak students. They also had the widest range. The good students wrote more words, then the weak students and finally the medium students. The good students had the widest range.

Grammar Errors

The good and the medium students had the same grammar error averages. However, the grammar error per word ratio was lower for the good students. Interestingly, the weak students had the same grammar error per word ratio as the good student and they had the lowest number of grammar errors. This is mainly because their errors are mainly spelling errors that will probably be detected as grammar errors once they have been corrected.

	No. Stu.	No. Texts	G Err				G/W			
			Av	Md	Mn	Mx	Av	Md	Mn	Mx
Good	12	51	1.63	1	0	5	0.05	0.04	0	0.18
Med	9	41	1.63	1	0	8	0.07	0.04	0	0.36
Weak	4	16	1.00	0.5	0	3	0.05	0.01	0	0.20
All	25	108	1.54	1	0	8	0.06	0.04	0	0.36

Table O.3 Grammar Error Data for Writing Checker Component

Spelling Errors

The medium students had the lowest average number of spelling errors per text, followed by the good students, with the weak students having a much higher number of errors. However, the good students had a lower spelling error per word ratio than the other two groups. Note that the range of spelling errors is much greater (average of 29), than that for grammar errors (average of 7).

	No. Stu.	No. Texts	S Err				Sp/W			
			Av	Md	Mn	Mx	Av	Md	Mn	Mx
Good	12	51	8.80	8	0	27	0.31	0.29	0.00	0.75
Med	9	41	7.66	7	1	25	0.39	0.33	0.15	1.00
Weak	4	16	11.13	8	1	37	0.37	0.41	0.16	0.59
All	25	108	8.71	8	0	37	0.35	0.33	0.00	1.00

Table O.4 Spelling Error Data for Writing Checker Component

Appendix P Class 9 Learner Corpus Examples

This appendix shows some texts from the Class 9 in School 2 with teacher T5. Learner Corpus. The data is very limited due to the limited number of students who wrote texts and the limited number of texts they wrote.

ID	Type	Text	Comment
050	Good	*Cheanndigh mé siopi glasarí. Thoisaígh me an carr. Doscal me an doras.*	A group of short sentences.
051	Good	*cheannaigh mé milseán agus úll. Chuaigh mé go dtí an dóctíúr. Dith mé mó dinnér.*	A group of short sentences (with punctuation errors).
052	Good	*chonaic me an madra fuair me an ull shiul me go dti an scoil*	Long text with missing fullstops.
053	Good	*Thosaigh me ag shiul. Dhun me mo mala.Thug mamai plaster air.*	OK text with many spelling errors (due to missing accents).

Table P.1 Portion of C9 Students' Texts

Appendix Q Student's User Manual

The CLICI system enables you to study Irish lessons, learn about verbs and lets you enter stories in Irish. This manual shows you how to use the CLICI system.

There are several steps you have to follow to use the CLICI system. First you must log on and then you must select what you want to dQ.

Login

To login to the CLICI system, you must type in your username (ainm) and password (Focail specialta), and then click on "Chuir é!".

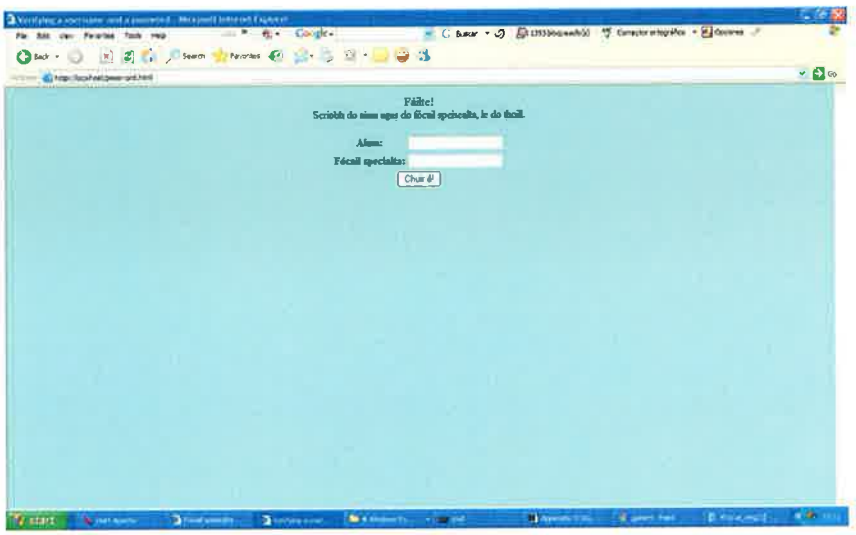


Figure Q.1 CLICI Login Screen

If you are successful, you will see the Welcome screen (see Figure Q.2). If you use the wrong username or password, the system will tell you that there is an error and you can try to login again. If you have a problem, make sure that you are typing your username in the right case (usually lower case). On the Welcome screen, you should click on "Isteach" to start using the CLICI system. You will then see the main CLICI screen (see Figure Q.3).

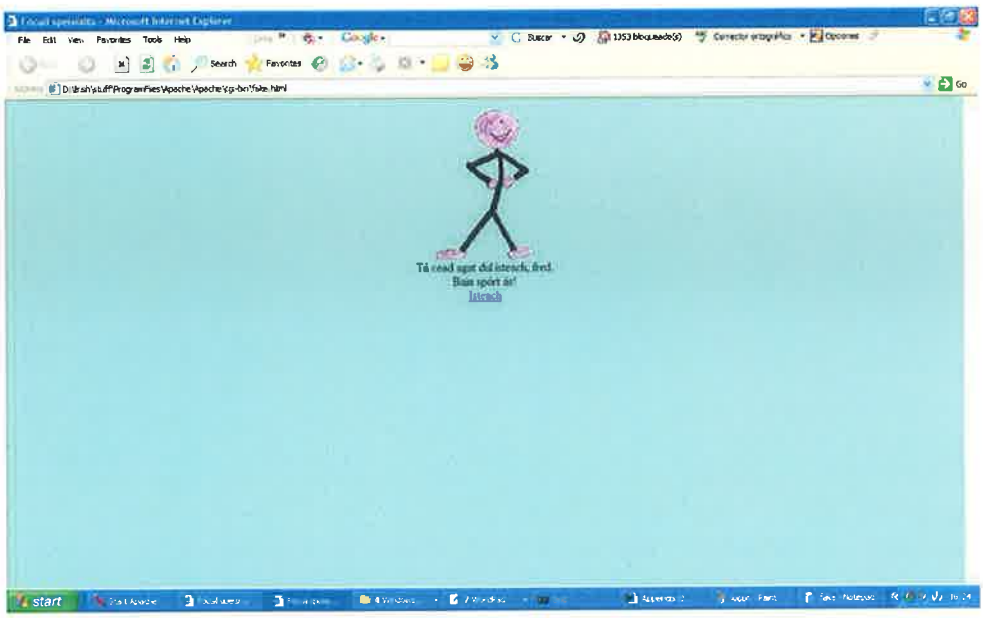


Figure Q.2 CLICI Welcome Screen

The CLICI Main screen has a menu panel (coloured green) on the left-hand side of the page. It shows you the different things you can do with the CLICI system. In the centre of the screen, there are the title words "Ag Súgradh as Gaeilge", as well as the CLICI happy man.

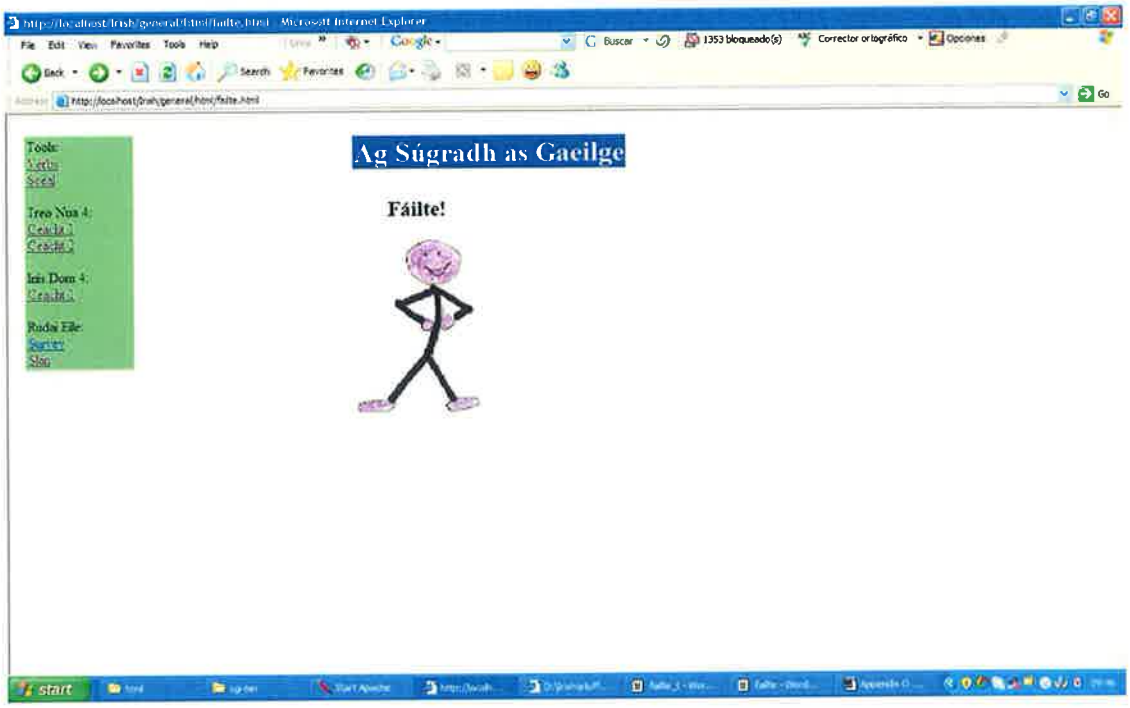


Figure Q.3 CLICI Main Screen

Using the Irish lessons

If you want to do one of the Irish lessons, you can click on the lesson (Ceacht) of the book you are using. For example, if you want to do Ceacht 1 in Treo Nua 4, you should click on the link "Ceacht 1" under the words "Treo Nua 4". When you click on this link, you should see the lesson page (see Figure Q.4). You will see the green menu bar on the left-hand side. You will see the title "Ag Sugradh as Gaeilge" on the top. There are 4 puzzled men, and each of them represents a game. These games will be explained later. You will also see the picture of someone talking ( ). This picture shows you that if you click on it, you will hear someone saying the text. If you click on the talking picture beside the lesson title (for example, "Mé Féin" in Figure Q.4), you will hear all the lesson being read. If you click on the talking picture beside a line of text, you will hear just that line being read. The picture on the screen is related to the lesson (for example, the picture in Figure Q.4 shows you two people saying hello to each other as this is what lesson 1 is all about).

You can study the lesson in whatever way you like, but it's probably best to:

1. Read and listen to the whole lesson
2. Then, read and listen to each individual line
3. Do the games.

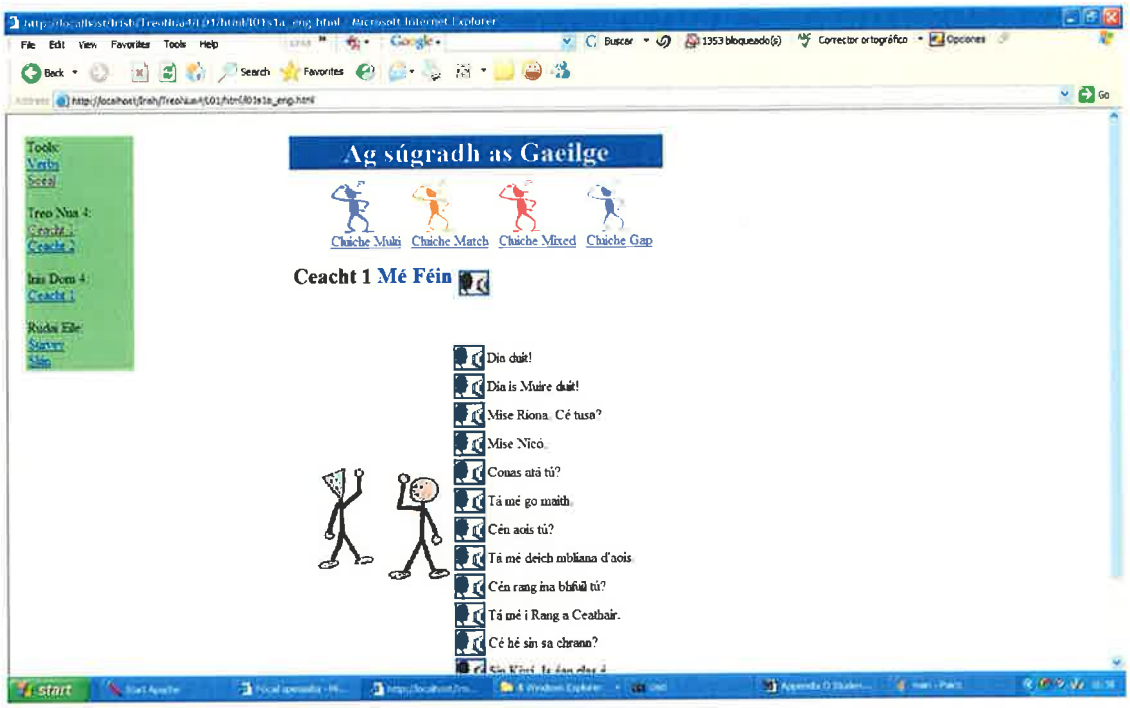


Figure Q.4 CLICI Lesson Screen

Doing the Games

Multiple-Choice Game

There are 4 games that you can play in each lesson. The first is the Cluiche Multi which is a multiple-choice game. Figure Q.5 shows you an example. There are 3 questions and you have to select the right answer for each question by clicking on the letter you think has the correct answer. You will see an 'X' for an incorrect answer and a happy face ':-)' for the right answer.

Matching Game

In the Cluiche Match, you have to move the words on the right-hand side to their correct place on the left-hand side of the screen (see Figure Q.6). You do this by dragging and dropping the right-hand side words to the left-hand side. This means placing the mouse over the words on the right-hand side, and keeping the mouse button pressed, move the words over to the left-hand side of the screen. The CLICI system will keep the correct answers with their match, and return the incorrect answers to the right-hand side of the screen. You can continue until you have all the paired matched correctly.

Mix-up Game

In the Cluiche Mix, you have to put the words in the correct order (see Figure Q.7). You do this by dragging from below the line and dropping them above the line in the right order. If you click on "Féach" you can see if you are right. You can get help by clicking on "Cabhair" but you will get lower marks if you ask for help.

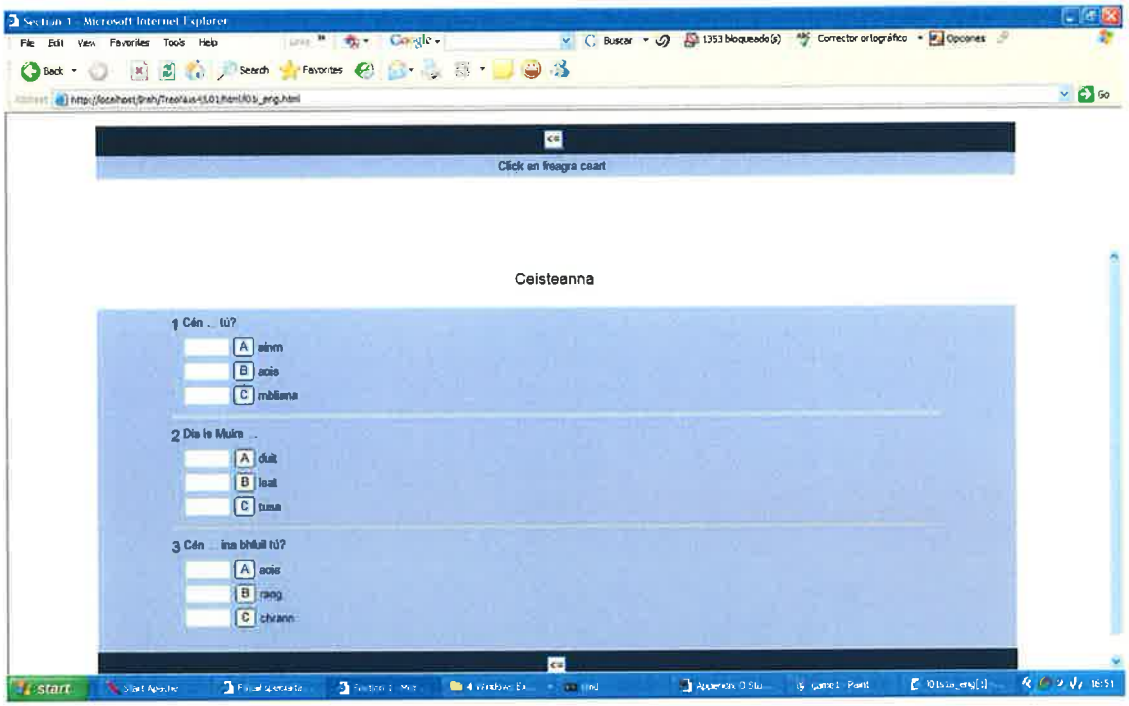


Figure Q.5 CLICI Multiple-Choice Game

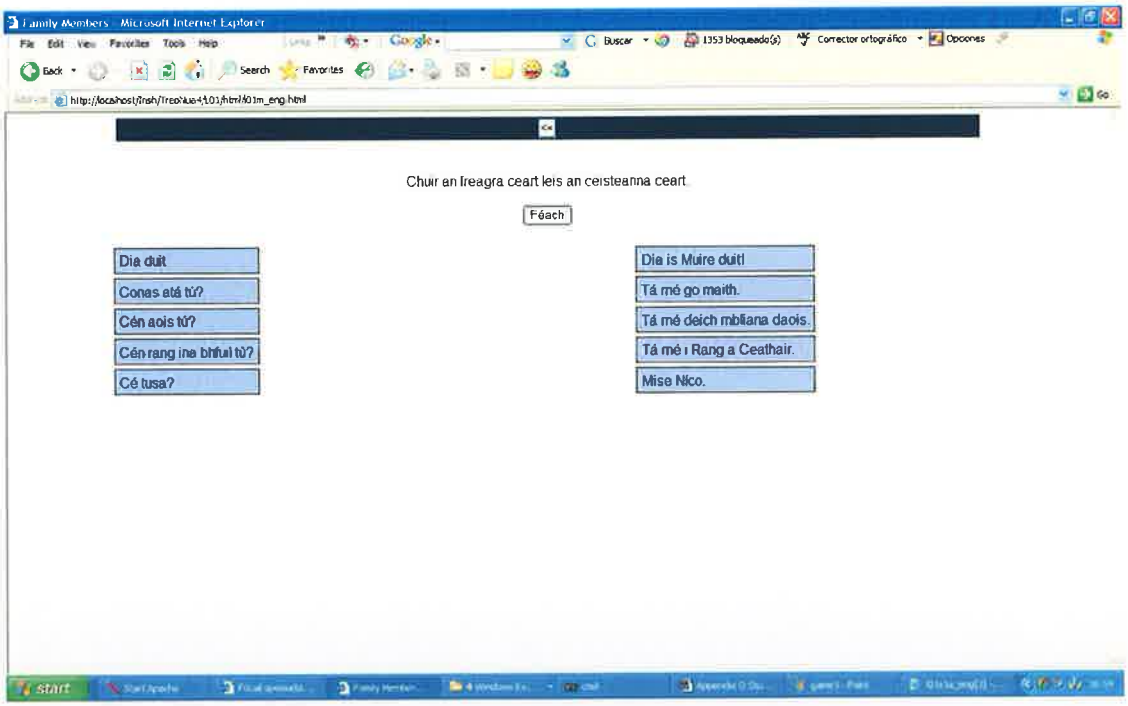


Figure Q.6 CLICI Matching Game

Gap Game

In the Cluiche Gap, you have to type in the missing words. To type in an accent (fáda), you should hold down the 'Ctrl' and 'Alt' buttons and the letter you want to put an accent. These may be marked with a white dot on your keyboard. For example, to type in 'á', you should hold down the 'Ctrl', 'Alt' and 'a' keys at the same time and the 'á' will appear on the screen. You can check your answers by clicking on 'Féach'. You can get help by clicking on 'Cabhair' but you will get less marks for your answers.

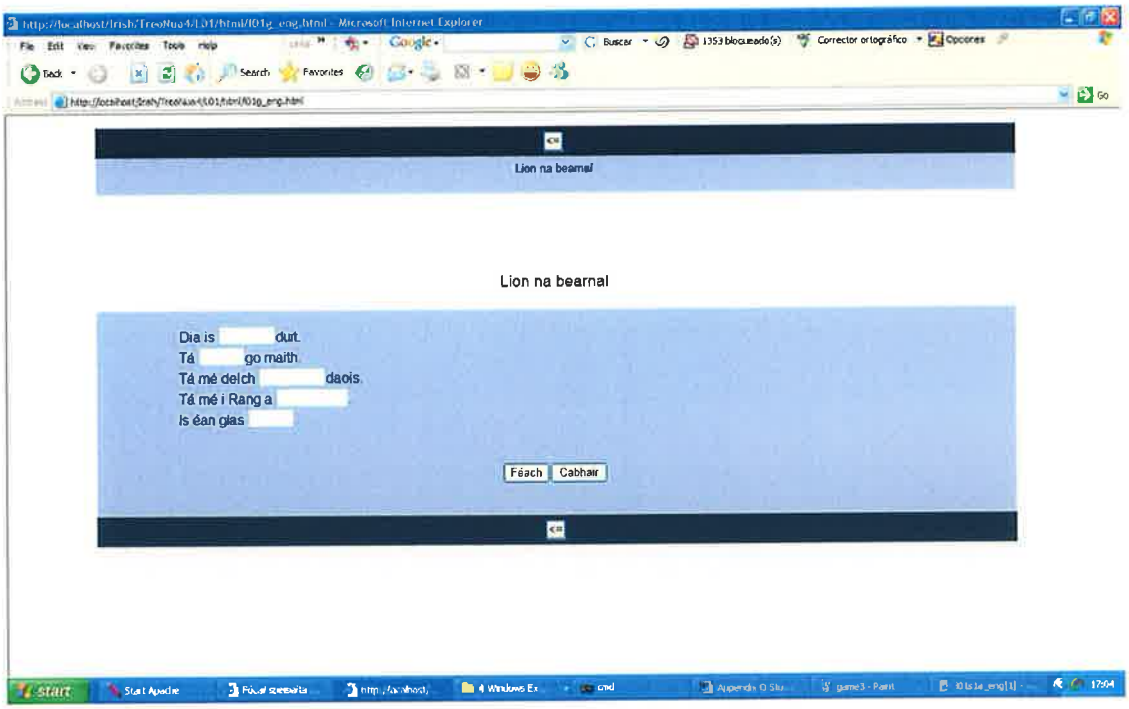


Figure Q.7 CLICI Gap Game

Using the Verb Lessons

You can do the verb lessons by clicking on the Verbs link on the green menu panel. You will see the main verb page with a list of verbs (see Figure Q.8). To study a particular verb, simply click on the verb link. For example, if you want to study the verb 'bris', just click on the 'bris' link.

Figure Q.8 CLICI Main Verb Screen

For each verb, you will see the games at the top of the screen and the verb information on the main part of the screen. If you can only see plain verb information, you will see the screen in Figure Q.9. If you have the option to see moving information, you will see the screen in Figure Q.10. If you have the moving option, when you click on a particular line, you can see the

changes that are made to the verb. Figure Q.11 shows how the letter 'h' is added between the letter 'B' and 'ris' to form the past tense of the verb bris. You can look at the verb information as often as you like.

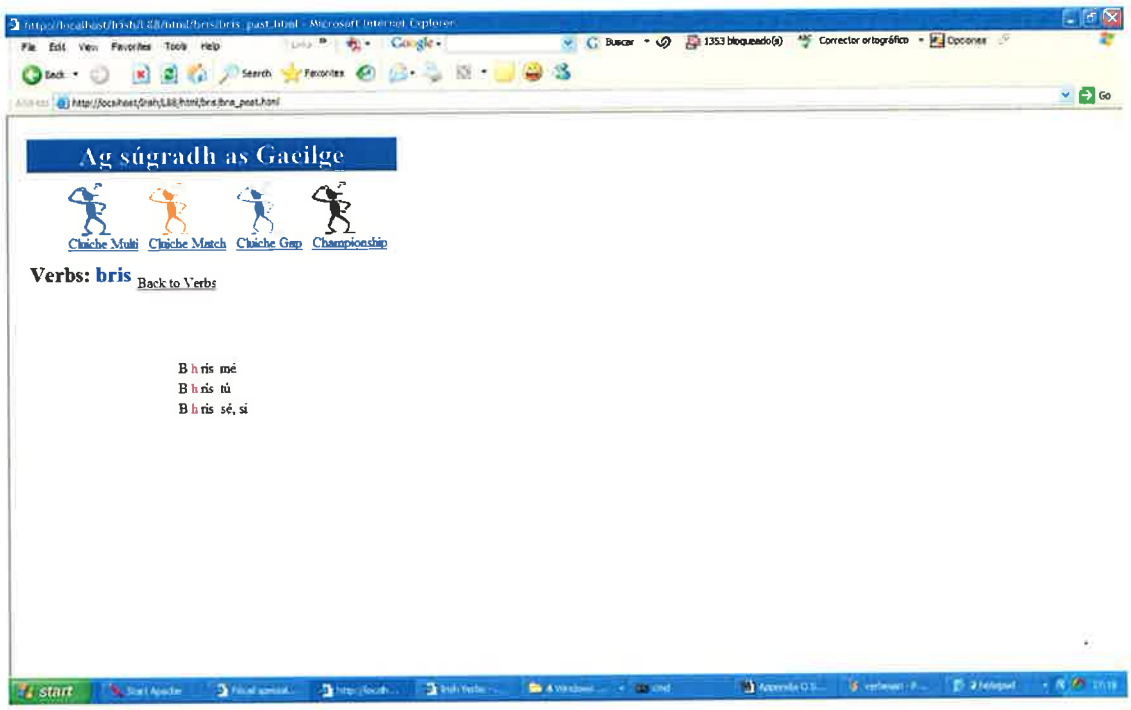


Figure Q.9 CLICI Bris Screen

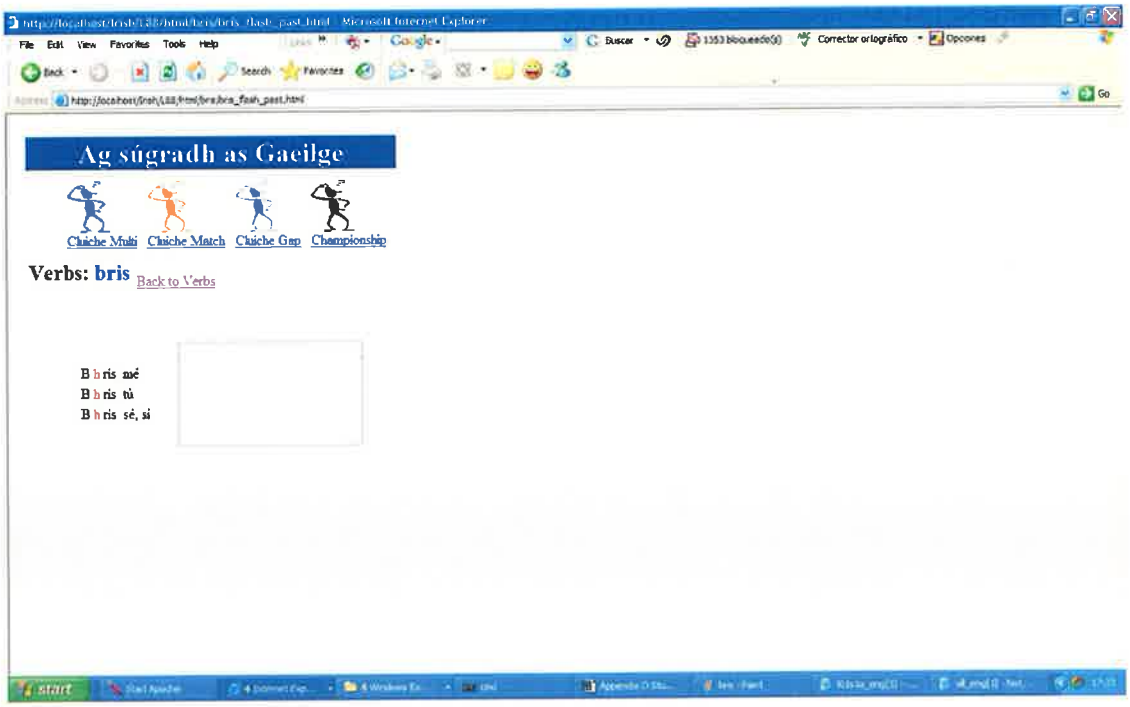


Figure Q.10 CLICI Bris Animated Screen

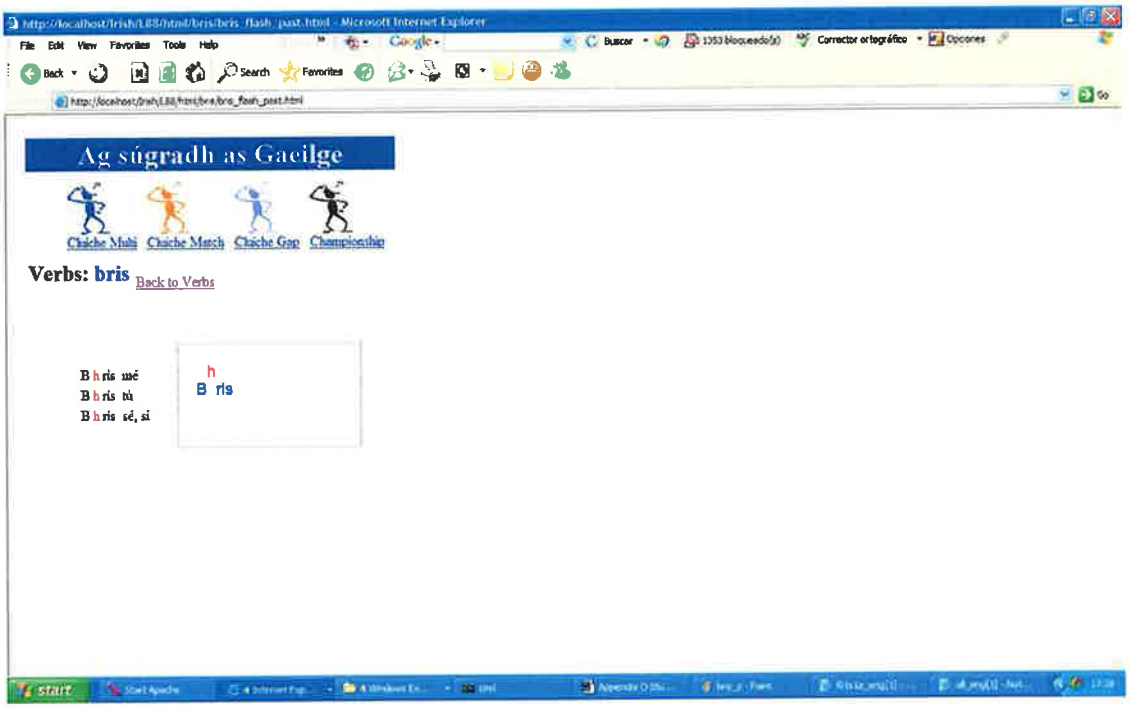


Figure Q.11 CLICI Bris Moving Screen

Doing the Verb Games

The are 4 verb games, 3 of them are similar to the lesson games (Cluiche Multi, Cluiche Match and Cluiche Gap) and there is 1 new game, the Championship. Please look at the information on Cluiche Multi, Cluiche Match and Cluiche Gap in the 'Doing the lesson' section above.

Championship Game

The Cluiche Championship is a mixture of multiple-choice and gap-fill questions (see Figure Q.12). You click on the answers for questions 1 – 4 and type in the answers for questions 5 – 7. To send your answers to the system, click on the 'Chuir é!' button. To clear your answers and start again, click on 'Glan é!'.

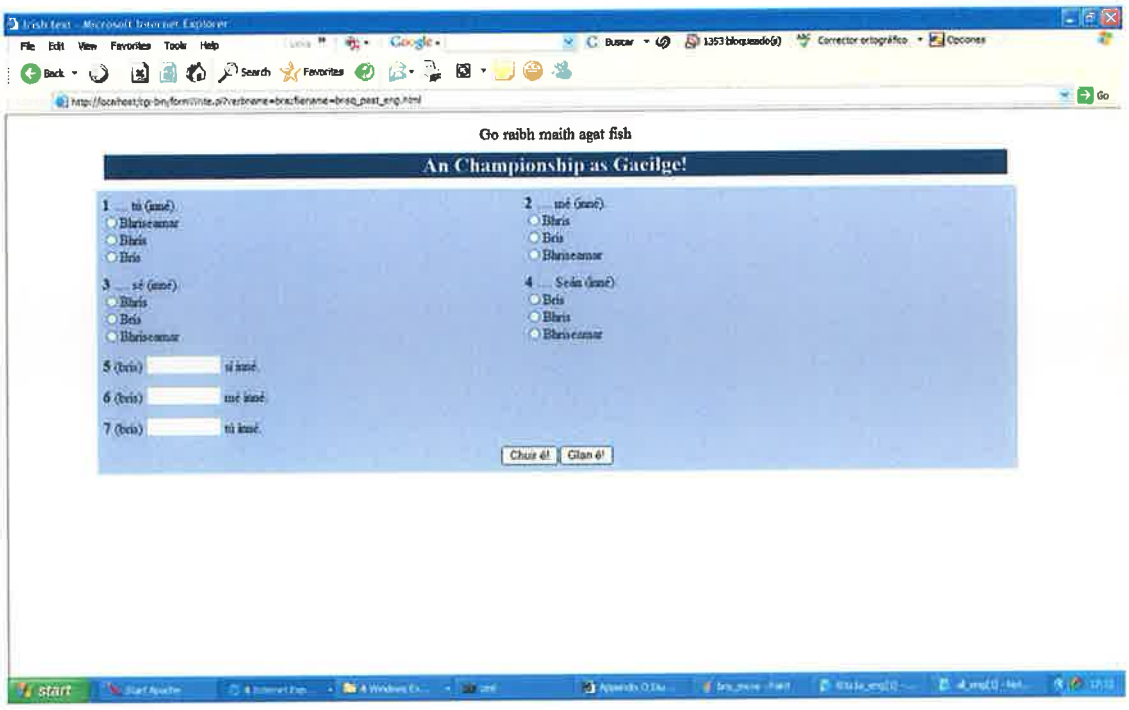


Figure Q.12 CLICI Championship Game

When you click on 'Chuir é!', the CLICI system will show you your results. It shows you which questions you got right and wrong, as well as your original answer and the correct answer. Figure Q.13 shows an example. To continue, please click on the 'Cad a ceapann tú?' link.

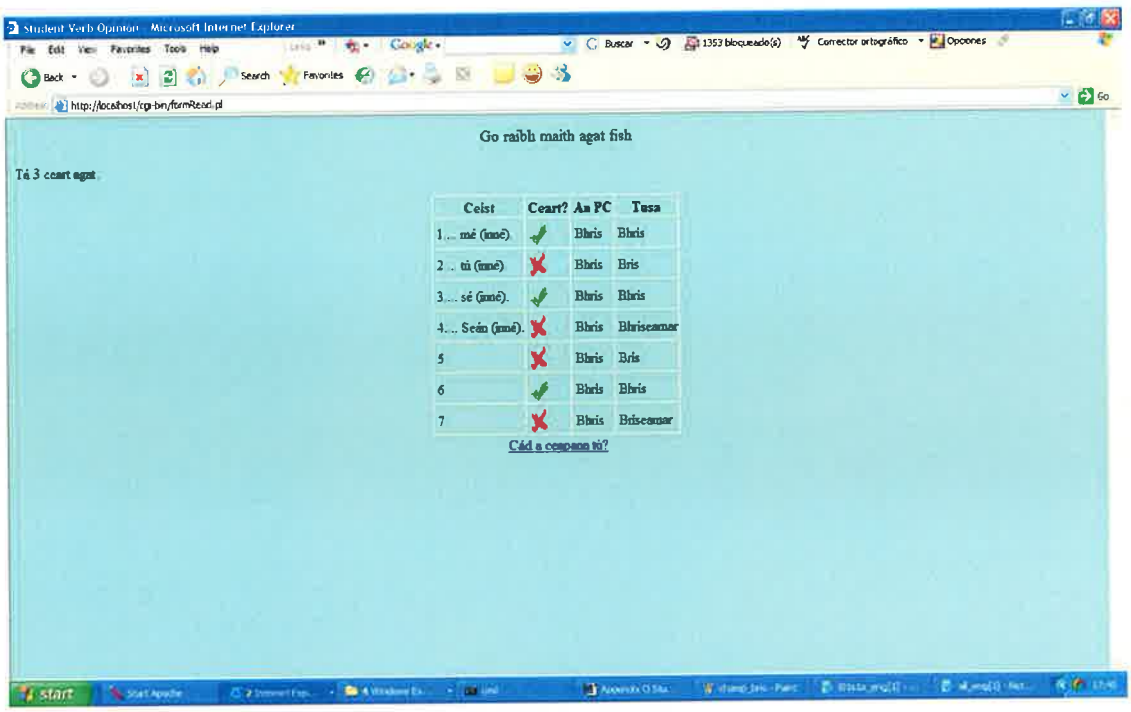


Figure Q.13 CLICI Championship Result Screen

The 'Cad a ceapann tú?' link brings you to a new page that asks you for your opinion on the Championship game. Figure Q.14 shows an example. Please click on 'Chuir é' to continue.

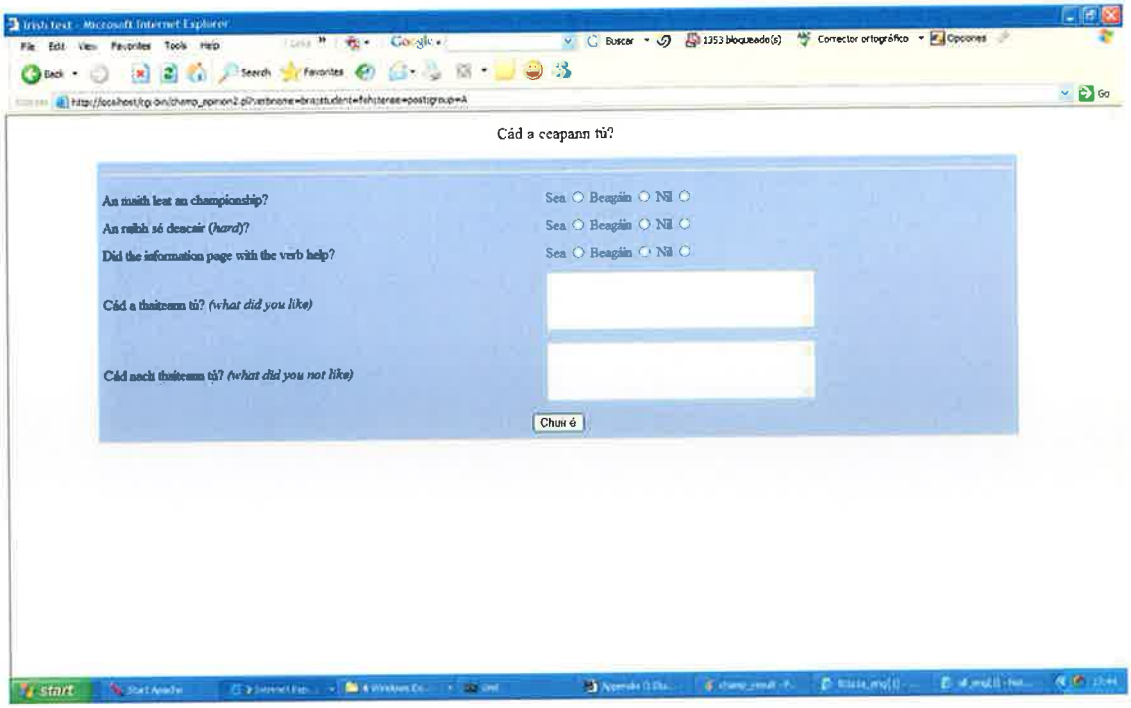


Figure Q.14 CLICI Championship Opinion Screen

Once you have clicked on 'Chuir é', you will see the Thank you screen (see Figure Q.15). Click on the 'Aras' link to bring you back to the main verb screen.

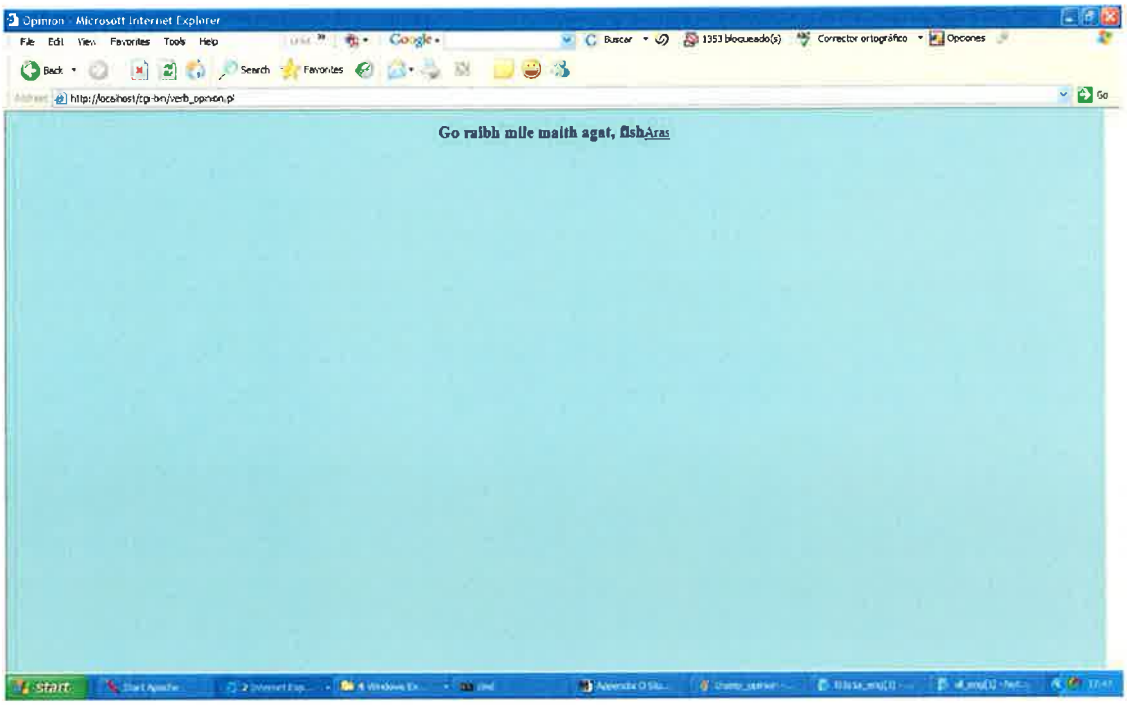


Figure Q.15 CLICI Championship Thanks Screen

Writing a Story

To write a story, click on the 'Scéal' link on the menu panel. You will see a page like the one Figure Q.16. You can type the title of your story into the Title part and your story into the part called 'Text'. You should click 'Chuir é' to send it to the CLICI system.

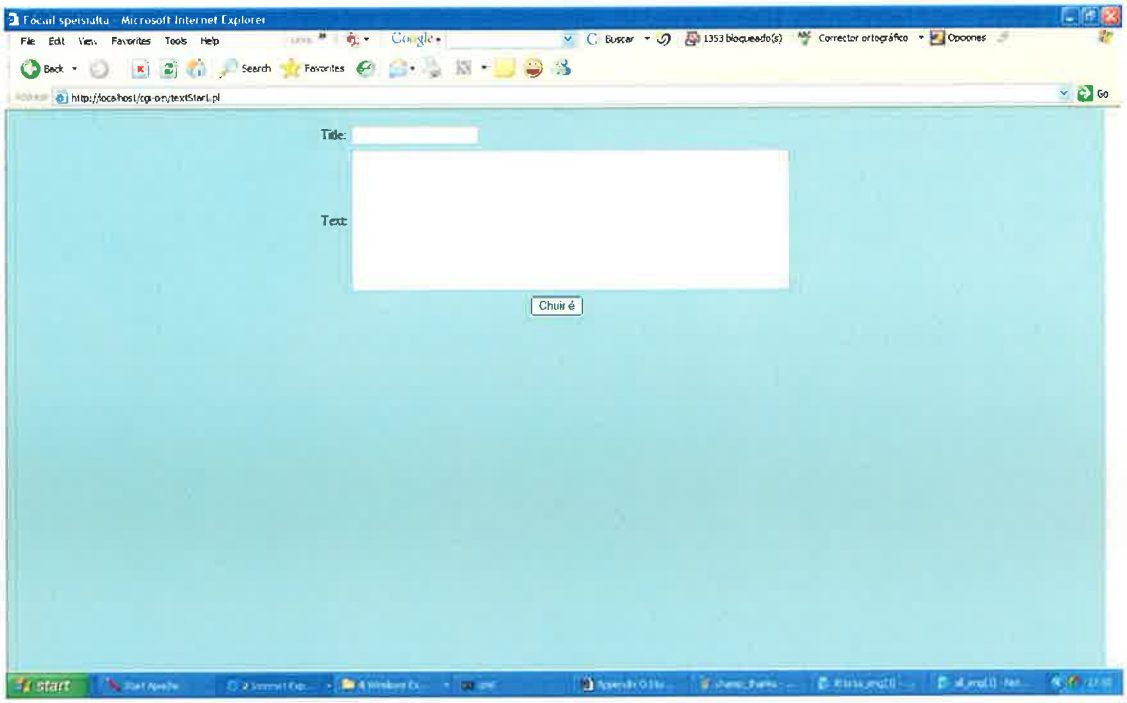


Figure Q.16 CLICI Story Screen

Figure Q.17 shows an example of a text. The grammar errors are shown below the text, while the spelling errors are shown on the right-hand side of the screen. You can make changes to your text and send it again to the system by clicking on the 'Chuir é' button. You can enter a new story by clicking on the 'Scéal eile' link. You can leave the story writing part by clicking on the 'Slán' link. This will bring you to the back main screen.

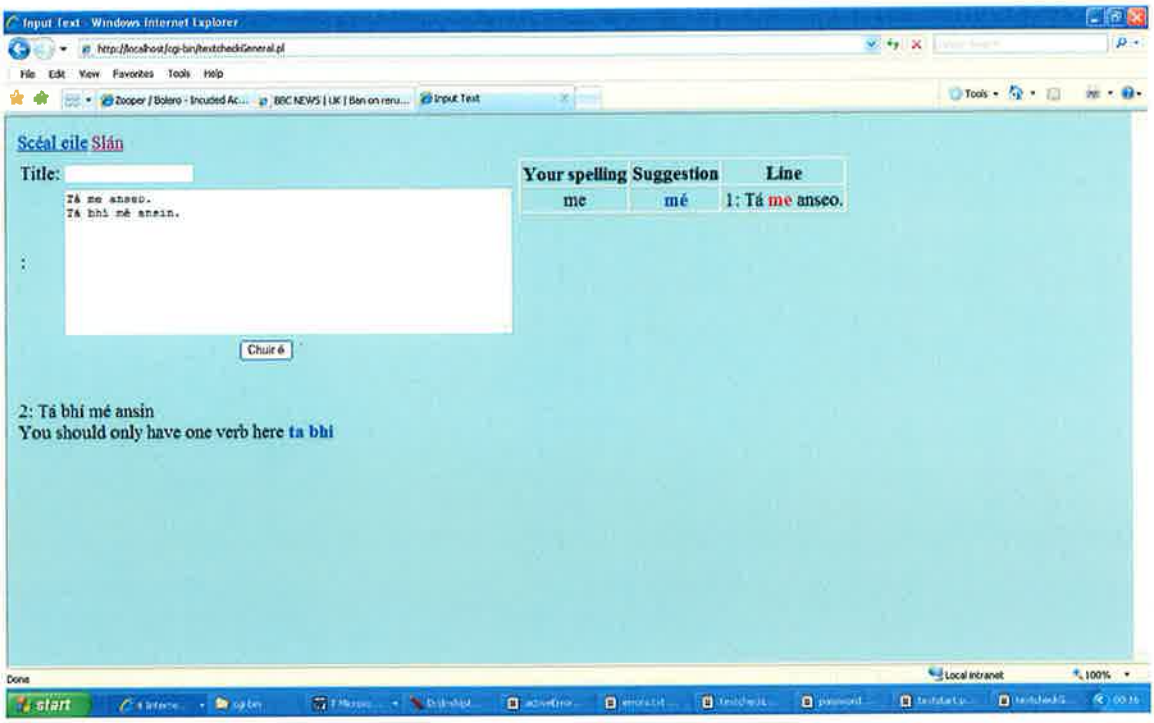


Figure Q.17 CLICI Story Screen with an example text

Appendix R Content Developer User Manual

This manual is for the content developers i.e. the person who is responsible for creating the learning content of the system. The steps required to develop material for the lessons, verbs and writing checker are outlined in the following sections. There is a Student's User Manual (Appendix O) that shows the learner how to use the system, while the Teacher's User Manual (Appendix Q) shows how the teacher can use the system.

R.1 CLICI System Level Files

Adding Users to the CLICI System

The list of users eligible to use the system is stored in the file `password.txt` in the cgi-bin/files directory. It specifies the username, the password and the user group. The user group A is for static verb presentation, group B is for animated verb presentation and group C is the teacher group. The data is not encrypted at present.

CLICI System Message File

There is a system message file that contains the overall label and message data for the CLICI system. The file is called `systemMsg.txt` and is found in the cgi-bin directory. The contents can be modified to suit the target language and learner group. Figure R.1 shows an example.

```
TITLE|Irish CALL
BACK|Back
BYE|Bye
SEND|Send
```

Figure R.1 CLICI System Message File - `systemMsg.txt`

R.2 Lesson Generation

Each lesson consists of a lesson page and 4 exercises. This section explains how to enter the data for each page. The process is the same for each lesson and the content developer can create as many lessons as are required for the target learner group. The data files are all stored in the source directory of the lesson directory. Each filename starts with the letter 'l' followed by a two digit the lesson number, and a file code. For example, the source file for the first lesson is stored in L01/source/l01s1.dat. These data files need to be converted into the CLICI internal format and there is a script in the generate directory (e.g. L01/generate) to convert each data file into its corresponding internal format. The content developer simply has to click on the required file name to carry out the conversion. Table R.1 shows a list of the source file codes, their corresponding conversion files and examples for lesson 1.

Source File Code	Conversion File	Example
lxxs1.dat	convertLesson.bat	l01s1.dat
lxxa1.dat	convertMulti.bat	L01a1.dat
lxxa2.dat	convertMatch.bat	L01a2.dat
lxxa3.dat	convertMix.bat	l01a3.dat
lxxa4.dat	convertGaR.bat	l01a4.dat

Table R.1 Lesson Generation Files

Lesson Page

Figure R.1 shows the format of the lesson page and an example. To convert this file to the internal format, simply click on the section1.bat file in the generate directory (e.g. L01/generate/section1.bat). This will automatically create the corresponding XML file (l01s1.xml) that is used internally by the CLICI system. The corresponding sound files for the whole lesson text and each individual line should be stored in the lesions/Lxx directory (where xx is the lesson number). The whole lesson sound file is stored as all.wav and each individual line is stored as 'l', the lesson number (two digits), the letter 'a', the lesson number (in one or two digits as appropriate) and the line number (two digits) followed by the .wav extension. For example, the sound file for the second line of text in lesson 1 is called l01a101.wav.

Format	Example
Each portion of text that you want to show on a separate line should be on a separate line in the source file.	Bhí Ciarán ag siúl lá amháin. Bhí lochán uisce ar an mbóthar. Ní fhaca Ciarán an lochán.

Figure R.2 Lesson Page - Format and Example

Multiple-choice Game

The data for the multiple-choice game is written in the lxxa1.dat file (e.g. l01a1.dat for the multiple-choice file for first lesson). Figure R.2 shows the format of the multiple-choice page and an example (with the correct answer given before the first '|' and distractors in subsequent positions). To convert this file to the internal format, simply click on the activityMulti.bat file in the generate directory (e.g. L01/generate/activityMatch.bat). This will automatically create the corresponding XML file (l01a1.xml) that is used internally by the CLICI system.

Format	Example
question1 answer1|answer2|answer3	Dia is Muire ... duit|tusa|leat
question2 answer1|answer2|answer3	Tá mé go ... maith|duit|ainm
question3 answer1|answer2|answer3	Conas atá ... ? tú|mé|agat

Table R.2 Multiple-choice Game - Format and Example

Matching Game

The data for the matching game is written in the lxxa2.dat file (e.g. l01a2.dat for the matching file for first lesson). Figure R.3 shows the format of the matching page and an example. To convert this file to the internal format, simply click on the activityMatch.bat file in the generate directory (e.g. L01/generate/activityMulti.bat). This will automatically create the corresponding XML file (l01a2.xml) that is used internally by the CLICI system.

Format	Example
Line 1 left-hand side text | Line 1 right-hand side text Line 2 left-hand side text | Line 2 right-hand side text Line 3 left-hand side text | Line 3 right-hand side text Line 4 left-hand side text | Line 4 right-hand side text Line 5 left-hand side text | Line 5 right-hand side text	An bhfuil |deartháir agat? Tá mé |go maith. Conas |atá tú? Tá seanathair |agam. An bhfuil seanmháthair |agat?

Table R.3 Matching Game - Format and Example

Mixed-up Sentence Game

The data for the mixed-up sentence game is written in the lxxa3.dat file (e.g. l01a3.dat for the mixed-up sentence file for first lesson). Figure R.4 shows the format of the mixed-up sentence page and an example. To convert this file to the internal format, simply click on the activityMix.bat file in the generate directory (e.g. L01/generate/activityMix.bat). This will automatically create the corresponding XML file (l01a3.xml) that is used internally by the CLICI system.

Format	Example
Each individual word is separated by the '|' character	`Bhí|Ciarán|ag|siúl|lá|amháin.`

Table R.4 Mixed-up Sentence - Format and Example

Gap-fill Game

The data for the gap-fill game is written in the lxxa4.dat file (e.g. l01a4.dat for the mixed-up sentence file for first lesson). Figure R.5 shows the format of the gap-fill page and an example. To convert this file to the internal format, simply click on the activityGaR.bat file in the generate directory (e.g. L01/generate/activityGaR.bat). This will automatically create the corresponding XML file (l01a4.xml) that is used internally by the CLICI system.

Format	Example

Line 1 before gap text |missing word(s)||after gap text
Line 2 before gap text |missing word(s)||after gap text
Line 3 before gap text |missing word(s)||after gap text
Line 4 before gap text |missing word(s)||after gap text
Line 5 before gap text |missing word(s)||after gap text
	`Dia is |Muire||duit.`
	`Tá |mé||go maith.`
	`An bhfuil deartháir |agat||?`
	`Tá seanathair |agam||.`
	`|Conas|| tá tú?`

Table R.5 Gap-fill Game - Format and Example

Title

The data for the lesson title is written in the titlexx.xml file (e.g. title1.xml for first lesson). Figure R.6 shows the format of the title file and an example. No conversion is required for this file as it is already in the internal format.

Format	Example

<title>
<base>Your title here </base>
</title>
	`<title>`
	`<base>Dia duit </base>`
	`</title>`

Table R.6 Title File - Format and Example

R.3 Verb Pages

The verb pages consist of a main verb page with a list of the verbs, an individual verb page for each verb and 4 games for each verb. The content developer only needs to develop the main verb page and the individual verb data as the games are automatically generated based on data supplied in the relevant games source files (see below). The main verb page is called all_eng.html and is found in the html sub-directory of the verb directory. The content developer must put the name of the verb and its corresponding link in the appropriate place in the all_eng.html file. Figure R.2 shows an example for some of the Irish verbs. The list of verbs available to the system should be specified in the verblist.dat file in the source directory. Any system specific or internal data can be stored after the name of the verb followed by the '|' character if necessary.

The verb data can either be entered manually or automatically if a verb conjugation data resource is available. In both cases, the data must be specified in the format shown in Figure R.3. The format is modular in that only the relevant data needs to be specified e.g. if only the past tense is of interest to the students, there is no need to specify the future tense. There is an individual file for each verb and its name is the verb name (with accents) followed by the .xml extension (e.g. bris.xml).

```
<a href="bris.html">bris</a>
<br/>
<a href="buail.html">buail</a>
<br/>
<a href="ceannaigh.html">ceannaigh</a>
<br/>
<a href="cuir.html">cuir</a>
<br/>
<a href="dean.html">déan</a>
<br/>
```

Figure R.3 Sample of Verbs Listed in Main Verb Page

```
<verb>
<name>bris</name>
<info>
<past>
<positive>
<p1>
      <special_start></special_start>
      <root>b</root>
      <new>h</new>
      <stem>ris</stem>
      <after></after>

      </p1>

<p2>
      <special_start></special_start>
      <root>b</root>
      <new>h</new>
      <stem>ris</stem>
      <after></after>

</p2>

.....

</positive>

<negative>
...
</negative>

</past>
</info>
</verb>
```

Figure R.4 Verb Data File Example - bris.xml

If a verb conjugation resource is available, the content developer should work with a software engineer or programmer to convert the data into the CLICI verb data format.

The games are automatically generated based on the information supplied in the relevant source file (e.g. `multiSource.dat` for the multiple-choice game). However, the content developer can manually edit the generated XML files if required. Figure R.4 shows an example which specifies that the multiple-choice game questions are based on the past tense and the answers offered are for the first person singular (past_s1), the first person plural (past_p1) and the name

of the verb (name). The general format is tense_person. The tense is the name of the tense e.g. past, present or future. The person ranges from s1 (the first person singular) to p3 (the third person plural). The Championship game is automatically generated from the multiple-choice and gap-fill games – therefore the content developer does not have to specify data for the Championship game.

```
quest|0|.... mé (inné).
ans|0|0|past_s1
ans|0|1|name
ans|0|2|past_p1
quest|1|.... tú (inné).
ans|1|0|past_s1
ans|1|1|name
ans|1|2|past_p1|special
quest|2|.... sé (inné).
ans|2|0|past_s1
ans|2|1|name
ans|2|2|past_p1
quest|3|.... Seán (inné).
ans|3|0|past_s1
ans|3|1|name
ans|3|2|past_p1
```

Figure R.5 `multiSource.xml` - Sample Data

In order to create the games automatically, the relevant files should be run in the generate directory. For example, `activityMulti.bat` creates the multiple-choice files for all the verbs. Table R.7 shows a list of the relevant files and their purpose.

File	Purpose
activityMulti.bat	Creates the multiple-choice games source file
activityMatch.bat	Creates the match source file
activityGaR.bat	Creates the gap source file

Table R.7 Verb Games Creation Batch Files

R.4 Writing Checker

The content developer does not need to specify any specific data for the writing checker, except for the User Interface text (see below). A competent software developer will be required to develop a language specific writing checker. However, the content developer should work with the teacher and the software developer to specify what grammar and spelling errors should be detected. See the Appendix R Technical Manual for more details.

The text labels and messages that the learner sees when using the Writing Checker are modifiable by the content developer. Depending on pedagogical considerations, the language used can either be the learner's L1, the target language or a mixture of both. The file `WCCMsg.txt` in the cgi-bin directory contains the labels and text messages that are used by the WCC architecture and sample texts in English. Figure R.5 shows a sample `WCCMsg.txt` file with messages in English. The name of the label or message appears to the left-hand side of the '|' character and the texts that the learner sees is to its right. For example, the message NO_WRITE is displayed when the learner submits an empty text to the writing checker. The sample shows a message in English, but this could be replaced by the equivalent text in the target language e.g. "*Níor scríobh tú aon rud*" in Irish. Obviously the tone and register of the messages may vary for a given language based on the target learner group and pedagogical considerations.

```
NO_WRITE|You didn't write anything
ONLY_SP_ERR|No errors, only some spelling mistakes!
NO_ERR|No errors!
YOUR_SP|Your spelling
SP_SUGGESTION|Suggestion
LINE|Line
THANKS|Thank you
INPUT_TEXT|Input Text
TITLE|Title
OTHER_STORY|Another Story
BYE|Bye
SEND|Send
```

Figure R.6 Writing Checker Component User Interface Message File

Appendix S Teacher's User Manual

This manual outlines how the teacher can use the system to monitor student activity. There is also a Student User Manual (Appendix O) and a Content Developer User Manual (Appendix P) available. Technical information is available in the Technical Manual (Appendix R), while the system installation details are given in the Installation Manual (Appendix S). There is also a one-page overview document describing the system (Appendix T).

S.1 Welcome Screen

The welcome screen (Figure S.1) shows the options available to the teacher. There are three types of checks that the teacher can perform: overall activity checking, verb study checking and writing checking. The activity checking refers to when the learner logged into and out of the system and how long was spent using the system. The verb study checking option reports on what verbs each student has studied and the number of correct answers. The writing checking option provides summary data for each student on the texts submitted to the system. These are explained below.

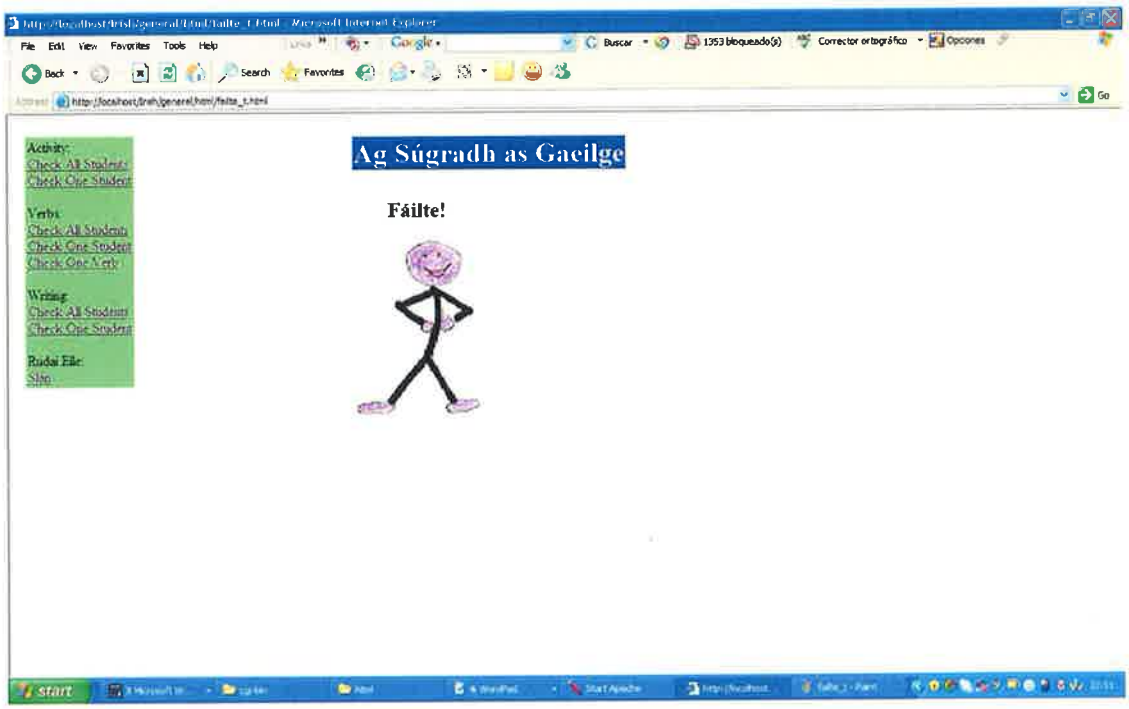
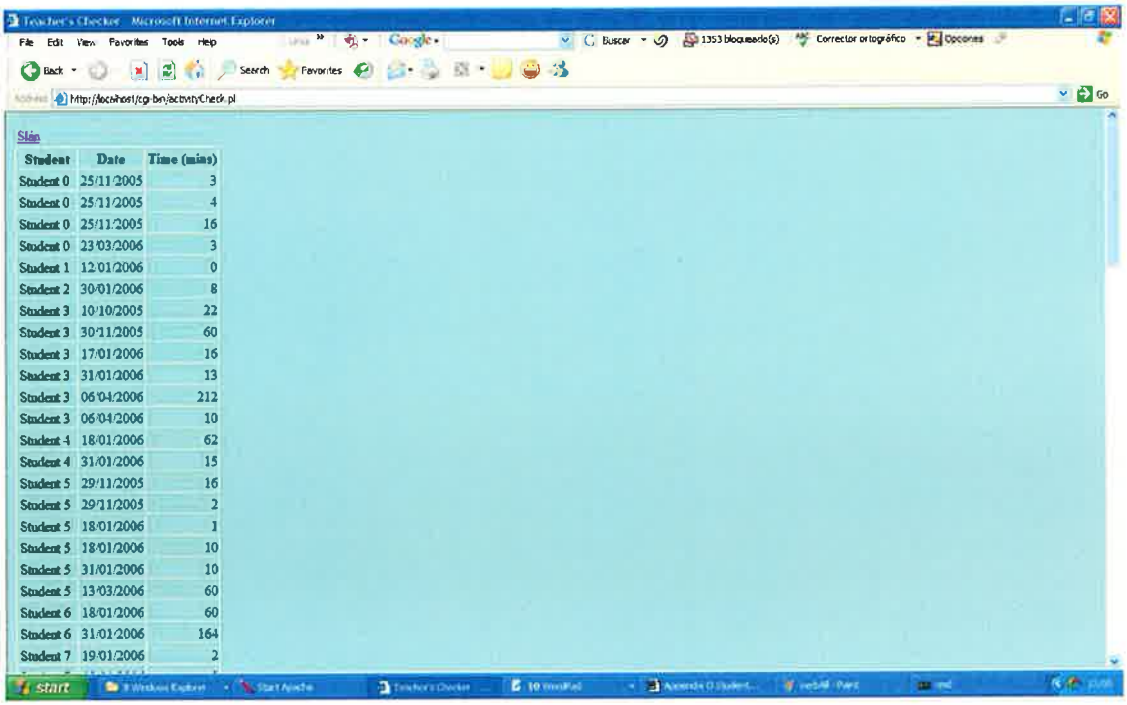


Figure S.1 CLICI Teacher's Welcome Screen

S.2 Lesson Generation

The teacher can check on the students' activity by clicking on the links under the 'Activity' section on the teacher's menu panel. The teacher can specify a particular student (Check One Student) or see the information for the whole class (Check All Students). The information shown is quite basic – the user name, the date and how long the student spent using the system. Figure S.1 shows an example. Note that the names have been replaced by student numbers in order to protect the identity of the students.



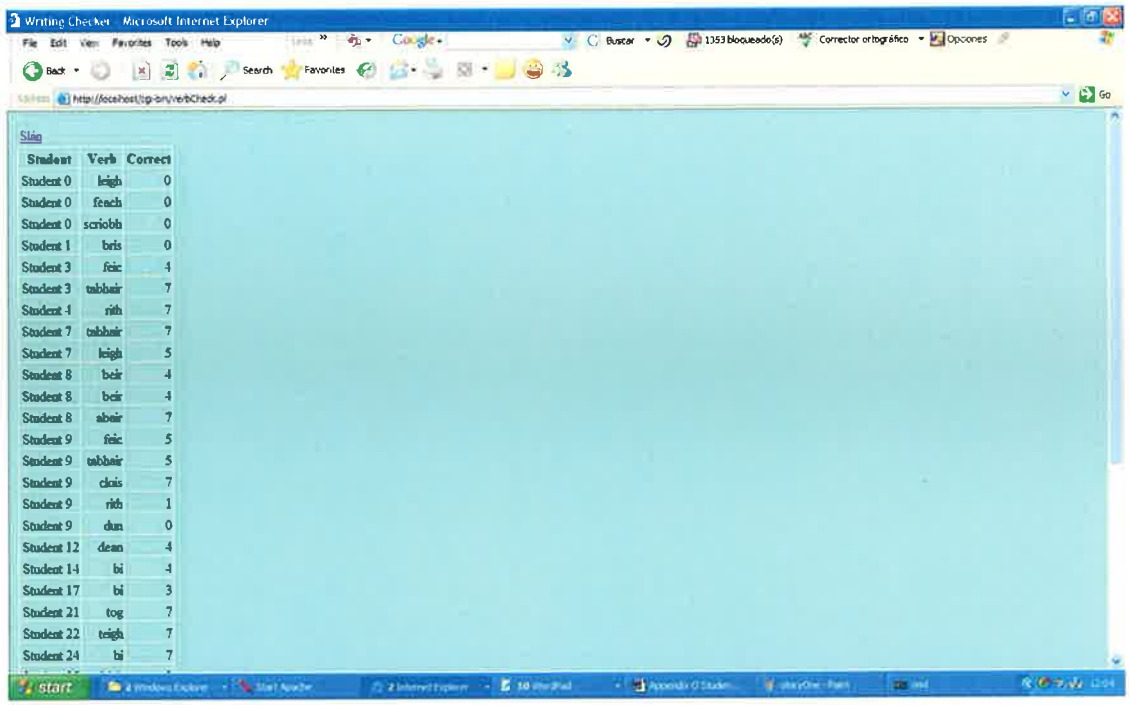
Slán

Student	Date	Time (mins)
Student 0	25/11/2005	3
Student 0	25/11/2005	4
Student 0	25/11/2005	16
Student 0	23/03/2006	3
Student 1	12/01/2006	0
Student 2	30/01/2006	8
Student 3	10/10/2005	22
Student 3	30/11/2005	60
Student 3	17/01/2006	16
Student 3	31/01/2006	13
Student 3	06/04/2006	212
Student 3	06/04/2006	10
Student 4	18/01/2006	62
Student 4	31/01/2006	15
Student 5	29/11/2005	16
Student 5	29/11/2005	2
Student 5	18/01/2006	1
Student 5	18/01/2006	10
Student 5	31/01/2006	10
Student 5	13/03/2006	60
Student 6	18/01/2006	60
Student 6	31/01/2006	164
Student 7	19/01/2006	2

Figure S.2 Activity Check Screen

S.3 Verb Pages

The teacher can check on the students' verb page activity by clicking on the links under the 'Verb' section on the teacher's menu panel. The teacher can specify a particular student (Check One Student) or verb (Check One Verb) or see the information for the whole class (Check All Students). The information shown is just the student name (shown as student number in the example), the verb studied and the number of correct answers (max = 7). Figure S.3 shows an example.



Slán

Student	Verb	Correct
Student 0	leigh	0
Student 0	feach	0
Student 0	scriobh	0
Student 1	bris	0
Student 3	feic	4
Student 3	tabhair	7
Student 4	rith	7
Student 7	tabhair	7
Student 7	leigh	5
Student 8	beir	4
Student 8	beir	4
Student 8	abair	7
Student 9	feic	5
Student 9	tabhair	5
Student 9	cluis	7
Student 9	rith	1
Student 9	dun	0
Student 12	dean	4
Student 14	bi	4
Student 17	bi	3
Student 21	tog	7
Student 22	teigh	7
Student 24	bi	7

Figure S.3 Verb Check Screen

S.4 Writing Checker

The teacher can check on the students' writing activity by clicking on the links under the 'Writing' section on the teacher's menu panel. The teacher can specify a particular student (Check One Student) or see the information for the whole class (Check All Students). The information provided includes the date, the number of lines and words, plus the number of grammar and spelling errors detected by the CLICI system. There is also a link to see the contents of the learner's text. Figure S.4 shows an example, with the small screen on the right-hand side of the page showing the learner's text.

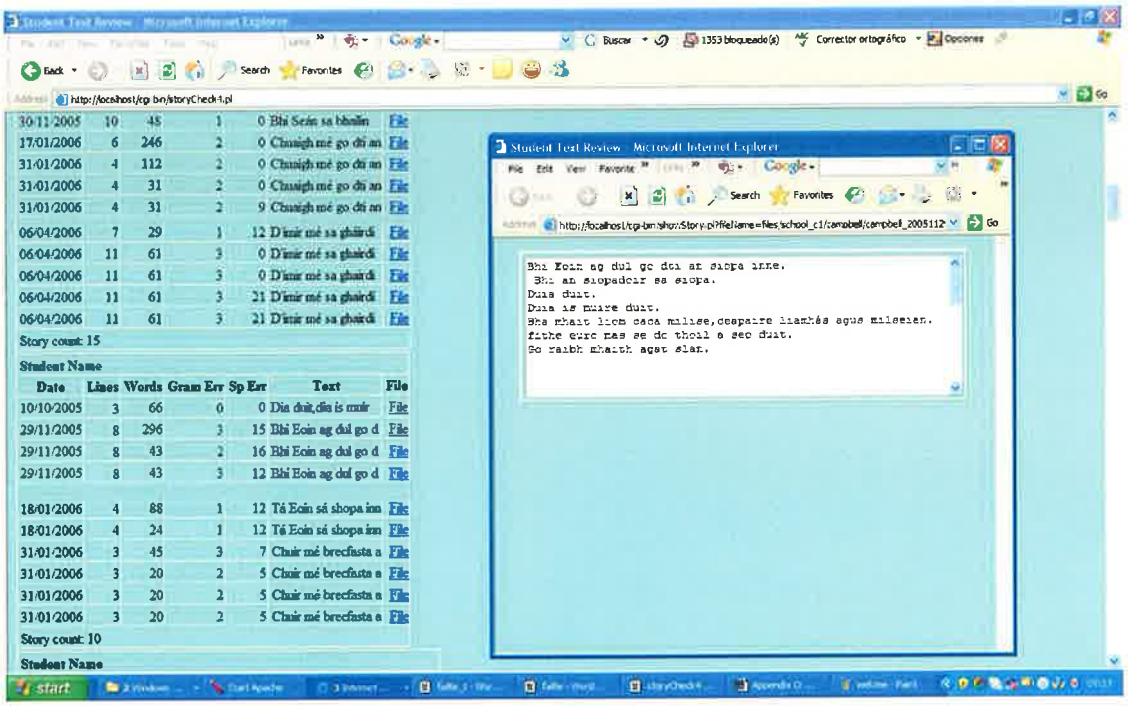


Figure S.4 Story Check Screen - All Students

Appendix T Technical Manual

This technical manual contains information on the source files and the architecture of the CLICI system. There is also a Student User Manual (Appendix Q), a Content Developer Manual (Appendix R), a Teachers User Manual (Appendix S) and an Installation Manual (Appendix U).

T.1 Overall Architecture

The CLICI system is built on top of the CALL Template (Ward, 2001). The CALL Template creates html pages from learning content data stored in XML files in lesson directories. The CLICI system uses a combination of Perl files, batch files and XML technology files (i.e. XML files and XSL files) to provide the system functionality. The CLICI system runs on an Apache server (Apache, 2006) version 1.3.29, which hosts the static and dynamic web pages. The static pages are stored under the `htdocs` directory, while the dynamic pages are in the `cgi-bin` directory. The overall project architecture is shown in Figure T.1.

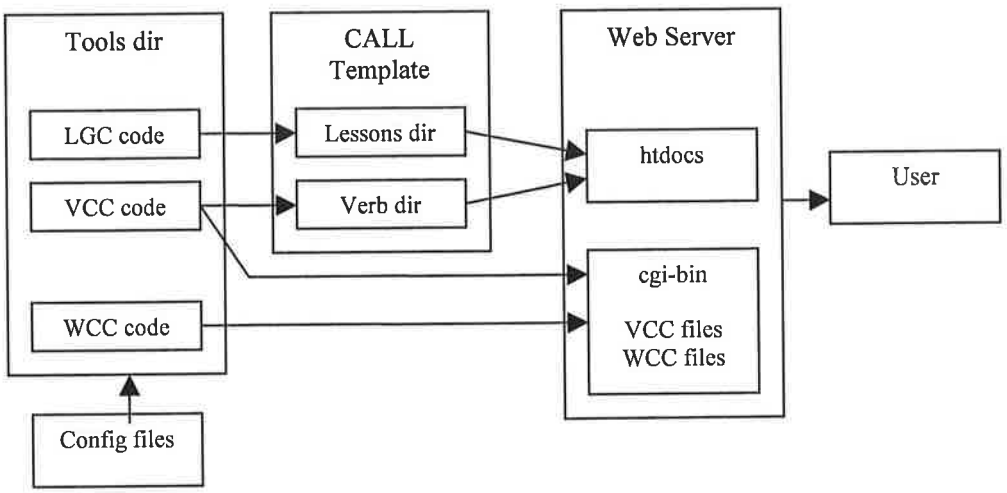


Figure T.1 Overall CLICI Architecture

The list of users eligible to use the system is stored in the file `password.txt` in the cgi-bin/files directory. It specifies the username, the password and the user group. The user group A is for static verb presentation, group B is for animated verb presentation and group C is the teacher group. The data is not encrypted at present.

T.2 Lesson Generation Component

The Lesson Generation Component (LGC) provides a flat-file user interface to the XML files used by the CALL Template (Ward, 2001). The CALL Template has four sub-directories for each lesson. The driver directory contains XML wrapper information, the generate directory contains the files to generate the html files, the source directory contains the data files (e.g. the lesson information) and the html directory contains the web pages. Figure T.2 shows the LGC architecture for the multiple-choice exercise. The other exercises (i.e. matching, mix-up sentence and gap-fill) follow a similar pattern.

Table T.1 shows the LGC files and their function. The Perl files are called from their corresponding batch files that can be run by the Content Developer (see the Content Develop User Manual – Appendix P for more details). The multi.pl, match.pl, mix.pl, gap.pl and write.pl files have been provided for backward compatibility so that existing XML file data can be extracted to flat file format for future use.

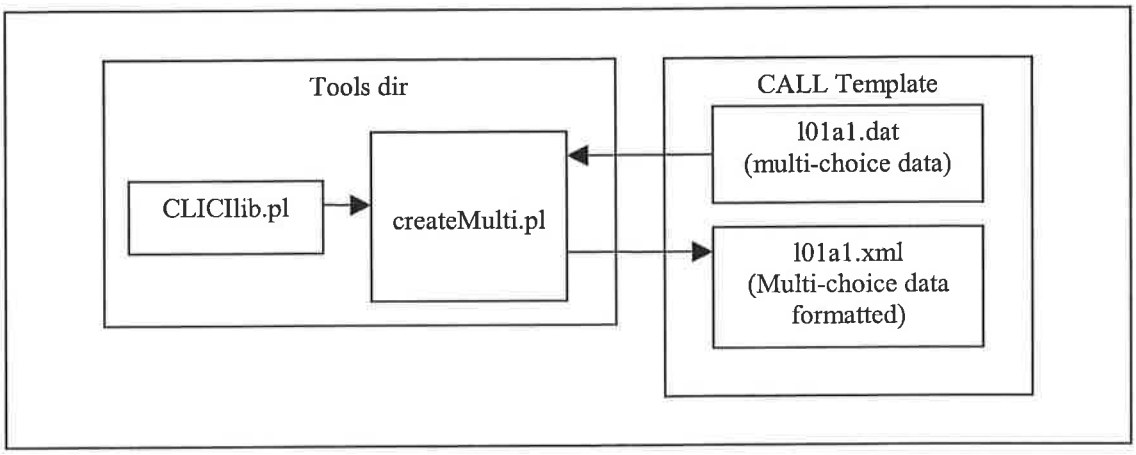


Figure T.2 Lesson Generator - Multiple-Choice Architecture

File	Function
convertGen.bat	Calls createGen.pl
convertMatch.bat	Calls createMatch.pl
convertMix.bat	Calls createMix.pl
convertMulti.bat	Calls createMulti.pl
convertSection.pl	Calls createSection.pl
createGap.pl	Creates the gap-fill exercise XML file
createGen.pl	Creates the generate batch file
createMatch.pl	Creates the match exercise XML file
createMix.pl	Creates the mixed-up sentence XML file
createMulti.pl	Creates the multiple-choice exercise XML file
createSection.pl	Creates the lesson XML file
gap.pl	Extracts the gap exercise XML file data to a flat file format
match.pl	Extracts the match exercise XML file data to a flat file format
mix.pl	Extracts the mixed-up sentence XML file data to a flat file format
multi.pl	Extracts the multiple-choice XML file data to a flat file format
what.pl	Extracts the lesson XML data to a flat file format

Table T.1 Lesson Generator Files

Each file type has its own format that is designed to facilitate data entry. Table T.2 shows a summary of the file formats and an example. The Content Developer User Manual (Appendix P) shows how the content developer can input learning material into the CLICI system.

The content of each of the conversion files (e.g. createMulti.pl) is similaT. The general logic is shown in Figure T.3. Figure T.4 shows the code for parsing the flat file data for the multiple-choice game from createMulti.pl and Figure T.5 shows the code for writing out the data in the appropriate XML file format.

Format	Example
Lesson data file (lxxs1.dat e.g. l01s1.dat)	
Each portion of text that you want to show on a separate line should be on a separate line in the source file.	Bhí Ciarán ag siúl lá amháin. Bhí lochán uisce ar an mbóthaT. Ní fhaca Ciarán an lochán.
Multiple-choice data file (lxxa1.dat e.g. l01a1.dat)	
question1 answer1|answer2|answer3 question2 answer1|answer2|answer3 question3 answer1|answer2|answer3	Dia is Muire ... duit|tusa|leat Tá mé go ... maith|duit|ainm Conas atá ... ? tú|mé|agat
Match data file (lxxa2.dat e.g. l01a2.dat)	
Line 1 left-hand side text | Line 1 right-hand side text Line 2 left-hand side text | Line 2 right-hand side text Line 3 left-hand side text | Line 3 right-hand side text Line 4 left-hand side text | Line 4 right-hand side text Line 5 left-hand side text | Line 5 right-hand side text	An bhfuil |deartháir agat? Tá mé |go maith. Conas |atá tú? Tá seanathair |agam. An bhfuil seanmháthair |agat?
Mixed-up Sentence data file (lxxa3.dat e.g. l01a3.dat)	
Each individual word is separate by the '|' character	Bhí|Ciarán|ag|siúl|lá|amháin.
Gap-fill data file (lxxa4.dat e.g. l01a4.dat)	
Line 1 before gap text |missing word(s)||after gap text Line 2 before gap text |missing word(s)||after gap text Line 3 before gap text |missing word(s)||after gap text Line 4 before gap text |missing word(s)||after gap text Line 5 before gap text |missing word(s)||after gap text	Dia is |Muire||duit. Tá |mé||go maith. An bhfuil deartháir |agat||? Tá seanathair |agam||. |Conas|| tá tú?

Table T.2 Lesson Generator Files - Format and Examples

```
getParameters()  /* Get the system parameters */
getAllText()     /* Get all the text data and convert it */
{
    for each lesson ()
    {
        getText();    /* get the flat file text */
        writeInfo();  /* write out the data in the appropriate XML file format */
    }
}
```

Figure T.3 Lesson Generator General Code Structure

```
$i = 0;
while ($line = <INPUT>)
{
      chop($line);
      $line = convertWord($line);
      $quest{$i} = $line;
      $line = <INPUT>;
      chop($line);
      $line = convertWord($line);
      ($ans0, $ans1, $ans2) = split(/\|/, $line);
      $ans{$i}{'0'} = $ans0;
      $ans{$i}{'1'} = $ans1;
      $ans{$i}{'2'} = $ans2;

      $line = <INPUT>;
      $i++;

      $questions{$i} = {$i};
}
```

Figure T.4 Code Section for Reading Multiple-Choice Data File

```
print (OUTPUT "<questions>\n\n");

for ($i = 0; $i< 3; $i++)
{
      print (OUTPUT "<question-record id=\"$i\">\n");
      print (OUTPUT "<question>\n");
      print (OUTPUT "<english>$quest{$i}</english>\n");
      print (OUTPUT "</question>\n");
      print (OUTPUT "<must-select-all>0</must-select-
all>\n\n");

      for ($j = 0; $j < 3; $j++)
      {
            print (OUTPUT "<answer id=\"$j\">\n");
            print (OUTPUT "<text>\n");
            print (OUTPUT
"<english>$ans{$i}{$j}</english>\n");
            print (OUTPUT "</text>\n");
            if ($j == 0)
            {
                  print (OUTPUT "<correct>1</correct>\n");
            }
            else
            {
                  print (OUTPUT "<correct>0</correct>\n");
            }
            print (OUTPUT "</answer>\n\n");
      }

      print (OUTPUT "</question-record>\n\n");
```

Figure T.5 Code Section for Writing Multiple-Choice XML Data File

T.3 Verb Conjugation Component

The Verb Conjugation Component (VCC) consists of a verb extraction part and a verb lesson generation part. The verbs available for study are listed in the main verb page (all_eng.html in the html sub-directory of the main verb directory) – see the Content Developer User Manual for details. The verb extraction part can be used if a verb conjugation resource is available. Figure

T.6 shows an overview of the verb extraction architecture. Figure T.7 shows the XML format of the verb data file. The content developer can specify the required tenses and persons. For each combination, the special start data (if any), the root, new changes for this particular conjugation, the stem and other data (i.e. if anything comes after the verb) must be specified. The format is modular in that only the relevant data needs to be specified. There is an individual file for each verb and its name is the verb name (with accents) followed by the .xml extension (e.g. bris.xml).

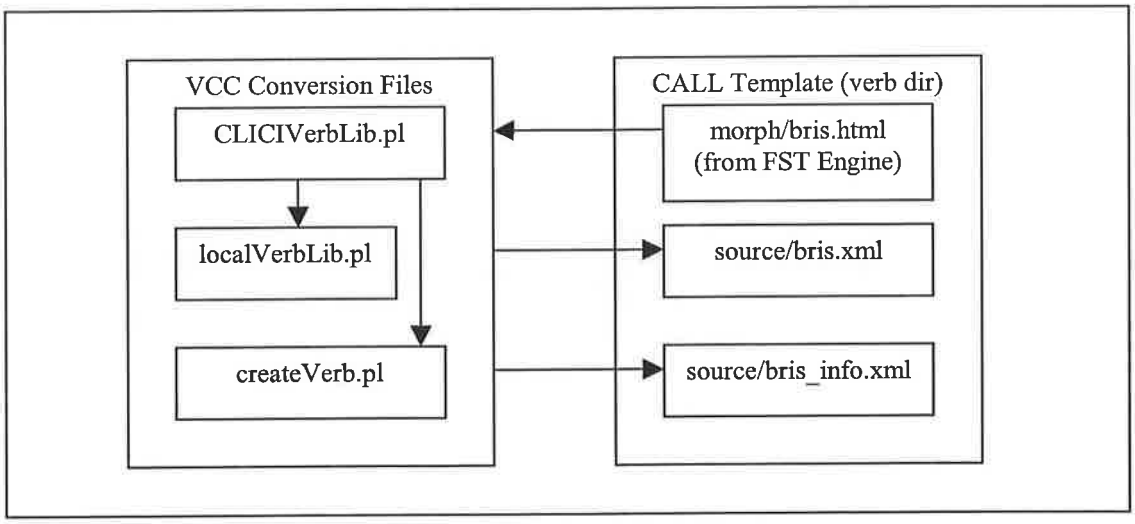


Figure T.6 Verb Conjugation Component - Verb Extraction Part

```
<verb>
<name>bris</name>
<info>
<past>
<positive>
<p1>
      <special_start></special_start>
      <root>b</root>
      <new>h</new>
      <stem>ris</stem>
      <after></after>
</p1>

<p2>
      <special_start></special_start>
      <root>b</root>
      <new>h</new>
      <stem>ris</stem>
      <after></after>
</p2>
.....
</positive>

<negative>
...
</negative>

</past>
</info>
</verb>
```

Figure T.7 Format of Verb Data File

The verb lesson generation part consists of the preparation of the verb information pages and the automatic creation of the language games. The preparation of the verb information pages is carried out using an XSL file called verb.xsl which reads the data in the verb data file and formats it into the required html format. An overview of the architecture is shown in Figure T.8 and the logic of verb.xsl is shown in Figure T.9.

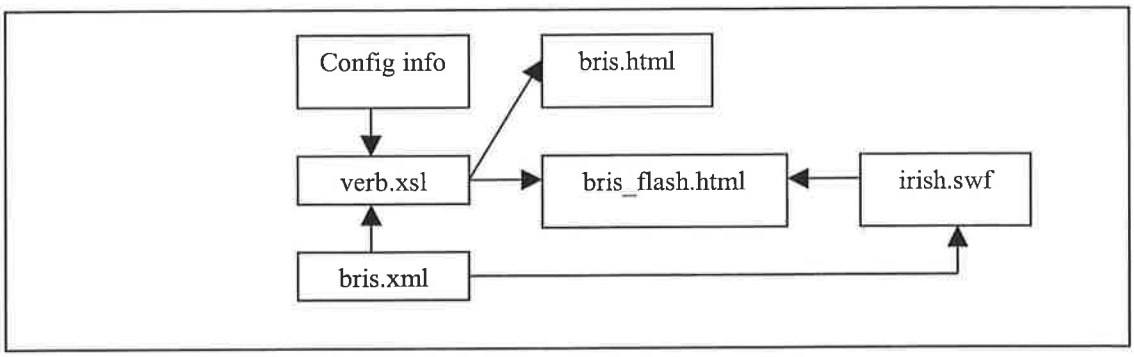


Figure T.8 Verb HTML File Creation Architecture

```
If past information available
    Process past information
If future information available
    Process future information

Process tense information
    process positive data (if available)
        for each person
            print relevant data with changes in red
    process negative data (if available)
    process question data (if available)

if animation mode
    add flash code to output file
```

Figure T.9 Overall Logic for verb.xsl file

The section of code that formats the verb data is shown in Figure T.9.

```
<td>
    <xsl:value-of select="special_start"/>
</td>
<td>
    <xsl:value-of select="root"/>
</td>

<td><font color="red">
    <xsl:value-of select="new"/>
</font></td>
<td>
    <xsl:value-of select="stem"/>
</td>
<td><font color="red">
    <xsl:value-of select="after"/>
</font></td>
```

Figure T.10 Verb Data Formatting Code from verb.xsl

The games are automatically generated based on the information supplied in the relevant source file (e.g. multiSource.dat for the multiple-choice game). Figure T.10 shows the general architecture outlining how the match games are created. Figure P.11 shows an example which

specifies that the matching game questions are based on the past tense and the answers offered are for the first person singular (past_s1), the first person plural (past_p1) and the name of the verb (name). The general format is tense_person. The tense is the name of the tense e.g. past, present or future. The person ranges from s1 (the first person singular) to p3 (the third person plural).

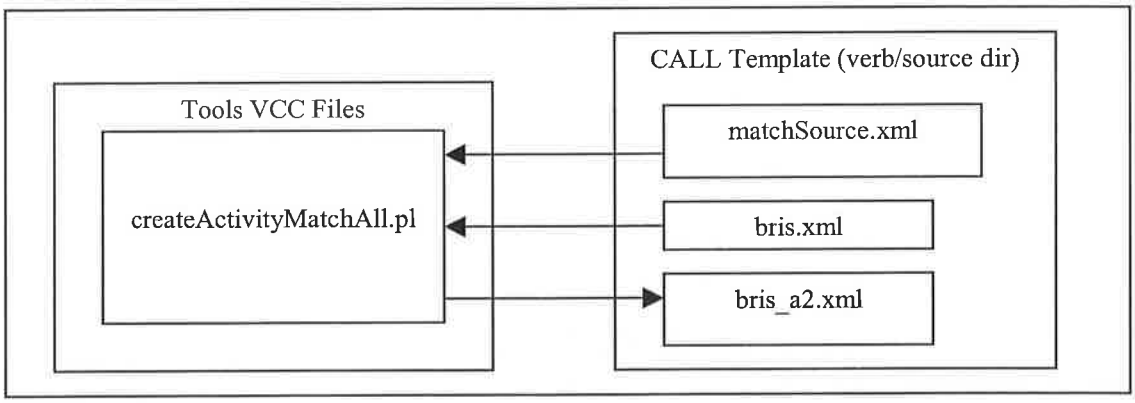


Figure T.11 Automatic Creation of the Matching Game

```
quest|0|.... mé (inné).
ans|0|0|past_s1
ans|0|1|name
ans|0|2|past_p1
quest|1|.... tú (inné).
ans|1|0|past_s1
ans|1|1|name
ans|1|2|past_p1|special
quest|2|.... sé (inné).
ans|2|0|past_s1
ans|2|1|name
ans|2|2|past_p1
quest|3|.... Seán (inné).
ans|3|0|past_s1
ans|3|1|name
ans|3|2|past_p1
```

Figure T.12 matchSource.xml - Sample Data

Figure T.13 shows a section of code from createActivityMatchAll.pl that formats the verb data into the appropriate format for the matching game XML file format. The files for the other games follow a similar pattern.

The Championship game is automatically created from the multiple-choice game and the gap-fill game (see Figure T.14).

In order to make the VCC as flexible as possible, there is a configuration directory with files to specify language specific files. The configuration directory contains three sub-directories: source, system and a language specific directory. The source directory contains `parameters.dat`, the global system configuration file. The system directory contains general header and wrapper information for the various VCC related files. The language specific directory (i.e. config/Irish) contains configuration files with language specific information. The contents of the three configuration sub directories are shown in Table T.3. A list of VCC files which are contained in the vcc sub-directory of the tools directory and their functionality is shown in Table T.4.

```
      foreach $verb (keys %verbList)
      {
            openActivityFiles($ext, $answerFile);

            while ($line = <INPUT>)
            {
                  chomp($line);
                  ($type, $data) = split(/\|/, $line);
                  $verb{$type} = $data;
            }

            prepareData($verb);

            print (OUTPUT "<words>\n\n");

            for ($i = 0; $i< 5; $i++)
            {

                  print (OUTPUT "<item id=\"$i\">\n");
                  print (OUTPUT "<left>\n");
                  print (OUTPUT
"<english>$quest{$i}</english>\n");
                  print (OUTPUT "</left>\n");
                  print (OUTPUT "<right>\n");
                  print (OUTPUT "<english>$ans{$i}</english>\n");
                  print (OUTPUT "</right>\n");
                  print (OUTPUT "</item>\n\n");

            }

            print (OUTPUT "</words>\n\n");

            closeActivityFiles($answerFile);
      }
```

Figure T.13 Code from createActivityMatchAll.pl

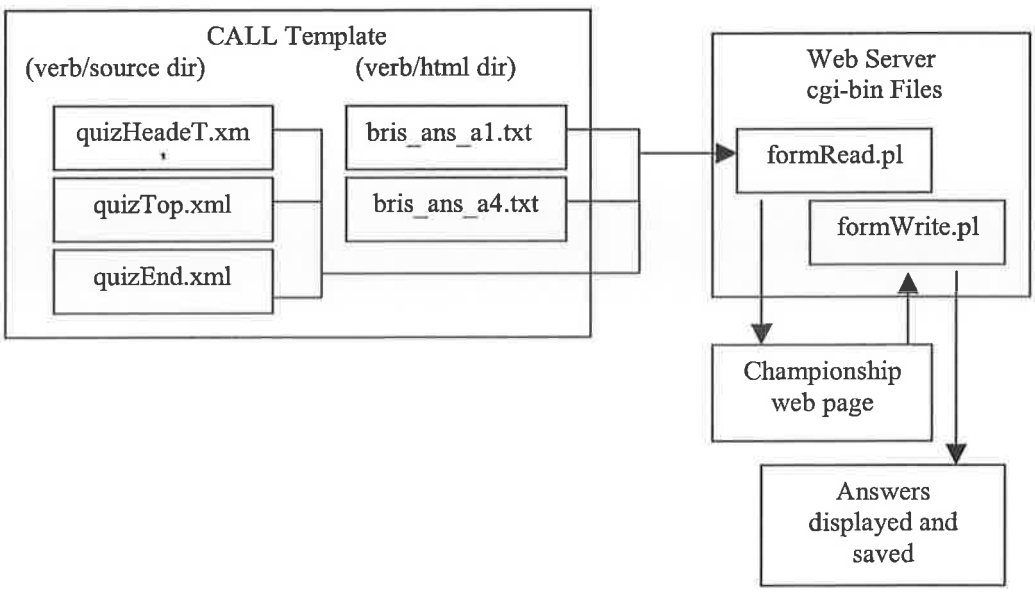


Figure T.14 Automatic Creation of the Championship Game

Directory	Filename	Purpose
Source	parameters.dat	Global parameters for the system
language	parameters.dat	Local copy of parameters
	pronoun.dat	Pronoun information
	verbInfo.dat	Information on verbs (if required)
	verblist.dat	List of the verbs
	verbType.dat	Information on the verb type (if relevant)
System	end.dat	End text for xml wrapper file
	endDriveT.xml	End text for xml driver file
	flashHeadeT.xml	Header text
	gapEnd.xml	End text for gap xml wrapper file
	gapHeadeT.xml	Header text for gap driver file
	gapSource.dat	Information for gap exercise
	gapTop.xml	Header text for gap xml wrapper file
	matchEnd.xml	End text for match xml wrapper file
	matchHeadeT.xml	Header text for match driver file
	matchSource.dat	Information for match exercise
	matchTop.xml	Header text for match xml wrapper file
	mixEnd.xml	End text for mix xml wrapper file
	mixHeadeT.xml	Header text for mix driver file
	mixSource.dat	Information for mix exercise
	mixTop.xml	Header text for mix xml wrapper file
	multiEnd.xml	End text for multi xml wrapper file
	multiHeadeT.xml	Header text for multi driver file
	multiSource.dat	Information for multi exercise
	multiTop.xml	Header text for multi xml wrapper file

Table T.3 Files in the config Directories

File	Function
createActivityGapAll.pl	Creates the gap-fill exercise XML file
createActivityMatchAll.pl	Creates the match exercise XML file
createActivityMixAll.pl	Creates the mixed-up sentence XML file
createActivityMultiAll.pl	Creates the multiple-choice exercise XML file
createDriveT.pl	Creates the XML wrapper file for the verbs
createDriverGames.pl	Creates the XML wrapper file for the games exercise
createDrivers.pl	Batch file to call each of the exercise driver creation files
createGenGames.pl	Creates the batch file for the games exercises
createVerb.pl	Main file for creating verb output files for the VCC
Libraries	
CLICILib.pl	Library of general functions
myVerbLib.pl	Library of Irish specific verb related functions
CLICIVerbLib.pl	Library of general verb related functions

Table T.4 Verb Conjugation Component Files

T.4 Writing Checker Component

The Writing Checker Component (WCC) consists of the overall Writing Checker (WC) architecture and the underlying checking engine. Figure T.15 shows an overview of the WCC Architecture.

A list of WCC related files is shown in Table T.5. The textcheckGeneral.pl and WCCLib.pl files should be used as supplied by the system (although they can be changed by a competent programmer if there is a need to change the overall logic or the User Interface). The file texcheckLocal.pl supplies the actual error checking routines, including the interface

between an external grammar checking if one is being used. The `activeErrors.pl` contains a list of flags which specify what errors are to be checked for by the Writing CheckeT.

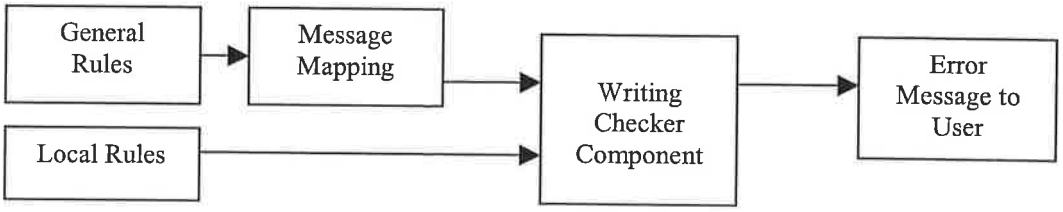


Figure T.15 Overview of the Writing Checker Component Architecture

File	Purpose
textcheckGeneral.pl	Contains the overall WCC logic
textcheckLocal.pl	Contains the error checking logic
WCCLib.pl	Contains the display related routines
activeErrors.txt	Contains the error checking flags

Table T.5 Writing Checker Component Files

Figure T.16 shows an overview of the overall WCC logic from the `textcheckGeneral.pl` file. It uses the local error checking routine supplied by the textcheckLocal.pl file to actually carry out the error detection.

Require textcheckLocal.pl (i.e. use the local error checking routines)
Read and process learner text
Depending on configuration options ....
- If External error checking on ... check for external errors
- if local error check on ... check for local errors

Display user text with grammar and spelling messages (if any)

Figure T.16 Overview of WCC Logic (from `textcheckGeneral.pl`)

The `activeErrors.txt` file in the cgi-bin directory is used to specify if an external error checker and/or a local error checker is being used. Local flags (e.g. to check for punctuation errors) can also be set in this file. Figure T.17 shows a sample activeErrors.txt file that specifies that both external and local error checkers are active and that spelling errors should be checked, while punctuation errors should be ignored. Only the `general` and `local` flags need to be specified. In the example in Figure T.17, the `spell` and `punc` flags are local to a particular writing checkeT. The local CALL development team is responsible for supplying the necessary error detection code.

```
general|1
local|1
spell|1
punc|0
```

Figure T.17 Sample `activeErrors.txt` File

The CALL development team will supply the error checking code in the `textcheckLocal.pl` file. This file is saved in the cgi-bin directory. The error checking logic is left up to the programmer but there are several key routines that must be defined in textcheckLocal.pl and these are shown in Table T.6.

Function	Purpose	Returns	Information
externalChecker()	Calls the external error checker (if any)		
processExternalErrors()	External error checker	numLines, errorFound, spErrorFound	Populates the error and spelling message arrays.
processLocalErrors()	Local error checker	localErrors	Populates the error and spelling message arrays

Table T.6 Required Routines in `textcheckLocal.pl`

Table T.7 specifies the error related arrays that will be populated by `textcheckLocal.pl` file. There are two array types – one for grammar errors and the other for spelling errors. However, if no distinction is required from a pedagogical point of view, then only the grammar error array needs to be populated.

Array	Purpose
`$lineErrorListText[$listLineNumy]`	Specifies if an error exists on a given line
`$lineErrorList{$listLineNum}{$wordNum}`	Specifies the original line of text with an error
`$msgErrorList{$listLineNum}{$wordNum}`	Specifies the error message for a given word in a given line of text
`$spellingError[$spErrorFound]`	Reports on the spelling error
`$spellingCorrection[$spErrorFound]`	Provides a suggested correction
`$spellingErrorLine[$spErrorFound]`	Provides the original line of text with the spelling error

Table T.7 Error Reporting Arrays

Figure T.18 shows a sample `processExternalError()` routine. For each error detected by the external error checker, it parses the error message and populates the relevant message error (i.e. grammar error or spelling error). The programmer has the option of calling a local routine to check for alternative spelling correction suggestions if this is deemed necessary or appropriate and resources are available to provide alternative spellings.

The Writing Checker aims to be language independent. The content developer can change the language of the text displayed to the learner by modifying the contents of the WCCMsg.txt file. Figure T.19 shows the contents of this file (see Appendix P Content Developer User Manual for more details).

```
sub processExternalErrors()
{
      $i = 0;
      $errorFound = 0;
      $spErrorFound = 0;

      /* For each error reported by the external error checker
... */
      while ($line = <INPUT>)
      {
            chop($line);

            $lineList[$i] = $line;

            /* if the line is not empty */
            if ($line)
            {
                  /* Parse the line */
                  ($lineNo, $type, $origLine, $msg, $extra) =
                                                split(/\|/,
$line);

                  /* If a spelling error is detected, populate the
*/
                    /* spelling error related arrays */
                  if ($type =~ /SP/)
                  {
                        $spellingError[$spErrorFound] = $msg;
                        $spellingCorrection[$spErrorFound] =
$extra;
                        $spellingErrorLine[$spErrorFound] =
$origLine;
                        $spErrorFound++;
                  }
                  /* Else, populate the error mssage related
arrays */
                  else
                  {
                        $errorMsg = $msg;
                        processLine($lineNo, $origLine,
$errorMsg);
                        $errorFound++;
                  }
            }
            $i++;
      }
      return ($i, $errorFound, $spErrorFound);
}
```

Figure T.18 Sample `processExternalError()` routine

```
NO_WRITE|You didn't write anything
ONLY_SP_ERR|No errors, only some spelling mistakes!
NO_ERR|No errors!
YOUR_SP|Your spelling
SP_SUGGESTION|Suggestion
LINE|Line
THANKS|Thank you
INPUT_TEXT|Input Text
TITLE|Title
OTHER_STORY|Another Story
BYE|Bye
SEND|Send
```

Figure T.19 Writing Checker Component User Interface Message File

Appendix U Installation Manual

This manual provides information on how to install the CLICI system. The other manuals for the CLICI system are the Student User Manual (Appendix Q), the Content Developer Manual (Appendix R), the Teacher User Manual (Appendix S) and the Technical Manual (Appendix T).

The instructions given here assume that you are installing the CLICI system on the C drive of your computer. It also assumes that you have Perl installed at C:/Perl on your hard disk. If you intend installing it in a different location or do not have Perl installed at the stated location, see below for details on how to customise the CLICI software for your environment.

Copy the CLICI directory from the CD to the C drive of your computer. This installs the CLICI software. To start the Apache Server, click on the Apache Server icon (a pink feather) in the CLICI/ProgramFiles/Apache/Apache directory. Next, click on the Login icon in the CLICI directory. You should see the login screen. See the Student User Manual for information on how to use the system. If you are going to be using the CLICI resources on a regular basis, you might consider automatically starting the Apache Server when you log in (consult your PC manual for details on how to do this).

Installing the CLICI Software in a different location

You can install the CLICI software in a different location, but you will need to make several changes to CLICI system files. If you feel competent to do so, it is a straightforward process. If you are unfamiliar with these types of files, you might consider getting a local technical support person to assist you in the process. The file httpd.conf in the CLICI/ProgramFiles/Apache/Apache/conf directory contains several variables that refer to the specific location of the Apache software. You will need to replace these values with your own local location information. Search for the word CLICI in this file and replace it with your new values. You must make these changes before starting the Apache Server.

Perl is installed in a different location

If you have Perl installed in a different location (other than C:/Perl) you will need to make several changes to CLICI system files. If you feel competent to do so, it is a straightforward process. If you are unfamiliar with these types of files, you might consider getting a local technical support person to assist you in the process. The Perl files (i.e. *.pl) in the CLICI/ProgramFiles/Apache/Apache/cgi-bin directory will have to be modified to reflect the local location of the Perl directory. This line is the first line in each of the Perl files.

Appendix V CLICI System Overview

This document provides an overview of the CLICI System. There are several other documents that address specific needs. These are the Student User Manual (Appendix Q), the Content Developer Manual (Appendix R), the Teacher User Manual (Appendix S), the Technical Manual (Appendix T) and the Installation Manual (Appendix U).

The CLICI System provides a CALL environment with three components. The Lesson Generator Component (LGC) facilitates the development of language lessons along with games (or language exercises) for the students. The Verb Conjugation Component (VCC) provides a mechanism for displaying animated verb conjugation information along with relevant games. The Writing Checker Component (WCC) provides a Writing Checker environment which can be adapted to the relevant target language. The CLICI software is available for CALL research and development by interested parties.

The CLICI System was specifically developed as a CALL resource for teaching and learning Irish in the Primary School context in Ireland. It comes with some language lessons and multiple-choice, matching, mixed-up sentence and gap-fill games. Other lessons can be added (see the Content Developer User Manual – Appendix P for details). The Verb Conjugation Component provides a selection of regular and irregular verbs with animated information which highlights the changes that are required to correctly conjugate a verb. It has multiple-choice, matching and gap-fill games which are automatically generated based on information provided by the content developer. The list of verbs available for study is customisable. The Writing Checker Component provides a grammar and spelling checker that focuses on typical errors made by primary school children learning Irish. Other checks can be added to the system with the help of a computer programmer.

The CLICI System was developed as part of the "Integrating Computational Linguistics Techniques in CALL" research project (SC/02/298) that was funded by the Irish Research Council for Science, Engineering and Technology (IRCSET). If you are interested in more information, please contact Monica Ward, School of Computing, Dublin City University, Glasnevin, Dublin 9, Ireland or mward@computing.dcu.ie for more information.