



User Experience Study of “Cipher: Faoi Gheasa”, A Digital Educational Game for Language Learning and Student Engagement

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ABSTRACT

Digital game-based language learning (DGBLL) has become an increasingly popular topic in the field of digital educational games. DGBLL can provide learners with an enjoyable gaming experience as well as enhancing their language learning experience. The need for engaging approaches to the teaching and learning of minority or endangered languages has also led to greater interest in the application of DGBLL approaches. In this paper, we introduce a digital educational game (DEG) designed to promote language learning and student engagement in the context of an endangered language. In order to evaluate the user experience, we employ a four-dimensional evaluation framework which evaluates user satisfaction in terms of gaming experience, learning experience, adaptivity and usability. Survey responses were analysed and the findings indicate that participants were satisfied with the game and their feedback will be used to improve the game in the future.

CCS CONCEPTS

• **Applied computing** → **Computer games**; • **Human-centered Computing** → **User studies**.

KEYWORDS

User Experience, Digital Game-based Language Learning, Digital Educational Games, Indigenous Language Revitalization

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1 INTRODUCTION

In this paper we introduce an educational game designed to promote language learning and language engagement. We do this by focusing on both entertainment and challenge as well as on the learning objectives [5]. The game uses storytelling as a means of encouraging learners to engage with the Irish language [28, 29]. In the game, the stories have been subjected to evil enchantments which leaves some of the words unreadable (the words ‘*Faoi Gheasa*’ in the name of the game means ‘under a spell’ in Irish). The object of the game is for the player to find these enchanted words which encourages ‘noticing’ [13]. Furthermore, the player must identify the particular spells that were cast upon the enchanted words. In order to move on to the next page of the story the player must a) find all of the enchanted words on a page and b) correctly identify the spells. This level of challenge increases student engagement with the game. In our user experience test, the players (mainly children aged 10-12) have shown a high level of interest in progressing in the game, and in order to do this, they must engage with the stories.

An educational and entertaining game such as this is particularly important in the context of Irish society, where Irish is a minority and endangered language [11]. In this context, many L2 learners do not have the opportunity to engage with the language outside of an educational setting, and this game provides the opportunity to improve certain language skills while engaging with the language in a fun way. In this paper we focus on student user experience as an indicator of student engagement. Objective measures of language learning are outside the scope of the current study.

2 BACKGROUND

2.1 Irish language learning issues

Irish is one of the official languages of Ireland, along with English and Irish Sign Language. However, the number of people who use Irish as their first language (L1), is much less (around 25K according to some estimates [1]). Students are often motivated to learn the language in the early stages of school (4-8 years of age), but their level of interest and motivation tends to drop after that. There are several difficulties with the teaching and learning of Irish

in schools in Ireland. The first challenge is the complex socio-cultural role of Irish in Ireland. While people are proud of the national language, many parents had non-positive experiences with learning the language. Secondly, there is no utilitarian reason to learn it as all Irish speakers are bilingual in Irish and English. Thirdly, the teachers are generally not native speakers and lack confidence in their Irish language skills. Fourthly, while the orthography of Irish is relatively transparent, in many cases teachers are not taught the letter-phoneme correspondence in their initial teacher education, and therefore, they do not teach it to the students. This means that when students learn to read and write in Irish, they are transferring their knowledge of English orthography to Irish, which is not a productive approach to adopt. Furthermore, Irish is a morphologically complex language compared to English. Finally, as Irish is a lesser spoken language, there are very few digital resources available. To our knowledge, *Cipher Faoi Gheasa* is the first DGBLL game of its kind for Irish.

2.2 Irish language learning issues

Digital game-based learning has been used for various purposes, such as learning languages [5], promoting cultural heritage [6], supporting children with ADHD [7]. Well-designed games encourage players to engage in complex and critical thinking [2] and they facilitate learning which involves change over time through experience [21]. There have been an increasing number of studies on digital game-based language learning (DGBLL). Dixon et al [5] conclude that digital games can be very effective for second language acquisition. Other meta-analyses on DGBLL also corroborate the conclusion that games have a positive effect on language learning, especially on L2 vocabulary acquisition [8, 9]. Moreover, research suggests that games can motivate readers [4, 10] and encourage writing and can also be applied to reading and writing instruction courses [12]. In addition, Dixon et al [5] found that games designed for entertainment are generally more effective than educational games specially designed for L2 learning. It is worth noting that games designed for entertainment normally do not have language options for minority or endangered languages because of low commercial interest, which denies access to DGBLL opportunities to potential learners of these languages. Therefore, digital games designed specifically for minority or endangered languages are very important for language learning.

2.3 User experience research in DEGs

Previous research and studies [2, 18, 19] suggest that digital educational games (DEGs) can facilitate learning in a more engaging and motivating way. However, evaluating user experience of these systems can be very challenging, due to the fact that gaming and learning can be considered as competing motives and can have a mutual influence on each other [7, 14]. Isbister and Schaffer [17] focus on users' behaviours and feelings when they play the games. Bul et al [7] evaluate user satisfaction mainly on the basis of gaming experience and learning experience, while other

researchers tend to focus only on how players feel when interacting with the system [20]. Elements like usefulness and usability are not always considered important, which can affect engagement, given that usability problems can cause a negative game experience [14]. Nacke et al [15] developed a three-layer evaluation framework, i.e. quality of the product, quality of human-product interaction, and quality of this interaction in a given context. Law and Sun [14] present a four-dimensional evaluation framework which focuses on gaming experience, learning experience, adaptivity and usability. We use this four-dimensional model in our user evaluation study.

3 GAME DESIGN

Cipher: Faoi Gheasa is based on the game Cipher [16] which is a crowdsourcing 'game with a purpose' originally designed for correcting errors in English text. This game was developed in the Unity game engine. The game network was implemented through Photon Server and the game data is stored in a MySQL relational database. The game server is hosted by Azure Windows virtual machine. Currently, the game can be run on three platforms: Windows, Android and macOS.

3.1 Game storyline and content

The game world is a magical one in which a mysterious and evil spirit is attempting to deny access to the ancient mythological tales in which the ancient spirits dwell, by placing the tales under a spell. The player's mission is to decipher these spells in order to restore the tales before they are sealed and lost forever. There are many different spells (ciphers) and stages before all the evil spells can be lifted and a story is restored. Each story is divided into different screens/pages before it is shown to the player. When the player starts the game, they are presented with a page of the story with enchanted words (errors). They need to find all the enchantments in the text, and they must also identify the spells (ciphers) that are "responsible" for creating the errors. For the lower levels of language ability, we use translations of common fairy tales which will be familiar to the players in their first language, in this case usually English. For the higher levels we use versions of Irish mythological tales, and folktales which we source in the freely available National Folklore Irish Schools Collection¹

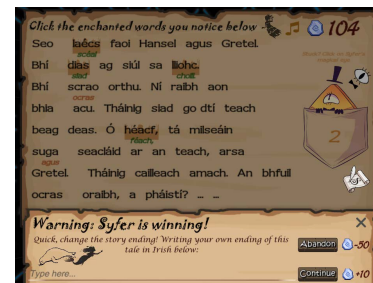


Figure 1: Finding enchanted words and spells

¹ <http://www.duchas.ie>

3.2 Adaptivity

The adaptive elements in the game are the level of difficulty and the length of stories, as well as the level of difficulty and the number of spells. Players are asked to provide their age, school year and type of school (English or Irish medium of instruction). Adults can enter 18+ as their age and they will be assigned an intermediate game level. According to the player's initial user information, a story is selected to meet the player's language capability. As the game progresses, the level of difficulty and the number of spells will be adjusted according to the player's performance. Furthermore, if the story becomes too difficult, the player can choose to abandon it and a new story with suitable difficulty and length will be assigned to them. Each time the player completes a page, the number of spells may increase and the spells become more challenging. Players must find all enchanted words on a page and correctly identify the spells used, in order to progress to the next page of the story. If they fail in either of these tasks, they will be asked to type an Irish sentence to continue the unfinished story on the screen (see Figure 1), in which case the same page will be presented but with a different set of randomly created enchantments. Alternatively, they can abandon the story and be given a new story. When the player successfully completes a story, they will be provided with a story with a higher level of difficulty.

4 USER EXPERIENCE STUDY

The user experience study took place at a boys English medium primary school in Ireland. Participants are students aged 10-12 years from 4th, 5th, 6th grades with each grade having three classes of about 30 students. There was a game session for each of nine classrooms on one day in two successive weeks. The school WIFI facility was used to meet the Internet requirement for playing the game. Participants played on laptops, mainly in pairs.

Two questionnaires were designed, in order to collect participants' feedback (see Appendix A for further details). Both were issued through Google Forms. We asked the participants to fill out a short questionnaire after the first session which gave us an overview of user experience and helped us identify issues encountered. Before the session in the following week, we had time to solve the problems (or improve the situation) based on the initial feedback. In the second week, the same participants took part, and afterwards were asked to fill out a long questionnaire regarding gaming experience, learning experience, adaptivity and usability. During both sessions, researchers were in the classrooms with the participants to answer any questions they had about the game and questionnaires.

5 RESULTS AND DISCUSSION

We analysed the players' ratings of satisfaction after playing the game, focusing on gaming experience, learning experience, adaptivity and usability, following the method used in [7]. The answer categories are based on a 5-point Likert scale (1 = very negative; 5 = very positive). The two highest scores (4 = positive

and 5 = very positive) were considered as a positive response. The satisfaction rate was recorded for each question.

Overall, the general gameplay experience was positive with 34.4% of students describing it as 'fun', 17.2% describing it as 'challenging', 15.6% describing it as 'boring', and 10.9% describing it as 'easy'.

Although only 51.6 percent of the participants indicated that they learned something while playing the game, 62.5 percent of the participants were positive about learning Irish through the game. 59.4 percent of the participants were willing to read the stories in the game. Furthermore, some of the valid Irish sentences typed into the game by the players, to continue an unfinished story, showed that they read and understood the story in the game.

Regarding the question about the appropriateness of the difficulty level of Irish in the game, most students felt that the level was 'about right' (46.9%), followed by 25% who felt it was 'easy', and 14.1% who felt it was difficult. In answer to the question 'Did you find the game easy to play?' 57.8% responded positively. Regarding the question 'What problems hindered your gameplay?', the participants' responses (e.g., poor Internet connection, repeated game tutorial, login issue, etc.) indicated a number of usability problems.

The results regarding student engagement of learning Irish through the game are promising. 73.5 percent of the participants gave positive responses when comparing learning or reading Irish through the game to normal classroom teaching and 73.5 percent of the participants were willing to play the game, (although we must bear in mind the Hawthorne effect whereby the game novelty factor can cause a positive bias). We noticed that a few students who do not study Irish could also play the game and even enjoyed the game (though they greatly rely on power-ups), which means that was a positive language exposure activity for them. This demonstrates that the *Cipher Faoi Gheasa* game is successful in combining entertainment and educational aims. In addition, some teachers provided verbal feedback which indicated that students were very engaged with the game. Some of the teachers even started to give extra language support to some of the students when they had problems finding errors or understanding the story in the game, which can be a new model of language teaching and learning in the future classrooms.

6 CONCLUSION

In this paper, we discussed the design and user experience of *Cipher: Faoi Gheasa*, a digital educational game for engaging students in Irish language learning. We explained the game ideas and pedagogical strategies involved in this game. Our user experience study employed a four-dimensional evaluation framework including gaming experience, learning experience, adaptivity and usability. The initial results regarding user satisfaction are promising, and we believe that it is well worthwhile tapping into the interest in game playing for educational purposes. However, longitudinal studies are needed in this area [5]. Player feedback will be used in improving future versions of the game.

This digital educational game currently has Irish as the target learning language, but we envisage that the game and findings from the Irish context can be transferred other minority or endangered language contexts.

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APPENDIX: QUESTIONNAIRE RESULTS

Table 1: Proportion of participants' ratings in terms of gaming experience, learning experience and adaptivity

Question	Satisfaction (n = 64) positive (percentage)
Did you like playing the game?	46 (71.9 percent)
What do you think of the storyline in the game?	38 (59.4 percent)
How willing were you to play the game?	47 (73.5 percent)
Would you like to play the game more often?	40 (62.6 percent)
What do you think about learning Irish through the game?	40 (62.5 percent)
How willing were you to read the stories in the game?	38 (59.4 percent)
How would you compare learning or reading Irish through the game to normal classroom teaching?	47 (73.5 percent)
How do you feel about learning Irish after playing the game?	36 (56.3 percent)
Do you think you learned anything while playing the game?	33 (51.6 percent)
What do you think of spells (ciphers) in the game?	44 (68.7 percent)
What do you think of the Irish stories in the game?	39 (60.9 percent)