

**An Educational Enquiry into the potential use of an Online Course Management
System to support learning in an all girl's second level science class**

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M.Sc. in Computer Applications for Education

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2002

Abstract

This study investigates the potential of an online course management system, used as an optional supplement to traditional classroom teaching and learning, to enhance the educational experience of second level chemistry students in an all girl's school.

Twenty Transition Year students participated in the study that stretched over a period of fifteen weeks, with several breaks from class for the students in that period. The students were of mixed ability and were encouraged to, as well as given ample opportunity to, use the range of features and tools that such a system brings to the sphere of education.

An evaluation of the study was made from evidence gathered through a personal diary, a usability test, student questionnaires, student interviews, a previously published examination question and student work.

The integration of the course management system, to run parallel to the traditional classroom delivery of education, enhanced the educational experience of the young students and increased the appeal of the subject for them. There were no major usability issues for the students with the system. The various features of the system, and their educational potential were realised by the students, especially the potential to expand the learning community. The system successfully mediated, in part, a link-up to a third level institution thereby bringing expertise and new pedagogical approaches into the classroom.

**Chapter 1
Introduction**

In recent years considerable sums of money have been invested in the IT infrastructure of Irish secondary schools, primarily as an outcome of the Schools IT2000 Initiative and subsequent top-ups to that initiative. Yet, there is still little penetration by cutting edge educational technology into the classrooms and teaching programmes of many secondary teachers in Ireland. There are very understandable reasons for this limited progress. In many schools, access to the computer room for both teachers and students is mainly limited to timetabled computer class periods. The appropriate and necessary hardware (AV projectors, Computers, Internet connectivity) to incorporate ICT into the base

classroom is expensive and beyond the reach of most schools. Also, many teachers entered the profession without any IT skills (and are still doing so), and for them the Schools IT2000 courses provided a steep learning curve to be surmounted in their free time. Few schools can afford the time, support, training and recognition for teachers who wish to pursue new methods of instruction or apply new skills. Acquiring new ICT skills and then having little opportunity to use and develop them, is not helpful when it comes to either retaining or applying those skills in the classroom.

Meanwhile other aspects of the secondary school curriculum came under government scrutiny. In October 2000, the Minister for Education and Science set up a Task Force on the Physical Sciences under the chairmanship of Dr. Daniel O' Hare, President Emeritus of Dublin City University. The Task Force sought to examine the decline in the take-up of science in secondary schools over the last decade. This decline has inevitably fed through to third level institutions with a drop in recruitment of students to science, engineering and technology (SET) courses in higher education. Ironically these third level SET courses experience high failures rates in first year, in part attributed to a lack of exposure to the physical sciences at secondary level. The Task Force also found that gender equity is a cause for concern, with only 79.7% of girls at lower secondary taking science compared with 96.2% of boys and only 7.9% of girls taking physics at upper secondary level compared with 25.4% of boys (Report of the Task Force on the Physical Sciences, 2002). The report suggested making science more widely available would, of its own, be insufficient unless accompanied by strong action aimed at influencing student choice.

The main purpose of the study is to determine if the use of a course management system can enhance the educational experience of female second level students of the physical sciences. It attempts to establish if the functionality offered by the system can be used to deliver courses in the physical sciences in a manner that caters for the learning styles associated with females? It also investigates how broadening the learning community through links with a third-level institution, (in part mediated by the use of blackboard), can improve students learning? It considers if the use of progressive ICT will necessitate the application of alternative pedagogical approaches by the teacher? In other words, can traditional teaching methods accommodate newer technologies or must innovative and alternative methods be applied? This suggestion is succinctly encapsulated in the following quotation, which also indicates recent trends in this area of educational research:

“The thrust of current research is no longer on comparing computer based learning with other media or with the teacher, but in determining what specific computer environments can best enhance student learning and in determining which instructional approaches used in conjunction with the computer are most effective”
(Thompson et al, 1996.)

Chapter 2

Literature Review

2.1 Gender and Science

There has been a persistent under representation of girls in science, particularly the physical sciences, engineering, technology and ICT courses at both secondary and tertiary level Report of the Task Force on the Physical Sciences (2002). This appears to be an international trend and there is a large body of literature highlighting this imbalance. For example, the OECD outlined the fact that across countries with membership, fewer women are enrolled at tertiary level in the natural sciences and industrial and engineering fields (OECD/CERI, 1997). This worrying trend is compounded in that fewer women graduate in mathematics, computer science, engineering and architecture (OECD/CERI, 1997.). More recent statistics compiled by the Higher Education Authority (HEA) regarding such international trends found that “while there has been an increase in the enrolment of women in first-degree tertiary educational programmes in sciences, engineering and businesses, in most countries considerable imbalances remain”. (OECD. 2001). In the United States, Weinman (1997) reports that women are awarded only 33% of bachelor’s degrees in the physical sciences and just 13% of engineering associates degrees. Meanwhile, the European situation appears similar, according to Kosuch (2000), “in Germany female students continue to be underrepresented in science and engineering.” Closer to home, a UK-wide survey on adult participation in education found that while a quarter of all those surveyed were studying computing, a similar gender imbalance exists with more men than women engaged in this area (Sargant, 2000).

Research to date varies on the extent to which learning styles differ by gender but there is general agreement that difference exists and needs to be addressed Montgomery and Groat (1998); and Zuga (1999). In general, findings indicate that boys are more competitive, girls more co-operative; boys are more abstract learners, girls have more anxiety about study success; boys are more intuitive, girls are more analytical; girls are more organised, boys more undirected. Such generalisations can be buttressed by the following seminal findings as summarized by Askew and Ross (1988).

Girls and boys seemed to approach joint activities in very different ways; girls tend to talk to each other about their activities as they went along. They would discuss how to organise their work; for example, break it up into different aspects and decided who would do which, or work out what was necessary for preparation. Boys tended to talk together about things not related to the activity they were engaged in, talking about it only when absolutely necessary or when conflict arose. (Askew and Ross, 1988)

2.2 Learning, Teaching and Online Course Management Systems

Information and communications technologies have transformed other sectors of society including medicine, finance and manufacturing, and as suggested by Dede (1998), and

they thus have the potential to revolutionise traditional educational infrastructures. The 1990's were characterized by rapid change, marked by the onset of a global economy, significant advancements in technology and the increasing impact of the World Wide Web. Concomitantly, learning environments also experienced change and some of those changes are illustrated by Papert (1998). These range from the increased use of computers in the classroom for personal productivity to the development of authentic educational technologies becoming infused into the curricula. Likewise the current trend of inventing new visions of education in the digital world rather than continuing to apply computer technology to traditional settings began during this period. It could thus be safe to say that the age of online learning has dawned.

2.3 *Teaching and Learning*

Across a diverse range of educational settings, teaching and learning practices have changed significantly in recent years as a result of developments in psychological and pedagogical theory. One of these developments is that the behaviourist view of learning has lost a lot of ground to the cognitive view of learning. There are several principles that underpin the cognitive view of learning or constructivism each of which bears relevance to this research. The first principle, adapted by Dewey is that each person forms their own representation of knowledge, building on their unique experiences, and that there is no single correct representation. The second principle, attributed to Piaget by Slavin (1994), is that people learn through active exploration, and that learning occurs when the learner's exploration uncovers an inconsistency between their current knowledge representation and their experience. The third principle according to Dalgarno (2001), normally attributed to Vygotsky, is that learning occurs within a social context and the interaction between the learner and their peers is a necessary part of the learning process. Each of these principles add up to the view that learning occurs best within an environment that allows collaboration between the student, their peers, their teachers and professional and academic experts in the field.

2.4 *The School as process*

Ewing and Smith (2001), succinctly state that schools have traditionally been regarded as physical and geographical places where the learners have assembled to be put into contact with the teacher and/or other knowledge sources. Some of the ICT developments outlined in the previous subheading are challenging this arrangement for formalised learning. Likewise, the teaching profession is no longer the sole custodian of the knowledge required of students by the national curriculum. During the past decade or so, the economic rationalism of the new right throughout the developed world has meant identifying new means of teaching and learning that are less costly than traditional methods. This has been most evident in third level institutions but is now trickling through to second level education. It has become increasingly obvious to many that the Internet can be used to successfully design, deliver, select, administer, support and extend knowledge and is forcing a shift in perspective from the school as place to the 'school as process'. Indeed, as Conlon (2002) suggests, IT could help to realise the vision of a *deschooled society* that was famously portrayed in the early 1970's by Ivan Illich.

Chapter 3

Research Methods

This chapter considers the research approach taken in this study.

3.1 Research Questions

The fundamental research question behind this study is how the use of a course management system, used as a supplement to traditional classroom teaching, impacts on the educational experience of female second level students of the physical sciences? Online educational delivery can have many different contexts. Specifically of concern in this study is the use of a course management system solely as an optional accompanying resource employed in the second level education of girls – traditional classroom teaching proceeded as usual throughout the study.

3.7 Research Methods

Given the limited timeframe in which to carry out the study coupled with the voluntary nature of student participation, and the fact that I was a novice in employing virtual learning environment's in my teaching programmes, it was decided to favour qualitative research methods with quantitative methods being included where necessary and appropriate. It was also felt that a qualitative approach was most relevant in light of the following quotation from Silverman (2000), "if you are concerned with exploring people's life histories or everyday behaviour, then qualitative methods may be favoured." As I intended to seek the students' attitude to, and experience of the study, Silverman's assertion seemed particularly apt. Thus, the selection of a qualitative approach was not purely an ideological one but also a practical one, driven by the need to employ those research methods best placed to elicit the data needed to develop the research questions under investigation.

3.8 Action Research

Consequently, I decided to employ action research as it " aims critically to inform educational judgements and decisions in order to improve educational action" (Bassegy, 1995). Action research is a subset of educational research that is different insofar as the participants themselves carry it out in order to improve their practice. Thus the practitioners are integral to the research. Personal theory is created in order to advance practice. Neither control groups nor artificially set up experiments are involved and the focus is on the practitioner making classroom enquiries into a real situation. Action research involves the practitioner evaluating current practices that they consider unsatisfactory and asking how this might be improved. Because action research is a formal enquiry into the fundamental practices of the practitioner put into the public domain, it is therefore open to challenge. It is the method of research that I believe most

suitable in allowing the teacher examine the fundamental question; 'how can I best improve the process of education'? It allows me increase my understanding of educational theory so that I can develop the capacity to produce valid explanations for my own learning as a professional educator.

3.9 Usability test

As part of the study it was decided to determine the usability of such a course management system for second level students of this age by means of a usability testing session. In so doing I wanted to determine if the interface to the system might possibly prove a deterrent to the use of the system

3.10 One sample t-test

At the end of the study the students were tested with an unseen question from a previous Leaving Certificate examination paper on the topic that was taught during the period of the study to determine possible significant changes in learning outcomes. The question formed part of their end of term examination. The students' solutions were corrected according to the detailed marking scheme provided by the Department of Education and Science. The results were compared with the mean grade achieved in the question as provided in the Report of the Chief Examiner for Chemistry (1998) into the examination for that year.

3.11 Student Interview

At the end of the term, prior to the end of term examination, eight students were interviewed on a group basis to elicit their views of the experience and augment the responses of all the students in the questionnaire discussed later. A group interview was decided upon because of the age of the students and the feeling that they would be much more comfortable answering questions, either positively or negatively, in that situation rather than one-to-one basis.

Chapter 5 Results

5.1 Usability Test Findings

The test has indicated that the system, although not perfect, does not pose any serious usability problems for the students. These results compare favourably to the results obtained by Ruman and Gillette, (2001), working with an older cohort of students from a third level graduate course, where there was less completion of tasks and a higher mean number of attempts to complete comparable tasks. The user interface is not a deterrent to use of the system by students. However, the frustrations expressed by the students at the

download rate of the various pages are worrying as that is a factor that would discourage use of the system.

5.2 Survey Findings

The following is a detailed breakdown of the responses to the questions asked in the student survey.

Features of blackboard as rated by the students

Please rate how useful you find the following blackboard courseinfo features?

1 = No use whatsoever, 2 = Not really useful, 3 = Neither useful or not useful, 4 = Quite useful, 5 = Very useful

	N	Minimum	Maximum	Mean	Std. Deviation
Announcements	20	2	5	3.85	.875
Announcements	20	2	5	3.85	.875
Course Material	20	3	5	3.70	.571
Course Material	20	3	5	3.70	.571
Syllabus	20	3	5	3.70	.733
Syllabus	20	3	5	3.70	.733
Website Section	20	2	5	3.80	.768
Website Section	20	2	5	3.80	.768
Discussion forum	20	2	5	3.60	.883
Discussion forum	20	2	5	3.60	.883
Virtual Classroom	20	2	5	3.25	.910
Virtual Classroom	20	2	5	3.25	.910
Student - student email	20	2	5	3.20	.834
Student - student email	20	2	5	3.20	.834
Student - teacher email	20	2	4	3.40	.681
Student - teacher email	20	2	4	3.40	.681
Online testing	20	2	5	4.20	.951
Online testing	20	2	5	4.20	.951
Online grade check	20	3	5	4.55	.686
Online grade check	20	3	5	4.55	.686
Online assignment submission	20	2	5	4.00	1.124
Online assignment submission	20	2	5	4.00	1.124
Blackboard Academic Resources	20	2	5	3.45	.945
Blackboard Academic Resources	20	2	5	3.45	.945
Blackboard Help	20	2	4	3.15	.587
Blackboard Help	20	2	4	3.15	.587
Valid N (listwise)	20				
Valid N (listwise)	20				

Online community membership as rated by the students

Apart from your teacher and classmates, whom else would you like to see in this online community?

1 = Definitely no, 2 = No, 3 = Neither yes or no, 4 = Yes, 5 = Definitely yes

	N	Minimum	Maximum	Mean	Std. Deviation
All students from own school	20	2	5	3.95	.945
All students from own school	20	2	5	3.95	.945
All teachers from own school	20	3	5	4.05	.686
All teachers from own school	20	3	5	4.05	.686
Lecturers from third level	20	4	5	4.55	.510
Lecturers from third level	20	4	5	4.55	.510
Parents from school community with expertise in the subject	20	1	5	2.80	.951
Parents from school community with expertise in the subject	20	1	5	2.80	.951
Female students from other local schools	20	1	5	4.05	.999
Female students from other local schools	20	1	5	4.05	.999
Male students from local schools	20	1	5	4.10	.968
Male students from local schools	20	1	5	4.10	.968
Teachers from other local schools	20	1	5	4.00	1.026
Teachers from other local schools	20	1	5	4.00	1.026
Valid N (list wise)	20				
Valid N (list wise)	20				

Preference of students regarding community constituents by gender

Would you prefer if the community was...?

1 = Definitely no, 2 = No, 3 = Neither yes or no, 4 = Yes, 5 = Definitely yes

	N	Minimum	Maximum	Mean	Std. Deviation
All female community	20	1	3	2.40	.681
All female community	20	1	3	2.40	.681
All male community	20	1	3	2.45	.686
All male community	20	1	3	2.45	.686
Mixed community	20	3	5	4.35	.745
Mixed community	20	3	5	4.35	.745

Valid N (listwise)	20				
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Rated usability of blackboard courseinfo?

How would you rate the overall usability (ease of use) of Blackboard Courseinfo?

Very easy Easy Neutral Difficult Very difficult

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Difficult	4	20.0	20.0	20.0
Valid	Difficult	4	20.0	20.0	20.0
	Neutral	7	35.0	35.0	55.0
	Neutral	7	35.0	35.0	55.0
	Easy	9	45.0	45.0	100.0
	Easy	9	45.0	45.0	100.0
	Total	20	100.0	100.0	
	Total	20	100.0	100.0	

Estimation of potential usefulness of blackboard courseinfo

Could Blackboard Courseinfo help you with your homework, assignments and study?

Definitely yes Yes Neither yes or no No Definitely not

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1	5.0	5.0	5.0
Valid	No	1	5.0	5.0	5.0
	Yes	10	50.0	50.0	55.0
	Yes	10	50.0	50.0	55.0
	Definitely yes	9	45.0	45.0	100.0
	Definitely yes	9	45.0	45.0	100.0
	Total	20	100.0	100.0	
	Total	20	100.0	100.0	

Estimation of potential of online community to improve learning

Can online community improve learning?

Definitely yes Yes Neither yes or no No Definitely not

		Frequency	Percent	Valid Percent	Cumulative Percent
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Valid	Neither yes or no	1	5.0	5.0	5.0
Valid	Neither yes or no	1	5.0	5.0	5.0
	Yes	15	75.0	75.0	80.0
	Yes	15	75.0	75.0	80.0
	Definitely yes	4	20.0	20.0	100.0
	Definitely yes	4	20.0	20.0	100.0
	Total	20	100.0	100.0	
	Total	20	100.0	100.0	

Change in appeal of subject as result of developing online community

Would the setting up of a 'broader online' community make the study of the subject more attractive to you?

Definitely yes Yes Neither yes or no No Definitely not

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	2	10.0	10.0	10.0
Valid	No	2	10.0	10.0	10.0
	Neither yes or no	1	5.0	5.0	15.0
	Neither yes or no	1	5.0	5.0	15.0
	Yes	15	75.0	75.0	90.0
	Yes	15	75.0	75.0	90.0
	Definitely yes	2	10.0	10.0	100.0
	Definitely yes	2	10.0	10.0	100.0
	Total	20	100.0	100.0	
	Total	20	100.0	100.0	

5.3 Interview Findings

The complete interviewee responses may be read in Appendix G. For ease of clarification I have identified and categorised the following broad themes which emerged from the semi-structured group interviews:

The positive experiences

Many comments were made regarding the novelty involved in using the system and how it made the class different, typically, "the interaction with computers I think made it a little more enjoyable", or "using the computers seemed very modern". The features of the system were favourably commented upon in a manner that echoed the responses given in the survey, that is, the most praised being the assessment features while the least

praised were the communications features. The opportunities afforded to expand the learning environment were also positively commented upon. Comments were also made regarding how using blackboard has also enhanced the computer skills of the students.

The negative experiences

Several comments were made concerning access to the site and problems with downloading pages, especially the speed with which some downloaded. The frustration of some students was evident with comments such as “I have found the links slow or shaky. This was how it was different. In school most things are easily accessible through books. On blackboard the time taken to find information increased”.

How it could be used to the students benefit.

The students unanimously expressed the view that more resources (sample problems, solutions, more supplemental notes), additional online tests, other online assignments and expanding the community would be of benefit to them. In essence the students responses stated that the system could be used to their benefit in exactly the way that it was being used in the enquiry. From their responses I believe there is ample evidence that the students recognise the potential of the system even if they failed to avail of its potential.

Under use of system

Students gave a variety of reasons for not communicating online. These reasons suggested some were embarrassed or lacked the confidence to use these features as the following comments illustrate – “Probably the main reason I didn’t communicate online was because of the fear of asking a question that would appear very obvious and very easy to answer”, or “sometimes embarrassed because haven’t got a clue what is going on in class”. Several stated that it seemed nobody used the discussion boards or virtual classroom. They claimed they would use the communications features more if others did so. This possibly was expressing a fear that they might find themselves the only person in the virtual classroom with the teacher, an understandably awkward situation for many a sixteen-year-old student. Others stated they saw no point when they could use the phone or just ask each other in school. The access difficulties mentioned earlier were also given as a reason for under use. Several students were honest in admitting laziness, as a reason for not using the system more, while others claimed being overwhelmed with projects and other activities in Transition Year was a deterrent. They also expressed views that they would be more inclined to use the system on a ‘just in time’ basis, i.e., when an exam or assignment deadline is approaching.

5.4 One-Sample T test

This table displays the number of cases, mean value, standard deviation, and standard error for the test variable.

	N	Mean	Std. Deviation	Std. Error Mean
Leaving Cert Question	20	35.8350	32.10396	7.17866

Test statistic: The test statistic, t, has N-1 degrees of freedom, where N is the number of observations.

Results of the t-test: If the significance value associated with the t-test is not small (sig > 0.05), as can be seen from the following table is the case here, there is not enough evidence to reject the null hypothesis, and the conclusion must be that there is evidence that the mean is not different from the hypothesized value.

Test Value = 36.8						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Leaving Question Cert.	-.134	19	0.894	-.9650	-15.9901	14.0601
Leaving Question	-.134	19	0.894	-.9650	-15.9901	14.0601

Chapter 6 Conclusions and Recommendations

The course management system employed during this study does not pose significant usability problems to second level students of Transition Year age, and therefore usability is not a factor that would discourage usage of such a system, to its full potential, by such students. Evidence from both the usability testing sessions and the survey support this claim.

The research findings drawn from the survey and interviews do indicate that the students considered the educational facilities that the system provided for them very favourably. They rated all of the system features highly, the features relating to assessment and grade checking scoring highest. They also reacted very positively to the suggested opportunities the system allowed to expand the learning community. This is in accordance with the learning styles the literature ascribes to female students and comes as no surprise

The research has also shown that the system can facilitate successful link-ups between second and third level education for the promotion of science. In this enquiry such a

link-up provided an authentic reason for using the communications features of the system to expand the learning environment beyond the walls of the school.

It has been clear throughout this research that the students were not entirely enthusiastic about the system. Voluntary adoption of such a course management system by female Irish second level students, in a manner that utilises the system to its full potential, especially its potential to facilitate both student-student and student-teacher communication, is not a simple and straightforward matter. Perhaps students need to develop greater group communicating skills in a classroom first, before they go online.

The enquiry was unable to demonstrate any definitive improvement in the learning of the students (one sample T test) as a consequence of employing the system. The results achieved in the leaving certificate question were as disappointing as those received by the Leaving Certificate cohort in that year. The chief examiners report states it was the least answered (20.3% of student attempting the question) and worst answered question on the paper with very few candidates getting the calculation right. Although the one sample T test showed no improvement in learning, the action research undertaken did show an improvement in the use of the learning tool, a tool that the students clearly acknowledged the educational benefits of, and thus, can be said to have provided a satisfactory answer to the question "how can I improve my practice?" The research also clearly showed that usage of the system could increase the appeal of the physical sciences for female second level student

Of course such a system is not only of interest to teachers of the physical sciences. Highly structured content in subjects such as chemistry may not be as amenable to an online student centred instructional style than more value-laden and debated subjects such as English literature or history. Increased interaction inevitably occurs in value-laden topics, particularly student-student interaction, and this is of great assistance in terms of coming to an understanding of the material

Online instruction is more time intensive and requires more continuous attention. Students need timely feedback to their assignments and enquiries to help them refine their learning and provide guidance to the direction their learning is important so that they do not lose interest. Teachers' workloads would need to be re-evaluated before adopting this new educational tool in the education system. Ironically, the feature most highly rated by the students (online-grade checking) was the most troublesome and time consuming for the teacher to implement

The implementation of a course management system to augment traditional classroom teaching poses other significant difficulties for the teacher. New sets of skills need to be developed, including, how to create a welcoming and encouraging environment, how to model and encourage participation and establish norms of behaviour for users, how to monitor progress, arrange discussion groups and facilitate group processes and how to pace interaction and weave content with communication

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