Evaluation of Science Unleashed

April - November 2004

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Executive Summary

Science Unleashed (SU) is a pilot project aimed at Junior Cycle students in second level schools in Ireland. It is part of the IMMERSE initiative (Innovative Multi-Media Educational Resources for Students and Educators) which aims to produce a range of digital learning and teaching materials for use in primary schools (Visual Arts and Sci-Spy) and post primary schools (Science Unleashed).

In this pilot project of SU material, 15 video clips had been prepared and were trialed in two stages in 6 second level schools, 5 of which were in the Dublin region. The key evaluation was to examine the impact of the use of these video clips within the classroom both on the teachers' methodology and also on students learning. A website accompanied the DVDs and provided additional support material. The National Centre for Technology in Education (NCTE) selected three schools in February 2004, which were evaluated in May 2004. A further 4 schools were trialed in October 2004, with their evaluation in November 2004.

Key findings:

- While all of the teachers in this study had specific criticisms of the SU materials, they all agreed that the concept of the DVDs and website for Junior Cycle Science was excellent and one that would be used by teachers and students. This overall initiative of SU was welcomed as all the teachers commented on the time that it takes for individuals to source and find suitable resources for use in teaching science.

- All the teachers found different elements of the SU material to be useful and they all stated that some aspects of the materials would be useful to them in the future. In particular, all the teachers strongly recommended the further development of the website, making use of the potential it has in teaching and learning. The success of the Building Atoms game (as noted in the report) in motivating and engaging students shows the potential powerfulness of this technology in the Junior Science Curriculum.

- The DVD materials had a mixed reaction by the teachers. The teachers generally showed the DVDs as the focus of their class to either introduce a particular topic or as a revision exercise. The main review of the material in class was by question and answer sessions. The teachers identified sections of the SU materials that aided them in the explanation of particular topics.

- Teachers reported no marked difference in student learning as a result of using the SU materials (atom building game was the exception), but that generally the DVD and website were useful as a tool in reinforcing teaching and learning. Teachers felt that while students generally enjoyed the use of different media in the classroom, there is an element of them just being passively involved.

- The students opinions are very interesting as they favoured the use of the DVD material in class, stating that that the "images helped them to understand" and that the use of the different medium was a "nice distraction from the teacher". This contrasts with the general teacher view that there was no remarkable difference in student learning.

- While teachers identified several sections / snippets of the DVDs that were useful, they felt that their use would not necessarily merit the additional effort of getting the equipment set up in advance of the class. The DVDs, as they currently are, provided little added value to their teaching.

- It is worth noting that in 50% of the schools in this pilot the IT equipment was not permanently set up in the science rooms but was stored elsewhere e.g. in a central location in the school. Therefore there is an extra barrier to use of any DVD /website material in that the material must be appropriate for the teachers needs to be worth their while to put in the additional time to set up the equipment.

- Teachers felt that the DVD content would require redevelopment as follows, if it were to be a useful teaching resource:

    - The presentation of DVD's should reflect the investigative nature of the Junior Cycle Science curriculum.
    - Style of presentation would require "livening-up".
    - More probing questions within each topic should be used to encourage a deeper approach to learning.
    - There should be a link to the practical element of the curriculum.
    - DVD material requires clearer diagrams, animation and video material. Errors in content should be corrected.
    - A variety of approaches to support student learning are required e.g. quizzes, games, simulations.
    - Transfer of the revised material presently on DVD to the web, within an easily navigable site, using small discrete video clips and streamimg technology was suggested.

In conclusion, the teachers in this study all welcomed the development of materials for use in the Junior Science Curriculum. Specific areas of the DVDs and website were identified as very useful in teaching. Students also liked the change to the IT use and the visual images used. However, specific issues were raised in relation to the DVD medium and content and to the website. Teachers indicated their strong preference for the further development of the website to exploit its interactivity for the teaching of science at this level. DVD video streams could then be made available on the website.

REPORT DETAILS

BACKGROUND

Science Unleashed (SU) is a pilot project aimed at Junior Cycle students in second level schools in Ireland. It is part of the IMMERSE initiative (Innovative Multi-Media Educational Resources for Students and Educators) which aims to produce a range of digital learning and teaching materials for use in primary schools (Visual Arts and Sci-Spy) and post primary schools (Science Unleashed).

The White Paper on Education (1995) states that the revision of the curriculum for all second-level education subjects should be supported by changes in teaching methods. In order that the objectives of the restructured second level curriculum can be realised, wide changes in teaching strategies need to be introduced into Irish classrooms, complementing existing traditional methods. The National Council for Curriculum Assessment report (2002) claims that students who were given the opportunity to explore their problem-solving skills and who were exposed to ICT, in particular to multimedia, would consequently develop conceptual understanding.

With the current introduction of the new Science syllabi for primary schools and also for Junior Cycle (JC) Science, a pilot project that makes use of different forms of media is indeed timely. The availability of multi-media resources may be potentially of immense benefit to both teachers and students – particularly in helping in the area of visualisation of ideas or concepts. There is a growing awareness that literacy in the 21st century will have to include knowledge and understanding of media other than print (A Wider Literacy, 2004). The new Junior Cycle syllabus emphasises an investigative approach to the teaching of science. This shift in approach will hopefully allow teachers to be more flexible in their teaching methods.

In this pilot project of SU material, 15 video clips had been prepared and were trialed in two stages in 6 second level schools, 5 of which were in the Dublin region. The key evaluation was to examine the impact of the use of these video clips within the classroom both on the teachers' methodology and also on students learning. A website accompanied the DVDs and provided additional support material. In this pilot project, the National Centre for Technology in Education (NCTE) selected three schools in February 2004, which were evaluated in May 2004. A further 4 schools were trialed in October 2004, with their evaluation in November 2004. There was an overlap of one school between each phase, however, different teachers were involved. In each school, at least one teacher agreed to trial the SU material. Each school was supplied with 3 DVDs; Chemistry, Biology and Physics, and the schools in phase 1 were also supplied with a dvd player and a data projector. The main teachers involved in this study were very experienced science teachers with minimum of five years teaching experience and also were open and enthusiastic about trying new ways of teaching and learning.

TERMS OF REFERENCE

The brief for the consultants was to evaluate the impact of the Science Unleashed materials from a learning and teaching perspective according to the following Learning and Teaching Objectives of Immerse, i.e.

Learning and Teaching Objectives of Immerse

1. *Demonstrate how dedicated media-rich resources can be used to support and enhance the classroom experience in the selected curriculum areas.*
2. *Evaluate and assess the value of materials in the learning contexts by:*
    - *Identifying teaching methodologies and approaches used during the pilot (in particular changes from traditional methods).*
    - *Observing student motivation and attitudes to learning using the media rich materials.*
    - *Observing learning – Does interaction and engagement with these materials lead to any observable improvement in understanding / comprehension of certain concepts among individual students?*
    - *Assess teachers' views of the appropriateness, relevance and usability of the materials with regard to the Junior Cycle curriculum.*
    - *Does the availability of relevant and targeted interactive materials lead to:*

      (a) greater utilisation by teachers

      (b) significant student usage

      (c)greater support and facilitation for school principals / school management **.**

The following terms of reference were agreed:

- Provide advice prior to the roll-out of the actual pilot in schools and assist in the development of training workshops.
- Develop an overall evaluation framework which will measure the items addressed in the learning and teaching objectives outlined above.
- Understand the rationale underpinning the new Junior Cycle science curriculum.

TIMEFRAME

A list of teachers and schools involved is given in Appendix A.

The evaluators met with NCTE in Autumn 2003 and agreed the framework for the evaluation and the structure and content of the workshops for teachers involved in the project. The initial meeting of phase 1 between the evaluators and the teachers took place in NCTE in January 2004. At this meeting, the format of the evaluation was discussed and each teacher was asked to compile a reflective diary when using the SU materials. The format of the diary was sent electronically to all 5 teachers (Appendix B). Following this meeting, there were a number of technical issues, which resulted in delays in starting the pilot project. Teachers then required time to familiarise themselves with the content, thus trailing of the material in the classroom commenced in mid-April 04.

Phase 2 of the project had an initial meeting with the teachers in October 2004, at which the format of the evaluation was outlined and each teacher was asked to complete the reflective diary (Appendix B). Also at this meeting, each teacher examined the content of the DVDs and chose a number of areas (approx 3) that they would focus on. This allowed the teachers to engage more quickly with the content. In November 2004, a feedback meeting took place in NCTE between the evaluators and the 4 teachers involved in phase 2.

EVALUATION METHODS

Phase 1 evaluation took place in May 04. The evaluators visited each school in May 04 and, in two of the schools observed teachers in their class as they used the SU materials. In two schools, the students were asked to complete a questionnaire. In the third school, no class was observed, but the teachers had evaluated the DVDs and website. Only one teacher maintained a reflective diary in this phase.

During phase 2, which took place in October 04, all teachers maintained the reflective diaries and the main feedback was provided at a group meeting in November 2004. This meeting was immensely beneficial, as the teachers had focussed on particular topic(s) that related to their immediate practice. The teachers were able to discuss as a group their experience of using the SU material.

FINDINGS

1. Physical Set-up

The physical set up, with respect to ease of access to equipment (such as DVD player, laptop, data projector), varied in each school. In three of the schools (Teachers C, D, F, H), the equipment was permanently set up in the science room. In one school (Teacher A), the data projector was set-up on a moveable stand where it could easily be brought out from its storage in the prep-room and set up in the science room. In the remaining two schools, (Teachers B, E and G) the DVD player was stored centrally and had to be booked in advance.

Teacher B commented that, in general, the take up of the use of technology within his school was very limited. The laptop and the data projector were stored in the Secretary's office and therefore there was a 'set-up' time required before usage in the classroom.

Teacher B commented that;

> ***It has to be worth your while to put in the additional time to set up the equipment.***

Access to the computer room was not possible for the majority of the teachers in this study, with only Teachers F and G indicating that there was no difficulty in bringing a class group to the computer room for class. In the other schools, timetabling access to a computer room was not possible as the computer room(s) were fully utilised.

The teachers noted that the most efficient and appropriate manner to solve this problem was to have a trolley of laptops with wireless connectivity available in each school. This would then be available for any class group, regardless of location around the school.

2. Teaching Methodology

Use of SU DVD's in teaching and learning

The teachers used the DVDs in two main ways:

- to introduce the topic or
- as a revision tool at the end of a topic to reinforce learning.

This section summarises how the teachers incorporated the DVD material within their classes; Appendix C summarises the main topics covered by each teacher.

Teacher A used the DVD material as the focus of her class teaching. She played the topic of interest through, then replayed smaller sections with a question and answer session based on the material. A worksheet was then handing out for the students to complete in class. In this case, the DVD was used as the primary

source of information. The DVD material was used to introduce the topic and also as a revision tool. A web quiz was used in class to as a question and answer session.

Teacher C used the DVDs over a three-week period with 3rd year students as a revision tool. It is noted that there is a very strong emphasis on practical work in this school. Teacher C commented that;

> ***The DVDs are good revision material but would need to be extended further to allow the teacher to adopt the material to their own specific needs.***

In this case, the DVD was used as another resource available to teacher in tandem with additional (not SU) web based material.

Teacher D in the same school, indicated that the DVDs were used with a group of Transition year students who were impressed with the medium but not the content.

Teacher E used the 'Ecology' section of the Biology DVD with second years as a revision tool. The basic terms and principles of ecology had already been introduced to students as the class had been on a field trip. The teacher stressed that certain concepts within ecology are difficult to understand and it is important to relate these terms directly to what is experienced outside the classroom. The DVD material was useful in drawing together the large topic of ecology.

This teacher said that if she were to use the DVD material again, it would be used in advance of the field trip in order to illustrate the various collection and measurement techniques. Also she would use the weblinks on the website before the field trip to help in identification of plants and animals.

Teacher E looked at 'Motion' with second years as a recap on the topic. She played the section through once then replayed it, and paused at certain sections for discussions. If she were to use it again, she would use it to introduce the ideas of distance-time graphs before drawing them and also use quiz questions to reinforce the graphs.

Teacher J also used this DVD with 2nd years as a means of consolidating the topic and he stated that he would use it again as a revision tool only.

Teacher F used 'Introduction to Atoms' with 2nd year group. The purpose of using the DVD was to introduce the topic and generate some discussion with students. Generally, he felt that the concepts in this area are difficult for students to understand. He introduced the topic, played the DVD and then teased out some of the ideas with the class. He felt that the best approach to use of DVD would be to show small snippets of video, perhaps a few seconds. However, he was not sure of the usefulness of this approach as the video is too short (see section 5).

Teacher G used 'Speed and Motion' as a revision tool with 3rd year students. Within this topic, interpretation of graphs can be difficult for some students. A question and answer approach was used at the start of class and then the DVD was

shown, problems related to graphs were then completed before further questions and answers. He felt that the material was useful for reinforcing what had been previously taught and he would use it as a revision tool.

Teacher G also used 'Cells and Human Body' with a first year group to introduce students to characteristics of living things, cells, tissues and organs. Within the class, he introduced the topic in question and answer session, then showed the DVD. The students went to the IT lab where they used quiz, games and weblinks. In future, he would envisage using this material in a cooperative learning approach by dividing the student into groups and allowing them to watch the DVD, with worksheets and followed by written test.

Teacher I also used the Cell and Living things with first years to reinforce the textbook and he felt that it worked well.

Teacher H used 'Atomic Theory' as revision tool for 2nd year group. She has found that students in general find this topic difficult. She introduced the topic with DVD and followed by revising material using blackboard and models of molecules. The teacher felt that the DVD material was a useful revision tool.

Teacher H also used 'States of Matter' with 1st years as a revision tool and she felt that the students did not gain much from the material as they had already covered it all. She would use it to introduce the concept of States of Matter in future. This teacher used the motion DVD to introduce the topic of speed to a 2nd year group followed by discussion. It worked well as an introduction; however, the teacher felt that students became confused with too many distance and time graphs. Nevertheless, she would use it as an introduction in future, but emphasised that more difficult parts of the course are not covered in this topic, such as acceleration.

Teacher H also used 'Electricity and Magnetism' with 3rd years to revise electricity. In future, she would integrate it into her classes when teaching the topic, as the diagrams of circuits would be very useful.

Use of Website in teaching and learning

Teacher B used the website and particularly the weblinks from the SU Website as the teacher had technical difficulties with the DVDs. (NCTE were not informed about this difficulty and hence, it was not resolved within the timeframe of the evaluation).

The teaching approach was to show some appropriate material from a web site with accompanying worksheets for the students to complete. The evaluators observed a 2nd year all girls Ecology class of approx. 20 students. The website material covered in a previous class was replayed and students completed a worksheet on this topic. The new topic of food chains was introduced through a National Geographic site (weblink from SU Ecology web site). The website was relatively slow to load up. The narrator on this site was a cartoon like character that discussed disruption to the food chain through the use of visual images and animation (not video). The website material consisted of graphics, animation and

voice over to describe food chains. The teacher then replayed the animation, stopping at particular locations to reinforce key points. Finally the students completed a worksheet on the material viewed on website. The teacher attempted to go to the Habitat studies page on the website, but the website was very slow to download at that particular time and so the teacher opted to introduce the topic as part of the fieldwork outside. (A potential way to overcome this problem in future is to download the webpages before class sessions).

In general, this teacher's approach involved playing of appropriate material and then replaying with question and answers. Worksheets, games and quizzes were generally sourced from the web links.

Teacher F also used the website to allow students to explore and find out more about atoms and atomic structure with little direction by the teacher. Using the data projector, students were firstly introduced to the website. However, students seemed to have become bored with the website and quickly got distracted. In future, rather than students exploring the website, he felt it would be better if they had worksheets with specific tasks to carry out.

In contrast to the above, this teacher found the experience of using the Building Atoms game on the website with the same group of 2nd year students to be very motivating. Students were actively engaged, worked enthusiastically, and he stated that he would *'**definitely**'* use this game again and that *'**without a doubt**'* would teach this topic again using this material.

In summary, the teachers generally changed their teaching methodology to incorporate the use of the DVD materials within their classes, but did not change their approach to teaching of the particular topic. The most positive change was in the use of the Building Atoms game where the teacher allowed the students to work at their own pace through the game, which was very successful. Generally, the use of the DVDs were considered as a suitable revision tool forming the basis for question and answer sessions. Other than using the class time to play the video clips, the teaching methodology did not change and generally the teachers highlighted small snippets that would be a useful resource in aiding the explanation of a particular topic (as outlined above).

3. Student Reaction, Motivation and Engagement with SU Materials

DVD material

The teachers were asked to note the students' reactions to the DVD materials. Teacher A commented that;

> ***Initially students were attracted to the novelty of using the technology in the classroom; however, by the second class, the students engaged more easily, realising that they were to 'learn' rather than just watch the material.***
>
> ***The 3rd year group particularly loved the change to the new technology.***

Teacher H noted that students….

were motivated and interested by the different method of teaching.

From analysis of the reflective diaries, all of the teachers noted that the students were engaged in the DVD materials to varying degrees. Students were interested in the content and in some cases, the DVD material was the source of student questioning. However, three teachers noted that students were easily distracted, particularly when the 'novelty' of the technology wore off.

All of the teachers noted that the presenters on the DVDs became a source of amusement in the class and commented that clearer, accent-less voices were required of the presenters in any future productions. Also the students were distracted by the constant music introductions.

Generally, students positively received the visuals. However, Teacher C thought that any visual would have this effect, stating that students look at ***"anything other than a book"***. He stated that the DVDs generally held their attention especially the more able students but that it was not clear if it helped the less able students, as they struggle with complex topics. The 3rd year students were generally positive about its use - Teacher H noted that her 3rd year class were

*'**delighted to be able to relax and watch something**'*.

There was general agreement between the teachers that the content was presented in a manner that was of interest to students (see detailed comments in section 5). Students generally showed a reasonable level of interest in the content, liked the images and enjoyed the alternative medium – the Ecology section and the Human Body were particularly useful. However, the main usage of the DVD material was as revision or consolidation tools after the topic had been covered in conventional class. In their current form the DVD were not seen as appropriate in the main to introduce topics.

Teachers felt that while students generally enjoyed the use of different media in the classroom, there is an element of them just being passively involved or as Teacher E noted that they were '**obediently interested'**.

Website and weblinks

The website was a good source of relevant and interesting material through weblinks, quizzes and games. Teacher F observed that;

Students who were often distracted in other classes, engaged with the web based game.

Use of the website / weblinks was also favoured by Teachers B and G with Teacher G noting that web use was a better motivator, generating more positive attitudes in the students, than the use of DVD alone.

The teachers observed that when the students were actively involved in activities, their engagement with the material increased greatly. This was particularly evident when students were active in completing quizzes and games on the web (for example the atom building game engaged 2nd year students to such a degree that they continued with the activity even in the absence of the teacher - **Teacher F**).

In both of these instances, the teachers involved brought their classes to a computer room where they worked on the material.

Evaluators' class observation

The evaluators visited two classes in two separate schools, one in which the DVD material was used with a 3rd year class of boys and the other where a 2nd year class of girls were involved in looking at material from weblinks. The students in the 3rd year class appeared to be reasonably attentive to the DVD material shown in class, but they did appear somewhat bored/annoyed by repeated 'Science Unleashed' music introductions at each section. The students in the 2nd year class were very attentive and appeared interested in the content. They were actively completing worksheets as they listened to the programme.

4. Teachers' Observation of Student Learning

Teacher A felt that the SU material used had helped the students to engage more with the topics covered. This teacher noted that her students seemed to like 'talking back to the video' and it seemed to boost their confidence in their knowledge of the subject matter (this was noted for both 2nd and 3rd years). The evaluators observed the class giving answers to a Web quiz. Students enjoyed the competitive aspect of the quiz and seeing the affirmation of a correct response.

In the teacher's opinion, seeing pictures of everyday examples in a context appealed to the students and helped them to see that what they were learning had relevance to their everyday lives. Repeat viewings of DVD were required to elicit all the information.

Teacher A made the following comments on atom section;

> ***This is a very good resource for this difficult topic, which can be a bit 'dry' especially for weaker students. It would have helped however if it showed a picture of the sodium chloride crystal at the end as this also presents problems for weaker students.***

The teachers noted that students with poor concentration were helped by the change in teaching method; however, it was still difficult to maintain their concentration.

Teacher D comments…

> ***We don't know when students actually pick up information. With the DVD (as another medium) it may help to get it into the brain.***

Teacher B felt that the SU websites themselves added little compared to a textbook, as they were both text based. The weblinks were much more useful, as they contained useful graphics or animations that could be used in class. Teacher F commented that he felt that students gained more by playing the atom building game than from other parts of the website or DVDs.

In summary, teachers did not feel that there was any remarkable difference in student learning (atom building game was the exception), but that generally the DVD and website were useful as a tool in reinforcing teaching and learning. However, the teachers generally identified sections of the SU materials (as outlined in Section 2) that aided them in the explanation of particular topics.

5. Student Opinion of SU materials

The evaluators visited a 3rd year class, where the teacher had used the DVDs in a number of topics. Students' opinions on the SU materials were obtained from a questionnaire completed by each student in the class group. Of the 20 questionnaires returned, only 1 student indicated that he did not like the material, considering it too long, boring, dull and a waste of time. All of the others felt that it was an extra aid and requested development of more such materials.

The positive features noted by students included:

material easy to understand;
more enjoyable than a normal class;
better than reading a textbook, more interesting;
easier to remember pictures.

Other positive features noted by a few students were the use of Irish places, diagrams, and that listening to the DVD was a positive alternative to listening to the teacher. Students generally did not like the voices and music on the video clips – noting them as dull and boring. Two students requested female presenters and asked for fewer / shorter introductions to each section.

These students had looked at the DVD Human Body (Movement) approx 3 weeks prior to the evaluator's visit. The images that they remembered, 3 weeks after viewing the DVD, included (number in brackets indicate student responses, total of 20 students in the class):

Dancing in a dance room (13)

Gym (5)	Joints (4)
Skeleton (3)	Plants (3)
Respiration (3)	Waterfall (2).

This data appears to reinforce the previous comments by the teachers that everyday contexts of interest to the students were more appealing to them.

On the knowledge questions asked, 45% scored 75% or greater (15% scored 100%), 50% scored between 50 and 74% with only 5% achieving just 40%.

A group of 2nd year girls in a different school were asked their opinions of the websites they had seen in class. The aspects of the materials that the students liked (these students had seen material from the weblinks on the ecology site) included; (number in brackets indicate student responses, total of 17 students in the class)

made science fun (8),
movie images (7),
using cards for food web (6),
pictures attracted attention, were interesting (3).

No student in this class recorded any dislike of the material other than the difficulty in reading the screen in the class-room as the projection facilities used in the classroom were not suitable for the large class group. The main images that were remembered were specifically the food chain animation and images of “man with the bear”.
The majority of the students (88%) wanted to see more of this type of material, with only 12% indicating that they would like to see it used only sometimes.

Both student groups were asked to indicate the three most important factors for them in the use of the SU material. Table below shows the % of the student group that considered these factors as important:
Interestingly, none of the students chose the 'no different from a text book' option but a large number on both groups liked the 'distraction from the teacher'. This factor was almost as important as the use of images, relevance of material and revision.

Factor	**3rd year group**	**2nd year group**
Images helped me to understand	95%	82%
Nice distraction from teacher	90%	65%
Useful in revision	80%	65%
Made topic relevant	70%	71%
Didn’t learn anything	5%	0%
Waste of time	5%	0%
No different from textbook	0%	0%

The students opinions are very interesting as they support the use of the DVD material in class, stating that that the "images helped them to understand" and that the use of the different medium was a "nice distraction from the teacher". This contrasts with the general teacher view that there was no remarkable difference in student learning.

6. Appropriateness and Relevance in the Junior Cycle Curriculum

There was a variety of views expressed by the teachers on the appropriateness of the material and the medium of DVDs for use in the Junior Cycle curriculum, many relating to specific topics on the DVDs. Therefore it is appropriate in this report to examine both the appropriateness and relevance of the content and the general appropriateness, relevance and usability of the medium.

6.1 Appropriateness and relevance of the content

Below are the specific comments given by individual teachers on particular aspects of the DVD materials. An issue raised by all teachers was the general presentation of the DVD content. While the use of young presenters was welcomed, it was felt that their style of presentation generally lacked enthusiasm and interest. The voice-overs lacked animation - thus unfortunately adding evidence to ***'the image of scientists as boring individuals*** ' (Teacher G). Also Teachers G, C and D noted that the accents of the individuals was a source of amusement for students in the classroom.

The following feedback on DVD material was elicited from the teachers during the phase 2 evaluation session.

PHYSICS DVD

- The material on Newton's Laws was well presented.
- Electricity (resistance and voltage) - content somewhat laboured
- Motion material was good for revision with third years but not useful as an introductory aid. Additional interactivity would be very useful in this section e.g. generating and manipulation of students' own data – this could be done in the interactive website.
    - Illustrations generally very good in this section, particularly illustrations of distance time graph were very helpful (e.g. walking, running).
    - Use of Formula 1 racing was good.
    - Acceleration should be included.
    - 'Braking time' and 'stopping distance' not on course, but good relationship to speed on roads.
    - Too much emphasis on speed triangle
    - Too many graphs to make this useful as an introduction to topic.

CHEMISTRY DVD

This DVD was seen as potentially the most useful by Teacher **C.**

- States of Matter material seen as mainly useful for revision but not for first year students.
  - Water cycle was clear.
  - Animations of solid, liquid and gas were clear and appropriate.
  - While many concepts are covered, e.g. bonding, structure of atoms, latent heat of fusion, periodic table, this could be limited or otherwise compartmentalised to be able to use it more effectively as a revision tool.
  - Key terms need to be included e.g. evaporation, condensation, freezing.
  - Topic of alloys are not really appropriate in this section.
  - Cooking analogy needs to be presented more in context as in its present form it is not really appropriate to the topic.

- Atoms - useful as a revision tool for third year students;
  - Graphics were seen as very useful to explain this topic; the visual back up was valuable, however, a picture of NaCl crystal would have been useful at the end.
  - Use of everyday examples helped to demystify this material.
  - Useful sections are about 30 seconds duration only, therefore becomes unusable in the classroom.
  - The material was suitable for a third year class rather than first or second years as too many concepts are introduced.
  - Nicely illustrated – more examples required. Bonding is nicely illustrated but again too much dealt with all at once.
  - Significance of roller coaster is unclear.
  - Used successfully for revision with a third year class (Teacher H)
  - Graphics are needed to liven up this topic and the DVD provided these. (Teacher A)

BIOLOGY DVD

General comment by two teachers that the DVD in Biology was useful.

- Human Body:
  - Generally a good section and useful for all students from 1st to 3rd year.
  - Suitable for 1st year students if small details were amended.
  - The topic would benefit from being divided into two distinct sections – living things and digestion
  - Explanation of specific terms required e.g. many terms used but not explained (i.e. ingestion, respiration, types of teeth).
  - In the diagram of the cell, you were looking down the microscope but

this was not immediately evident to the students. Also the plant and animal cells looked the same – this requires revision.

- Human Body (Movement) covered more material than is usually taught, it linked up with the circulatory system and brought all aspects of movement together very nicely. This approach was very suitable for 3rd year.
- Integration of plant and animal respiration helped in teaching the complete topic. The graphics were very helpful.

6.2 Appropriateness and Relevance of the medium in Junior Cycle Curriculum
Recommendations for Science Unleashed

Teachers were asked their opinion on the appropriateness and relevance of all the SU materials to the Junior Science Curriculum.

DVDs

It was felt that the DVDs were like a synopsis of Junior Science curriculum. In a general discussion between teachers in phase 2 of the evaluation, it was agreed that a lot of the material on the DVD was outdated in terms of presentation and graphics. Teacher F noted that it had *'a 1980s feel to it'*. The teachers doubted that the material could really stand the test of time. Also that the use of long video footage in classrooms is now somewhat outdated (Teacher E hasn't used standard video medium in 10 years).

While two teachers (Teacher A and B) had prepared worksheets when using the SU material, it was noted that some sections would not lend themselves to this approach very easily. Also it was felt that provision of worksheets would only go part of the way to addressing some of the issues with the materials.

A key criticism shared by the group and articulated by Teacher D was that the material on DVD didn't encourage a investigative approach, being more instructional in design and encouraged a passive approach to learning. Teacher C emphasised that the new Junior Science Curriculum is based on an investigative approach. Teacher C questioned the effectiveness of DVD for promoting deep learning. While the material was generally presented clearly, it was useful as a revision tool (particularly for the more able students). It lacked any link to practical work and didn't follow the emphasis of the new JC Science curriculum. No historical context was given. While teachers liked relating the topics to everyday experiences, Teacher C believed that the manner in which this is done in DVD is somewhat "**laboured**".

In relation to visuals, it was felt that pictures and diagrams presented on the DVD were not as good as those currently available on the web. Material requires further development of quizzes, games, crosswords and word searches to be integrated within it. The material on DVD is presented to students but they do not have to think about it. In terms of a topic such as photosynthesis, it is important to find out what the student already knows rather than simply

presenting the facts. In general, it was felt that there was a lack of probing questions. The DVD material did not support the practical aspects of the Science curriculum.

Teacher D commented that;

> ***If technology is to be effective, it should do something more than what teacher can do him/herself in the classroom.***

In summary, while the teachers accepted that there were elements of the DVDs that were useful, they were such short snippets that it would hardly be worth setting up a DVD player to use them. Therefore, the materials would probably be only used as revision tools. Also, the video presentation was outdated and deadpan. Use of video is questionable without support material such as quizzes, worksheets etc.

WEBSITE

Three teachers used the website and weblinks. Teacher B welcomed the concept of a website for Junior Cycle Science stating that it could become a great reference and focus point for teachers and students in the future. The Homepage for the website was attractive and interesting and, when all the links were working, it appeared that it could contain enough science to interest and attract students. However, the website would have to be regularly updated with contemporary science and new items of interest.

The topics selected and the general layout for each topic with divisions of the topics into separate WebPages was appropriate. However, the design of the WebPages was seen as inappropriate, being too text-based with difficult language, lacking examples and not exploiting the interactivity of the web. The teacher felt that **you might as well use the book**! The new science curriculum is centred on investigative and exploratory work - which is not reflected on the website.

For instance, the teacher used the section from the SU website ‘What is ecology?’ to highlight the point. A definition of ecology is presented. The teacher felt that an animation, graphic image or a large image map of a habitat, with interactive features, would be much more beneficial rather than the static text. He felt that he couldn't incorporate the WebPages effectively into his teaching process as he could just photocopy any material that was useful and distribute them to the students.

Teacher F suggested that a successful website should work without much control by the teacher. On the section that he asked his class to use – atoms - the students didn’t read the text but were totally absorbed in the game element of organising electrons. The competitive element kicked in and students were asking each other how they did. A double period was spent on this. Teacher F suggested that interactivity is a key to student engagement.

Teacher G had used the website on cells and had a similar experience in that students were totally absorbed. A lot of interactivity is required – i.e. development of more quizzes, games – maybe even different levels that the student can aim to attain the next level.

Access to a computer room was not possible for the majority of the teachers in this study. However, it was suggested that webquizes could also be done in classrooms with prepared work/answer sheets. The future is a trolley of laptops with wireless connectivity – available for use within the school.

7. Future Development

While all of the teachers in this study had specific criticisms of the SU materials, they all agreed that the concept of the DVDs and website for Junior Cycle Science was excellent and one that would be used by teachers and students. This overall initiative of SU was welcomed as all the teachers commented on the time that it takes for individuals to source and find suitable resources for use in teaching science.

All the teachers found different elements of the SU material to be useful and they all stated that some aspects of the materials would be useful to them in the future. In particular, all the teachers strongly recommended the further development of the website, making use of the potential it has in teaching and learning. The success of the Building Atoms game (see page 10, 11 of this report) in motivating and engaging students shows the potential powerfulness of this technology in the Junior Science Curriculum.

There were many facets of the potential of the website that teachers were extremely enthusiastic about. Website could include:

- High level of interactivity;
- Simulations;
- Games, possibly with different levels;
- A teacher communication section to encourage collaboration and sharing of resources between teachers;
- Self-directed learning facility and provide opportunities for students to learn at their own pace;
- The DVD videos could be made available through streaming video on website;
- Section on how to carry out simple investigations and research projects.

While the majority of the teachers in this study had limited access to computer room (s), they felt that an interactive website could be used effectively in their teaching within their own laboratories / classrooms, allowing them to show simulations, run games / quizzes and manipulate student data. Teachers felt that the current SU website could be developed as outlined above. It should not be

developed as a revision site e.g. www.skool.ie, but should take a different approach and place more emphasis on the following:

- Simulations, games, quizzes;
- An investigative approach;
- What if ? scenarios;
- Interactivity which allows students to input their own data to investigate effects.

Teachers felt that appropriate use of technology in the classroom should allow the teacher to do something more in the classroom other than what he/she could have done before. Potential areas are: showing hazardous reactions, interactive exercises to view changes in graphing functions etc. The website, if further developed, has the capability to fill this gap.

The DVD materials had a mixed reaction by the teachers. The teachers generally showed the DVDs as the focus of their class to either introduce the topic or as a revision exercise. The main review of the material in class was by question and answer sessions. While teachers identified several sections / snippets that were useful, they felt that they would not necessarily merit the additional effort of getting the equipment set up in advance of the class. The DVDs, as they currently are, provided little added value to their teaching.

As stated earlier in this report, in many schools the IT equipment is not permanently set up in the science rooms but can be stored elsewhere e.g. in a central location in the school. Therefore there is an extra barrier to use of any DVD /website material in that the material must be appropriate for the teachers needs to be worth their while to put in the additional time to set up the equipment. In view of this, it may be the case that material accessed in 'snippets' from a clearly navigable website would increase accessibility, usage and decrease the need for hardware (the DVD player). Some of the teachers who took part in the evaluation overcame considerable administrative difficulties in accessing IT equipment outside the school computer room and had to take time before class to set the equipment up for use in their own class. The less hardware needing to be assembled on a portable trolley the better, and it would appear that small, streamed video clips on the web may be more intuitive than accessing sections on DVD technology.

Interestingly, almost all the students surveyed in this study stated that they liked the use of images in the DVD materials and they also enjoyed the medium as a distraction from the teacher. This reinforces the need for a variety of stimuli and resources in teaching.

Teachers felt that the DVD content would require redevelopment as follows, if it were to be a useful teaching resource:

- The presentation of DVD's should reflect the investigative nature of the Junior Cycle Science curriculum.
- Style of presentation would require "livening-up".
- More probing questions within each topic should be used to encourage a deeper approach to learning.
- There should be a link to the practical element of the curriculum.
- DVD material requires clearer diagrams, animation and video material as previously discussed. Errors in content should be corrected.
- A variety of approaches to support student learning are required e.g. quizzes, games, simulations.
- Transfer of the revised material presently on DVD to the web, within an easily navigable site, using small discrete video clips and streamimg technology where needed.

In conclusion, the teachers in this study all welcomed the development of materials for use in the Junior Science Curriculum. Specific areas of the DVDs and website were identified as very useful in teaching. Students also liked the change to the IT use and the visual images used. However, specific issues were raised in relation to the DVD medium and content and to the website. Teachers indicated their strong preference for the further development of the website to exploit its interactivity for the teaching of science at this level. DVD video streams could then be made available on the website.

APPENDIX A Teachers involved in Pilot Study

TEACHER NAME	SCHOOL
Phillipa Moran	Templeogue College, Templeogue, Dublin
Jim McManus	Louis Secondary School, Dundalk, Co Louth
Pat Hanratty	Tallaght Community School, Tallaght, Dublin 24
Peter	Tallaght Community School, Tallaght, Dublin 24
Siobhan Greer	Louis Secondary School, Dundalk, Co. Louth
Ray O'Neill	St Aidans Secondary School, Collins Ave, Dublin 9
Greg Smyth	Knocklyon Community School, Dublin
Fergal O'Neill	Knocklyon Community School, Dublin
James Scott	Knocklyon Community School, Dublin
Elaine Kelly	St. Mary's Secondary School, Glasnevin, Dublin 9

APPENDIX B Reflective Diary

APPENDIX C Main Topics Covered by Each Teacher

Topic\Teacher	A	B	C*	D*	E	F	G	H	I	J
BIOLOGY										
Human Body	X		X	X			X		X	
Plant Processes	X		X	X						
Reproduction	X		X	X						
Ecology		X	X	X	X					
Food			X	X						
CHEMISTRY										
States of Matter			X	X				X		
Atoms	X		X	X		X		X		
Substances			X	X				X		
Air & Water			X	X						
Fuels & Burning			X	X						
PHYSICS										
Motion			X	X	X		X	X		X
Particles and Heat			X	X						
Forces			X	X						
Magnetism & Electricity			X	X		X		X		
Circuits			X	X				X		

*these teachers overviewed the whole range of material