TECHNOLOGY SUPPORTED, SELF-DIRECTED LEARNING: AN INVESTIGATION OF BLENDED LEARNING AND ONLINE ASSESSMENT ON A PRE-SERVICE TEACHER EDUCATION PROGRAMME

By

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Technology supported, self-directed learning: an investigation of blended learning and online assessment on a pre-service teacher education programme

Greg Scanlon

Abstract

This study aimed to explore the use of a blended learning course of study on an undergraduate teacher programme in the Republic of Ireland. The study aimed to examine the use of a blend of online learning with face-to-face tuition and web-based assessment. The study also aimed to investigate students’ reactions to the course of study by examining their levels of participation and investigating the extent to which the course may have influenced their attitudes to the use of ICT in teaching and learning.

The study was exploratory in nature and employed a case study methodology which involved the use of online surveys, the collection of students’ responses to formative assessment questions as well as summative assessment grades, the analysis of online logs to determine levels of participation, student focus groups and tutor observation.

The study found that student engagement with the course was both widespread and enlightening, student enthusiasm for the use of information technology in education was almost ubiquitous and most students expressed a desire to utilise the technology as part of their teaching. The study also found that the course was instrumental in causing a change in attitude in favour of the use of blended learning as a tool to enhance teaching and learning for a majority of this student cohort.

These findings suggest that student-teachers are willing and able to engage with a self-directed, online course of study but that tutor support continues to be required to optimise student learning. Student-teachers are enthusiastic about the potential of information technology in teaching and learning but their limited exposure to models of good practice may result in quite traditional forms of usage that fail to benefit from the enormous potential of the technology.
DECLARATION

I hereby declare that this is my own work and that it has not been submitted for the award of any degree at any other university.

Signed:

Greg Scanlon

Date: 31st May 2010
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1 Introduction and the Research Problems

1.1 Introduction

Information and communications technology (ICT) is now widely used in education and this is certainly the case at third-level where not having an online learning management system (LMS) is the exception rather than the rule both within Ireland, where all of the universities, Institutes of Technology and teacher education colleges are operating an LMS, as well as globally. Conferences and symposia investigating the use of ICT in education have proliferated for many years as have the number of peer-reviewed journals dedicated to this area. There are many reasons for this explosion in the use of ICT in teaching and learning, not least of which is an attempt to address some of the problems associated with the massification of education, where it is becoming increasingly obvious that ICT can be used both to enhance learning and to support more independent learning. The traditional model of formal learning is firmly based on teaching and since the Industrial Revolution, this has been accepted as a good model of preparing young people to participate as adults in the wider world. Within main-stream education, where learning that is dependent on teaching is seen to be the norm, self-directed learning is anecdotally regarded as a step too far.

Third-level education intimates that students have responsibility for their own learning but in reality didactic teaching, coupled with mandatory labs and tutorials together with end-of-term, high-stakes examinations dominate.

Until recent decades, the logistics of accommodating anything more than a miniscule level of self-directed learning meant that this form of learning was almost exclusively confined to individuals pursuing research degrees but the ready availability of ICT enabled educational tools (Conole et al, 2008, p. 519) has changed the landscape considerably. However, the ready availability of tools to enable change, *per se*, need not justify change.
A second challenge facing third-level education is the increased numbers of students coupled with decreasing funding not only in Ireland but across the globe and particularly in the UK (King & Duke-Williams, 2001, p. 3). The number of students enrolled in third-level education in Ireland certainly increased considerably from 1965 to 2001. In 1965 less than 15% of Irish 17 year olds entered third-level education. By 2001, more than 60% of the same age-group was enrolling in third-level education as Table 1.1 indicates.

Table 1.1 indicates a steady increase in the number of students entering Irish third-level education (http://www.business2000.ie/pdf/pdf_9/Dept_of_Ed_2005.pdf)

Even though figures from the Irish Department of Education and Science show a steady increase in exchequer spending for the period 2001 to 2005, as indicated in Table 1.2, this must be viewed in the light of the dramatic increase in the number of students entering third-level institutions. Institutes of learning are increasingly under pressure to produce more graduates but without compromising the quality of the qualifications.

Other perceived needs for change include an increasing recognition of the benefits to learning of formative assessment (Crooks, 1988, p. 470; Black and Wiliam, 1998, p. 7) as well as continuous assessment, especially when used to support active learning (Holtzman, 2004, p. 1).

Within this context, this study aimed to use web-based software to enhance the learning experience of student teachers on a 4-year undergraduate degree programme. The software was used to present content related to how ICT is used in education, particularly at second-level, and to provide feedback to students using formative assessment. The web-based learning was supplemented by a guided investigation of other educational software, face-to-face with a tutor in the computer labs. The decision to incorporate a blended learning format emerged from a desire to explore how the potential of this combination of tutor-guided, small-group investigation with self-directed e-learning would affect students’ learning. The decision was guided by a desire to:

- See what implications using e-learning might have for a class of first-year pre-service teachers;
- Allow the students to be exposed to an ICT related innovation because the subject of the course was on how ICT might be used in teaching and learning;
- Determine students’ reactions to using e-learning, in particular to try to determine if their use heightened their awareness of its potential in their own teaching;
- Investigate the role of assessment in supporting a more autonomous, independent learning format.

It was felt that for independent learning to be successful, the importance of assessment, and in particular formative assessment, as a means of informing the students of the success or otherwise of their own learning, could not be overstated.

This change was also influenced by the increasing number of students enrolled in these programmes (256 in 2004/2005, 278 in 2005/2006 and 303 in
2006/2007) and the consequent demand in providing a quality experience to all students. An investigation of available e-learning platforms, both commercial and open-source, resulted in the choice of Moodle for the following reasons:

- Rich availability of features – presentation, assessment & tracking;
- Large community of users – more than 50,000 across 120 countries;
- Open Source – no licence fees;
- Moodle was already in use elsewhere in the university.

Historically, the university has a good IT infrastructure together with a knowledgeable and helpful IT support staff, significant support factors in the decision to try to implement an online module. A test-version of Moodle was set up in December 2004 on which the relevant features required to present and assess the course content were exhaustively tested over an eight week period. The software proved itself to be resilient, easy to use and error free during this testing.

The blended learning programme of study was introduced in the spring semester of 2005 to 256 students enrolled on the EN4002 module and the course utilised this blended format for the following three years. This research reports on the 2006/2007 cohort.
1.2 Aims of the study

This study attempts to determine the answers to several questions regarding the use of ICT as a tool to enhance teaching and learning. The concepts covered by such questions included:

- To examine the issues that would effect the use of e-learning software to support a blended learning experience for students on campus;
- To explore the use of formative assessment in supporting more independent learning for students;
- To examine students’ participation on the course and how that participation appears to have influenced a change of attitude towards the use of ICT in teaching and learning;
- To explore how students’ previous knowledge and experience of ICT was reflected in their participation in the course.

In recognition of the exploratory nature of this study it was decided that this would be best served by using an exploratory case study methodology to answer the research questions. This involved the use of online surveys, online discussion fora, student responses to MCQs as well as open-ended questions, summative assessment grades and the tutor’s observations in addition to the tracking facility inherent in the LMS which tracked both student interaction with the online content and their responses to the questions posed in the formative assessment.

1.3 Thesis overview

This thesis contains five further chapters. The next chapter consists of a literature review in which the published work of other researchers investigating the assessment of learning, how the introduction of ICT has affected or is likely to affect existing models of assessment and the factors that effect student participation in learning, is presented and analysed. An examination of the rationale behind the choice of exploratory case study as the means of investigation and the theoretical approach underlying that choice, are
outlined in chapter 3. Chapter 4 describes the findings, presenting the data which were gathered by the several means outlined in the methodology chapter. An attempt to show how these data were used to answer the research questions in the context of the literature is made in chapter 5 and finally, in chapter 6 the main conclusions which emerged from the study are summarised and tentative recommendations for the inclusion of ICT as a tool to enhance teaching and learning in the future are presented.
2 Literature Review

2.1 Introduction.

As highlighted in the previous chapter, a key aim of this research was to explore how a blended learning format, which supported a more independent model of learning for students, could be used in a third-level context. A critical aspect of this research was to explore the role of assessment, particularly formative assessment, in providing supported feedback for the learner, in this independent mode of learning. Therefore, this section will begin by exploring the role of assessment as well as the ways that assessment can be used to support independent learning. The focus of this review is on what constitutes assessment, the rationale for using assessment (what its purposes are), how assessment is related to learning, how assessment is carried out, whether peer and self-assessment are beneficial strategies, the potential of collaboration over individual assessment and what problems are related to assessment. The final section of this chapter examines what the role of ICT in assessment is, from the perspective of the opportunities that are enabled but also how it might detract from some forms of assessment.

2.2 What is assessment?

Although the International Dictionary of Education, defines assessment as ‘the process by which one attempts to measure the quality and quantity of learning and teaching’ (Page & Thomas 1979, p. 26), the reality is that this definition fails to take into account the purposes and possibilities of formative assessment or assessment for learning. Some of these purposes and possibilities are examined by Sainsbury and Walker (2007) who suggest that assessment can be perceived as being a way of understanding learning from the student perspective and cite Ramsden (1992) in support of this assertion:
… reporting on students’ achievements and about teaching them better through expressing to them more clearly the goals of the curricula. It is about measuring student learning and it is about diagnosing specific misunderstandings in order to help students to learn more effectively. It concerns the quality of teaching as well as the quality of learning … it is not only about what a student can do; it is also about what it means he or she can do. (Ramsden, 1992, p. 182, emphasis in the original)

There is widespread agreement that assessment can be classified as either formative or summative and as these two classifications differ greatly in their intent, a concise definition of assessment is not practical. The view that a subject as vast as assessment could never be defined concisely is articulated by Black and Wiliam (1998) in their seminal review of the literature on classroom formative assessment before they proceed to define formative assessment as:

… encompassing all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. (Black and Wiliam, 1998, p. 7)

While being factually correct, to suggest that formative assessment is assessment for learning while summative assessment is assessment of learning, does not capture the complexity of what assessment is. Wiley & Haertel (1996) defined summative assessment as:

… an activity that is intended to reveal (uncover, estimate assess, evaluate) skills, conceptions, abilities, or knowledge of the individuals being tested. The use of such estimates may be to compare individuals to one another or to a criterion for the purpose of making a decision about subsequent opportunities or requirements in education, therapy, social life or work. (Wiley & Haertel, 1996, pp. 61 - 62)

but equally Crooks (1988) in his review of formative assessment suggests that:

… as educators we must ensure that we give appropriate emphasis in our evaluations to the skills, knowledge, and attitudes that we perceive to be most important. (Crooks, 1988, p. 470).

Taras (2007) asserts that the difference between formative and summative assessment is a difference in function or purpose and that there is not and should not be a difference in process.
To suggest then that assessment is multi-faceted is an indication of the complexity of the subject. Later sections examine the relationship between assessment and learning-style (deep learning or surface learning), the functions that assessment is claimed to fulfil, the benefits to individual learning of developing good self-assessment and peer-assessment skills, the possible benefits of continuous assessment over end-of-unit assessment, the potential MCQs may have in the assessment of conceptual learning, the question of the validity of collaboration over individual assessment, the problems/challenges of students having a greater say than they currently have in what is assessed and how that assessment is administered as well as the opportunities and limitations of employing ICT as an integral part of the assessment process. Reiterating that assessment is a complex issue, not easily defined or summarised, leads to questions regarding its supposed uses and purposes.

2.2.1 Why do we assess?

Accepting that the concept of assessment is a contested term, there are clear reasons why assessment is part of the teaching and learning process. Traditionally, the purposes of assessment included accountability (are teachers doing a good job?) and using results to determine future choices or certification (Meisels, 1989, pp. 16 - 17) but this narrow focus has been shown in recent decades to be inadequate and the purposes of assessment have been expanded to include:

- To pass or fail a student.
- To grade or rank a student.
- To select for future courses.
- To predict success in future courses.
- To provide a profile of what a student has learnt.
- To diagnose students' strengths and weaknesses.
- To provide feedback to students to improve their learning.
- To help students to develop their skills of self-assessment.
- To motivate students to provide feedback to teachers.
- To evaluate a course's strengths and weaknesses (JISC, 2008).
This list combines elements of both summative and formative assessment and while not exhaustive gives a good indication of the usefulness of assessment.

Miller (2009) referring to Stout (2002) contends that in recent years summative assessment is giving way to formative assessment (Miller, 2009, p. 181). Taras (2008), in an opinion paper on student self-assessment, proposes that all assessment should be summative and that if a piece of assessment is also intended to have a formative function, teacher feedback should be given to students but the summative grade should be withheld until after the student has assimilated the feedback (Taras, 2008, p. 88). Taras’ assertion is considered in more detail in a later section while the next section considers the effects of assessment on styles of learning.

### 2.2.2 Deep or surface learning?

How assessment is used and the role that it can play appears to have an influence on students’ learning styles and there seems to be quite a strong correlation between methods of assessment and students’ tendency to engage in deep or surface learning. In support of the contention that formal examinations encourage surface learning, Tian (2007) refers to the published work of Currie (1986), Brown & Knight (1994), Gibbs (1995), Baillie & Toohey (1997) & Ritter (2000) and compares this to the deep learning required to compose an assignment essay (Tian, 2007, p. 388). If, as seems to be the case, deep learning is preferable to surface learning (Crooks, 1988, p. 447; Svirko & Mellanby, 2008, p. 219), both from an ability to function better in the wider world as well as becoming a lifelong learner, it is incumbent on universities to put a greater emphasis on assessment methods that differentiate in favour of students who adopt deep learning approaches over students who adopt surface learning approaches, i.e. an approach that favours assignment essays or their equivalent over formal examination (Tian, 2007, p. 392). Tian claims that surface learners should be “punished” for not adopting a deep learning approach (Tian, 2007, p. 387).
Crooks (1988) cites the Entwistle and Kozeki (1985) study of the differences of approach between British and Hungarian secondary school students. They concluded that the emphasis on an external examination system that encouraged the correct reproduction of information in Britain also encouraged surface learning while:

In Hungary, on the other hand, there has been a strong reaction against a former stress on rote learning in the schools, and the emphasis has recently been placed on attempting to foster creativity through helping students to think about relationships, with much reduced emphasis on factual knowledge or operation learning (Crooks, 1988, p. 446)

which suggests that there was a clear correlation between deep learning and a less prescriptive assessment regime. In acknowledging the value of encouraging a deep learning approach, the next section considers the importance of feedback in formative assessment and how this can enhance learning.

2.3 How is assessment related to learning?

In spite of the large volume of literature addressing assessment (Black and Wiliam considered 681 relevant publications for their 1998 review of the literature on classroom formative assessment), assessment is frequently seen as being something of an add-on within mainstream educational publication. In an opinion paper on the scholarship of teaching and learning (SoTL), Rust (2007) highlights the missing component of assessment and argues cogently for its inclusion:

… it is vital that we explicitly articulate and establish a scholarship of assessment, which should be at the very heart of our scholarship of teaching and learning. (Rust, 2007, p. 229)

Rust lists seven good-practice principles that refer to the alignment of learning activities suggesting that 1) learning outcomes that are clearly defined, 2) assessment that is evidently non-threatening and non-anxiety provoking, 3) encouraging intrinsic motivation as a realistic possibility through active
engagement, 4) sufficient formative tasks being available, 5) skills
development that is structured, 6) different rates of learning being
accommodated and 7) explicit guidelines on effective and prompt feedback
should all be seen as being important. In making the case for the importance of
feedback, he enumerates the 11 conditions identified by Gibbs and Simpson
(2002) which stress the relevance of assessment in the support of learning,
highlighting the fact that seven of these conditions refer to aspects of
feedback.

The significance of feedback as an intrinsic part of formative assessment is
scrutinised by Crooks (1988) in a review of the literature on assessment and he
specifies three ways which could enhance the effectiveness of feedback:

First, feedback is most effective if it focuses students' attention on their progress in
mastering educational tasks… Second, feedback should take place while it is still
clearly relevant… Third, feedback should be specific and related to need. (Crooks,
1988, pp. 468 - 469)

The importance of feedback and especially an investigation of the effects of
different forms of feedback are investigated by Miller (2009). This research
examined students' reactions to the effectiveness of four types of feedback
from formative computer-based assessment (CBA), at Queen’s University
(Ontario, Canada), using a combination of students' comments and two
separate questionnaires. The assessment, completed during 2006, investigated
the potential of formative CBAs to provide feedback in support of learning to
673 Bachelor of Education students studying a compulsory module on
classroom assessment practices. Individual students determined the type of
feedback from four available choices (directions to a resource, rephrasing a
question, providing additional information and providing the correct answer)
using an assessment instrument that combined formative and summative
assessment.

This CBA was formative to the extent that it provided feedback to support students’
learning (Stiggins 2005) and summative in that the successful completion of the
assessment was used as a graduation component (Chappuis 2005), (Miller, 2009, p.
183).
Student response through comments taken from students' course portfolios was very positive but Miller cautions that these comments represent only 2.5% of the cohort. The first of two questionnaires was completed by 18 students who were taking an optional course on classroom assessment practices as well as the compulsory module while 152 students (26% of the cohort) completed the second questionnaire.

In discussing the findings, Miller questions the advisability of an assessment instrument attempting to simultaneously combine formative and summative assessment:

... the formative/summative role of the assessment may have contributed to students’ ranking the utility of the feedback lower than we had anticipated (ibid, p. 190).

Miller concludes that while the students perceived the feedback to be moderately effective, further research was required to determine the feasibility of combining formative and summative assessment in a single assessment instrument, a question also raised by Crooks (1988) where he cites the work of McPartland (1987), Miller (1976), Sadler (1983), and Slavin (1978) in arguing that;

where evaluations count significantly toward the student's final grade, the student tends to pay less attention to the feedback, and thus to learn less from it. (Crooks, 1988, p. 457)

The question of the attention that students pay to feedback and the value that they gain from it is investigated by Crisp (2007) in which she explores the extent to which students act on feedback they have received, and questions the assumption that higher standards of work by students can be achieved by providing feedback alone. The study examined the feedback given to Bachelor of Social Work students at Deakin University in Australia in 2005 on two essays, submitted as a mandatory course requirement in the module ‘Introduction to Social Work’, and was originally conducted as a quality assurance exercise in response to concerns that feedback provided to students was having only limited impact.
In many universities, the marking of essays is largely carried out by post-grad students rather than by lecturers and frequently, in large undergraduate classes, many different assessors are employed. In order to deliver some level of consistency, only the 51 participants (approximately half of the class) who had both of their essays assessed by a single anonymous marker were included in this study and that marker’s feedback comments were analysed under seven categories:

- accuracy, relevance and coverage of the topic;
- clarity and structure;
- integration of theory and practice (was there appropriate use of examples);
- critical analysis and reflection;
- evidence of reading (i.e. sufficient use of appropriate references);
- referencing;

The analysis of the feedback together with the grade earned was determined to be significant only if the difference in the grade, between the first and second essays, was greater than four marks, which revealed that the marks for both essays for two-thirds of the students were at a similar level. The remaining 17 students were almost equally divided between those who improved their grade by more that five marks and those whose grade declined. That such a substantial proportion of students showed no change in marks suggests that the majority either did not take cognisance of the feedback offered on the first essay or did not understand how the feedback might be used to improve (a point also made by Miller (2009, p. 190)), which raises questions on the value of the feedback.

Crisp recognises that a shortcoming of this study is an indication of how students perceived the feedback from the first essay and concludes that any further investigation in this area should garner students’ subjective responses as well as being of a larger scale.

In examining the apparent disregard of students for feedback, Crisp does not refer to concerns by other researchers about combining feedback with a summative grade (Crooks 1988, p. 457; Miller 2009, p. 190), which indicate that students’ attention to feedback is greatly reduced if it is presented to the
student together with a summative grade. The questions raised by Crisp suggest that further investigation is needed into combining formative and summative assessment in a single instrument as well as a determination of what factors might be taken into account in order to make feedback more meaningful to individual students.

While the use of formative assessment has been shown to enhance learning gains (Black and Wiliam, 1998, p. 61; Crooks, 1988, e.g. p. 455) the uptake of formative assessment appears to be far from universal. Notwithstanding this lack of uptake, individual teachers continue to strive to improve the learning experiences of their students by employing such innovative stratagems as self-assessment, peer-assessment, game-assessment, collaboration and the benefits of involving students as active participants in assessment processes. Reports of how such assessment practices are used are examined in the next section.

2.4 How do we assess?

Traditionally, assessment was seen to be the prerogative of teachers and external agencies but in recent years the use of other forms of assessment is becoming more prevalent. The dichotomy of formative and summative assessment has already been discussed and this section will investigate the usefulness of peer-assessment, self-assessment, portfolio-assessment, collaborative versus competitive assessment, assignment versus end-of-course assessment and the vexed question of different methods of assessing deep and surface learning. Developments in how ICT is currently being used as an assessment tool, how this is likely to change in the future and the benefits and drawbacks that such changes might pose for learners and teachers as well as for assessment and learning, will be investigated in a later section.

2.4.1 Self-assessment and peer-assessment

Peer-assessment involves students critically assessing the work of other students and in common with self-assessment moves away from a traditional view of assessment where the locus of power was seen to rest with teachers or
The act of critically assessing one’s own or others’ work requires a deeper understanding than the simple ability to recall discrete pieces of knowledge. This awareness encourages students to become more autonomous and independent by becoming more self-reliant (ibid, p. 85). In an investigation of students’ ability to self-assess, Kirby and Downs (2007) report on a study of mature students in the Science Foundation Programme (SFP) at the University of KwaZulu Natal in South Africa to use self-assessment to move away from a perceived culture of surface learning. The SFP is a 12 month access programme and the study investigated how two cohorts (2002 – 219 students & 2003 – 222 students) self-assessed essay assignments in botany and zoology as part of a biology module in comparison to the actual marks awarded by lecturers. The number of students whose results were considered as part of the study was reduced to 171 in 2002 and 164 in 2003 as not all students completed the assessment process.

The students had seven weeks in which to complete their essays and in spite of being encouraged to submit a draft, less than half of the students availed of that facility. The results indicate that all of the participants over-estimated their essay writing ability when compared to the summative grades awarded by the lecturers, even though one of the staff markers was very lenient in applying the agreed marking criteria – the leniency became obvious when the essay mark was compared to the final module mark, although there was some correlation between high student marks and relatively high lecturer marks.

In highlighting their students’ inability to accurately self-assess:

The results provide overwhelming evidence that SFP students do not have the ability to accurately self-assess in relation to standards set by staff (Kirby and Downs, 2007, p. 486)

Kirby and Downs (2007) suggest that students’ lack of understanding of the requirements of accurate self-assessment is an area deserving of more attention:
Not only will perseverance with continued redesign of the criteria and necessary training of the students in assessment practice go far towards improving the ability of SFP students to self-assess, it has great potential for improved academic performance, as students learn to recognize the criteria that are important in fulfilling the requirements of a task, and dispense with their naïve ideas of what contributes to success. (ibid, p. 491).

Recognising that their students’ inability to accurately self-assess will not be easily overcome, Kirby and Downs conclude that the steps needed to achieve this outcome should include students firstly learning to peer-assess and a redesign of the essay-writing process that would include more feedback.

In seeking to use assessment to help their students to move away from a perceived culture of surface learning, Kirby and Downs highlight the potential of assessment to much more readily assess surface learning (ibid, p. 477). The use of MCQs is one method that is widely used for this purpose and the facility with which this assessment tool can be adapted for use with ICT has been seen to be an important factor in reducing the costs of assessing increasing numbers of third-level students world-wide. Conversely, assessment tools that can credibly be used to assess deep learning or active learning, such as essay writing, have traditionally been marked by tutors and are consequently seen to be a more expensive option. The potential of peer-assessment of active learning has not been widely exploited principally because of a perception that peer-marking is not as reliable as tutor marking (Sitthiworachart and Joy, 2007, p. 218).

This perception is highlighted in the Vu and Dall’Alba (2007) report on a case study into the practice of peer-assessment which aimed to explore strategies for implementing peer-assessment, conditions influencing that implementation and the impact of peer-assessment on students’ experience of learning. Nine Social Science students at the University of Queensland (from a class of 11) participated in the study which required them to peer-review a viva voce conducted as a one-to-one interview for each student with the course coordinator.
The study gathered data under five headings:

1. Analysis of the institution’s assessment policy;
2. A questionnaire exploring students’ perceptions of peer-assessment (both before and after the assessment);
3. Observations of class meetings that dealt with peer-assessment;
4. Focus-group interviews with students regarding their experiences;
5. Interviews with the course coordinator, focusing on the assessment process (Vu and Dall’Alba, 2007, p. 544).

While the authors found that the process was appropriately embedded within the course, they expressed concern that the students were insufficiently prepared to use peer-assessment, which detracted from the learning potential of the process:

However, all the students had concerns about the possibility of unfair and inaccurate marking, including their own marking, due to lack of understanding of assessment criteria. Despite students’ concerns, their prior experience was not dealt with as part of preparing them to use peer-assessment. (ibid, p. 546),

a fact that was acknowledged by the course coordinator. Students’ lack of understanding of assessment criteria is a reflection of the lack of transparency that generally surrounds these criteria along with teachers’ perception that the sharing of this knowledge might be detrimental to existing teacher/pupil power structures. However, increasing this transparency will increase the perception that such criteria are not capricious or arbitrary (Shepard, 2000, p. 12).

The authors conclude that although the potential learning of this experience was not optimised, the data indicate that the students learned both from the process and from their peers, gaining a better understanding of what was expected of them, both within and beyond the course. Four conditions are identified that the authors believe need to be satisfied in order for peer-assessment to be successfully implemented:

1. Adequate and appropriate preparation for the use of peer-assessment;
2. Alignment of assessment, learning objectives, and the broader purpose of the course (e.g. preparation as professionals);
3. The availability of assistance from a teacher throughout the peer-assessment process;
4. Constructive discussions after peer-assessment, sensitively handled by a teacher (Vu and Dall’Alba, 2007, p. 551),
but they emphasise that the over-riding factor that is fundamental to successful implementation is the need for sufficient time to be made available for preparation. A lack of familiarity with the process of peer-assessment means that preparation should include a thorough understanding of the assessment criteria, time for constructive discussion and teacher availability as a guide and facilitator throughout the process. A major finding of this study related to the perceived reliability of peer-marking, a concern that might well be ameliorated by allowing the student and peer-marker to anonymously discuss the reasons behind the level of marking that was applied, thus giving both the learner and peer-marker a further opportunity for learning (Sitthiworachart and Joy, 2007, p. 218), although it is probable that a better understanding of the assessment criteria, and of how the criteria should be applied would do much to increase student confidence in the reliability of peer-assessment.

2.4.2 Assessment of deep and surface learning

The question of whether deep or surface learning is better was mentioned in an earlier section on why we assess and a suggestion that formal examinations encourage surface learning was highlighted. Support for the premise that deep learning is better learning comes from a report from Tian (2007) in which he investigates the effective differences between deep and surface learning in a survey administered to 134 students attending the Institute of Contemporary Chinese Studies at the University of Nottingham in 2004, representing a response rate of 82% of the 164 students approached. The study investigated how two different methods of assessment (assignment essays and formal examinations) distinguished between students who adopted a deep learning approach as opposed to a surface learning approach comparing the results to a previous similar study reported by Scouller (1998).

Of the 134 respondents, 34 were assessed using an assignment essay and the remainder using formal examinations and the study is based on student responses to 42 questions contained in a Study Process Questionnaire (SPQ – Biggs, 1987) that was previously used in a comparative study by Scouller (1998).
Tian asserts that a shortcoming of the Scouller study was that students answered two separate SPQs, one each in relation to their preparation for an assignment essay and preparation for a formal examination, creating the anomalous situation where the data collected were related to preparation for a particular assessment and not on students’ approaches to learning whereas in Tian’s study only a single survey was administered.

The results of the survey indicate that students who adopt a deep learning approach do better than those who adopt a surface learning approach when the method of assessment is an assignment essay but that that neither deep learners nor surface learners perform particularly well in formal examinations.

…the more the students adopt a deep learning approach the better they perform in assignment essay, while the more the students adopt a surface learning approach the worse they perform in assignment essay. (Tian, 2007, p. 395)

Tian concludes that universities are at the very least facilitating if not actually encouraging surface learning over deep learning by having a greater emphasis on formal examinations than on other methods of assessment, especially essay assignments and that this imbalance should be altered in favour of essay assignments, “at least in so far as humanities and social sciences are concerned” (ibid, p. 399) although he does contend that the study is limited in the scope of its empirical coverage.

A contrasting view is proposed by Bleske-Recheka et al (2007) in which they report on a study of the assessment performances of three separate cohorts enrolled in three different psychology courses in the University of Wisconsin-Eau Claire, USA, during the 2003 – 2004 academic year, in an investigation of discrepant performance on multiple-choice versus short answer assessments. The participants consisted of 100 students enrolled in General Psychology, 44 students enrolled in Research Methods in Psychology and 26 students enrolled in Evolutionary Psychology. The study sought to investigate two research questions – the frequency with which students perform well on one form of assessment but poorly on another and the extent to which student performance on multiple-choice and short answer items from specific course exams is
correlated with their performance on other, more general, measures of student learning. The results show that large discrepancies (i.e. greater than 20 %) were rare and that, in general, the discrepancy favoured multiple-choice over short answer in General Psychology and Evolutionary Psychology, vice versa in Research Methods in Psychology and that students were not consistently favoured by one form of assessment over another. The study also shows that multiple-choice assessments of student knowledge demonstrated definite links with other measures of general student aptitude, even after controlling for short answer assessments of student knowledge but that short answer assessments did not show similar independent links with scholastic aptitude (Bleske-Recheka et al, 2007, p. 100).

The authors conclude that while a mix of assessment methods is the optimum, an over-reliance on open-ended questions to the exclusion of closed-ended questions (such as multiple-choice) would appear to favour only a minority of students but that teachers might gain much by including some multiple-choice questions in addition to any short answer assessment. While cautioning that the three courses under consideration were all taught by the same instructor, attention is also drawn to the fact the three courses were all psychology courses and that any further investigation would benefit from a multi-disciplinary approach:

Future research could investigate performance discrepancies and correlates of different forms of assessment in courses from other disciplines taught by other instructors. (ibid, p. 103)

While the confidence expressed by Bleske-Recheka et al (2007) in the relative value of MCQs over open-ended questions as instruments of assessment is not in agreement with the confidence expressed by Tian (2007) in the use of assignment essays over formal examination to determine that deep learning has occurred, these differing views emphasise the need for a mix of assessment methods to be considered.
2.4.3 In-classroom assessment

Rather than spending time in discussing the merits of MCQs over short-answer questions or of assignments over end-of-term examinations, it is contended that the optimum solution probably lies in a mix of assessment methods. Such a mix is recommended by Sainsbury and Walker (2007) in a study carried out with 157 students in the first year of the Bachelor of Pharmacy at the University of Sydney, which describes the design, implementation and evaluation of an innovative assessment, broadly termed dynamic assessment, which used collaborative exchanges to promote learning during assessment within large first-year university classrooms. The study investigated the results and reactions to three separate quizzes containing only true/false conceptual understanding questions administered during lectures and which accounted for 20% of a summative grade.

Students were required to attempt each quiz, give each answer a confidence rating (on a scale of 1 – Don’t know, to 5 – absolutely certain), discuss the quiz with their immediate neighbours and also give their post-discussion answers a confidence rating. The requirement to give a confidence rating ensured that students were less likely to guess an answer and to stimulate critical evaluation as negative marking was applied. Correct answers were announced and their rationale discussed during the lecture to optimise the learning experience. A formal survey was administered at the conclusion of the subject, using both Likert-scale and open-ended items and 11 students were asked to comment on their perceptions of the collaborative quizzes.

The results show that 10% of the responses were changed by students after discussion with their peers, most in the direction of the correct answer and that the likelihood of change decreased as the semester advanced. Average student confidence increased in all cases as a result of discussion with peers but interestingly, student confidence was no higher in the third quiz than in the earlier quizzes.
Formal feedback indicated that more than 85% of students found that the collaborative exchange helped them to learn and the results suggest that students recognised that the process was a useful opportunity for learning. While the potential exists that the quizzes might seem to be assessing only surface learning, such potential appears to have been reduced by the combination of the opportunity to collaborate, which involves students discussing the reason behind a particular answer, and the requirement to give answers a confidence rating thus reducing the temptation of guessing.

Two potential drawbacks to this system, regressive collaboration and non-collaboration, are identified and discussed in the report, but the authors put forward convincing arguments that transform both from potential drawbacks to potential learning opportunities.

The authors conclude that while students are given the opportunity to learn during dynamic assessment, rather than simply being penalised for not knowing:

> it is clearly not sufficient in itself as a complete assessment scheme and is intended to complement other tasks that are designed to allow assessment of other aspects of student learning. Nevertheless, it is reasonable to suggest that an approach in which assessment is viewed as a learning opportunity is likely to provide greater benefits to the student than one which seeks only to quantify what has been learned previously. (Sainsbury and Walker, 2007, p. 115)

This assertion raises the interesting issues of the validity of collaboration over individual assessment and the relative learning opportunities of continuous assessment over end-of-course examinations. Another aspect that favours further use of dynamic assessment is the high level of student motivation that this method of assessment seems to engender.

A similar outcome of engendering greater motivation among students is ascribed to a model of assessment that also used class quizzes as the assessment opportunity. This attempt to combine summative assessment with formative feedback is the subject of a study by Haigh (2007) that has the advantage of encouraging lecture attendance. The study which examined the role of quizzes administered as part of lectures in promoting better student
learning, involved 373 students of two geography modules at Oxford Brookes University in England over a seven year period from 1997 to 2003. The quiz results contributed to a summative grade and immediate feedback in the form of sample correct answers reinforced learning from the previous week’s lecture.

The quizzes, which were administered at the start of the lecture or at the end of a coffee break, accounted for 20% of the available grade with each quiz being worth between two and four per cent. A qualitative questionnaire completed by all participants during the final week of the module indicated that most students viewed the quizzes positively and statistical analysis showed strong positive, highly significant correlations to some of the other methods of assessment such as the formal end-of-course examination, a learning journal, a virtual field trail exercise and class presentations. The proposal that such quizzes measure surface rather than deep learning is substantiated by the weak correlation with a fieldwork exercise and term papers but the point is made that surface learning that can be built on is a good beginning, especially when it engenders discussion within the classroom.

Haigh concludes that the class quizzes are a successful stratagem because they help build student engagement with content, reward participation by allowing marks to be gained, encourage discussion between students and teacher by providing immediate feedback and contribute to making learning more enjoyable:

However, students rank it among the most popular elements of coursework precisely because, by encouraging students to review their notes from previous sessions, it also helps them gain more from the current session (Haigh, 2007, p. 470).

The point that such quizzes should be only one of several methods of assessment in a module is strongly made, reflecting a similar concern from Bleske-Recheka et al (2007, p. 90).
2.4.4 Can assessment be enjoyable?

Can students’ preference for one type of assessment over another be construed as implying that the assessment is in any way enjoyable? Such preference is claimed in a study researching collaboration over individual assessment where Desrochers et al (2007a) investigated an alternative team-based format which they term game assessment, to assess students’ knowledge compared with the traditional format of testing students individually at a medium-sized, liberal arts college in New York State. In this study, 47 Social Psychology students were assigned at random to a group taking an end-of-term test by traditional pen-and-paper (23 students) or a group taking the test as part of a team. A team of three students competed against other teams to answer 20 MCQs, with stringent time controls, where the team answer was articulated only after each team-member had committed an answer to paper. The group taking the traditional test answered the same 20 questions individually in 60 minutes.

Although there was no significant difference on average between the number of correct answers for individuals taking the traditional test and for individuals pre-discussion in the team test, the correct answers by team were significantly better. The authors’ claim, that the team format surpassed the individual format (Desrochers et al, 2007a, p. 535) appears to be justified on the basis of participants’ (subjective) preference for the game format as well as the participants’ belief that the game format was a more accurate form of assessment. In support of this claim, the data show that 84% of team decisions were made by majority rule, indicating a very high rate of participation. Although the authors claim that students indicated a preference for game assessment and the paper is entitled *Game assessment: fun as well as effective*, the authors stop short of claiming that students actually enjoyed this form of assessment. While the authors claim merit for the competitiveness of the game format, they do not give any indication of any advantage that accrued to the team that managed to be the first to answer each question correctly other than that the team scored a point.
Desrochers and her colleagues investigated the reliability and validity of the team format, reasons why the team format might be superior to the individual format and what implications these results might have for educators. This investigation leads to the conclusion that the format is reliable and valid when measured against independent criteria, suggest several reasons as to why the format might be deemed to be superior and claim that a game format may have implications for student motivation and:

This result suggests that students know more than is apparent from their answers on an individual test and that that knowledge is somehow revealed through a team game situation. (Desrochers et al, 2007a, p.536)

In conclusion, the study reiterates students’ preference for game assessment over individual pen-and-paper assessment, citing increased motivation that seemed to be related to students’ perception of the game assessment as being less onerous. Does this example of using MCQs to encourage discussion transform MCQs from an assessment tool for assessing surface learning into a more sophisticated assessment tool?

Such a possibility is investigated by Nicol (2007a) who cites four published case studies to demonstrate that the power of MCQs relates to how they are used and specifically investigates their potential in self-regulated learning. Reporting on the increased use of MCQs as an assessment method in higher education in recent years, he accounts for the increase in their use in terms of larger student numbers, reduced resources and the greater availability of ICT (Nicol, 2007a, p. 53). He presents an assessment framework and a set of seven feedback principles (Nicol and Macfarlane-Dick, 2006):

Good feedback practice:

1. helps clarify what good performance is (goals, criteria, standards);
2. facilitates the development of self-assessment and reflection in learning;
3. delivers high-quality information to students about their learning;
4. encourages teacher and peer dialogue around learning;
5. encourages positive motivational beliefs and self-esteem;
6. provides opportunities to close the gap between current and desired performance;
7. provides information to teachers that can be used to help shape teaching (Nicol, 2007a, p. 55).
which he applies to each of the case studies. Nicol thus indicates how judicious use of this method of assessment can enhance learning well beyond the traditional use of MCQs to test memorisation or factual recall (Nicol, 2007a, p. 54). Nicol cites the research of Boud (2000) in emphasising the need to develop greater autonomy in learning and Brew (1999) on the benefits of involving students as active participants in assessment processes (O'Donovan et al., 2008; Taras, 2008).

The first of Nicol’s case studies (Bull and Danson, 2004) highlights the advantages of the facility of ICT mediated MCQs to provide immediate feedback, emphasising the benefits to the students of having sufficient time to act on the feedback that is given early in a course. This case study is cited as an example of “just in time teaching” (Novak et al., 1999) where the feedback generated as part of the electronic MCQs is used to shape further teaching (Nicol, 2007a, p. 57).

In the second case study (Gardner-Medwin, 2006), confidence-based marking (CBM) is introduced, encouraging students to be able to justify each answer, as the application of negative marking means that a high price is extracted for having confidence in a wrong answer. This procedure has the further advantage of encouraging students to reflect on their answers to determine the reliability of the reasoning behind those answers which in turn increases students’ confidence in their own knowledge.

Electronic voting systems (EVS) combined with MCQs are the context of the third case study (Nicol & Boyle, 2003), where subsequent to students making an initial choice they are encouraged to engage in peer discussion before using the voting system a second time. Introduced in the Department of Mechanical Engineering at the University of Strathclyde in 1999 (Boyle & Nicol, 2003), this teaching strategy encourages students to “convince your neighbours that you have the right answer” (Nicol, 2007a, p. 58) promoting student engagement in peer discussion about the thinking and reasoning behind their answers. The point is made that this case study satisfies all seven of the good feedback principles quoted previously. This strategy has similarities to that employed by Sainsbury.

In the fourth case study (Fellenz, 2004), students were expected to understand the course content sufficiently well to be able to create their own MCQs along with written feedback for each possible answer as a course assignment that accounted for 20% of the course grade. These MCQs were of sufficiently high quality that more than half of the total submitted for the assignment, were subsequently used in the end-of-term exam. Like Nicol’s own case study, this case study also satisfies all seven of the good feedback principles quoted previously while Nicol emphasises that in determining the assessment criteria by creating the question, the first good practice principle “helps clarify what good performance is” (Nicol, 2007a, p. 55), is powerfully satisfied. This raises the question of the feasibility of student participation in the assessment process (O'Donovan et al, 2008, p. 213) and students having more control over assessment (Taras, 2008, p. 85). Nicol notes that although Fellenz did not make any use of ICT in this process, the concept would be eminently amenable to incorporating the use of ICT.

Nicol concludes that it is the learning and assessment design rather than the technology that is the driver for change and that increased power can be leveraged from MCQs when they are linked to a clear pedagogical goal.

2.4.5 Determining the criteria of assessment

Is it inevitable that as education becomes more learner-centred, learners will have more input into how the learning is assessed? That is the thesis put forward by Taras (2008) in a theoretical paper in which she investigates issues of power and equity between students and tutors in higher education as borne out by two models of self-assessment which she terms the standard model and Taras’ model. In examining the essential features of a self-assessment model, Taras claims that:

Knowledge and understanding of criteria is very important as it helps to socialize students to assessment processes. (Taras, 2008, p. 84)
The self-reliance that students gain through the knowledge and understanding of assessment criteria is demonstrated by their autonomy and independence, abilities that are highly valued but not easily attained as the clarification of criteria and standards are not easily understood. It is quite probable that by ensuring that such knowledge and understanding of the criteria of assessment are available to students, the potential to self-assess would be more readily fulfilled, thus avoiding any over-estimation of capability such as that highlighted in Kirby and Downs (2007).

The standard model of self-assessment is based largely on the writings of Boud (1991, 1995) and is cited by Taras:

> Self-assessment encourages students to look to themselves and to other sources to determine what criteria should be used in judging their work rather than being dependent solely on their teachers or other authorities. (Boud 1991, p. 1)

which Taras sees as a good starting-point while expressing a number of reservations. The shortcomings of this model are that by allowing students only limited participation in assessments that count for accreditation (Taras, 2008, p. 85 citing Boud, 1995) by excluding them from summative assessments and a negotiated grade, it effectively excludes the students from the true locus of power in assessment (ibid) as well as failing to transfer the tutor’s guild knowledge and expertise through feedback.

Taras claims that her model of self-assessment differs from other models in three important aspects:

- it requires prior assimilation of tutor feedback by students;
- it is used with summatively assessed work;
- the grade is withheld until students have proffered their own grades (Taras, 2008, p. 88).

Empirical evidence in support of this position is quoted (ibid, p. 88) as is independent support for the advantages inherent in integrated tutor feedback (ibid, p. 89).
Taras concludes that the Taras’ model of self-assessment is more beneficial than the standard model because the standard model does not give students “access to the tutors’ guild knowledge” or “direct access to grade production and negotiation” (ibid, p. 90).

Is this model of participation in the assessment process a step too far or is there a cogent case to be made for greater student access to power and control? Increasing student participation in the assessment process is the subject of an opinion paper on developing student understanding of assessment standards in which O'Donovan et al (2008) investigated what approaches appear to help improve student learning and how these approaches fit with good teaching practice. The approaches investigated are:

- *Traditional Model* (passive student engagement and informal activities and inputs);
- *Dominant Logic Explicit Model* (passive engagement and formal activities and inputs);
- *Social Constructivist Approach* (active engagement and formal activities and inputs);
- *Cultivated Community of Practice Approach* (active engagement and informal activities and inputs).

The authors advise that these four approaches should not be seen as being mutually exclusive as there are elements of each that can be usefully incorporated in the others and while the objective is students’ better understanding of assessment standards, it appears that the circumstances that permitted the *Traditional Model* to be good enough in the past no longer apply. The paper emphasises that the way forward in the promulgation of assessment standards appears to be the *Cultivated Community of Practice Approach* and it is this approach that receives most attention.

A suggested approach to the implementation of communities of practice for the better understanding of assessment standards involves three areas of activity:
• the development of hospitable social learning spaces in which social interaction can take place and social relationships evolve;
• emphasising within curricula, more formalised social learning and collaborative assessment practices, such as peer review and assessment and research-based learning;
• facilitation of ‘pedagogical intelligence’ within learners (O’Donovan et al., 2008, p. 211).

A social learning space, which the authors posit can be virtual or physical, might combine social activities, learning activities and facilitative technology. Social learning practices include peer review, peer-assessment and marking practice, and use discussion to develop students’ self-evaluative ability as a way of sharing understanding of assessment requirements. The paper accepts that ‘pedagogical intelligence’ is a ‘contentious nomenclature’ but suggests that it means more than learning to learn and quote Hutchings’ (2005) definition that:

    pedagogical intelligence would require students not only to be able to critically evaluate their own learning, but also their learning environment including the teaching. (O’Donovan et al., 2008, p. 213)

and the authors contend that teachers should have the confidence to engage in constructive debate with learners on the quality of teaching and learning being offered and consumed.

O’Donovan and her colleagues conclude that if higher education is serious about facilitating learning, the use of communities of practice to allow students to participate in the assessment experience should at least be seriously considered and debated.

The potential of different methods of assessment to be administered with the aid of ICT has been briefly examined in this section and will be subjected to more rigorous investigation in a later section. While assignment essays have long been considered to be the gold-standard of determining that deep learning has occurred, it is clear that peer-assessment and self-assessment can be equally deployed to good effect for this purpose. Similarly, participation in the assessment process can be shown to be effective in the quest for deeper
learning while the use of collaboration to discuss the optimum answers to MCQs can raise the status of their functionality well beyond simple recall.

Is it inevitable that any attempt to incorporate the use of ICT in assessment will encounter problems? Even before that possibility is considered, the next section investigates problems with assessment that are already known to exist.

2.5 What are the problems of assessment?

Much of the literature on assessment discusses test anxiety – Crooks (1988) refers to six published reviews of the literature in this area and claims that substantial negative correlations have been shown between pre-test anxiety and performance on the test (Crooks, 1988, pp. 461 - 462). Rust (2007) citing Gibbs (1992) contends that we must “ensure that the workload is realistic and the assessment is non-threatening and non-anxiety provoking” (Rust, 2007, p. 230). Can assessment be enjoyable or is the stress commonly associated with assessment part of the purpose? Continuous assessment is a possible solution to the problems caused by test anxiety and one method of applying continuous assessment is the compilation of a portfolio over an extended period of time. Kuisma (2007) reports on a study into the use of portfolios assessment, as a measure of proof of learning, by two separate cohorts of final year, Physiotherapy students at Hong Kong Polytechnic University. The two cohorts were made up of 80 and 103 students respectively and the portfolio accounted for 20% of the available grade for a group project. The content of the portfolios provided the data for the study together with in-depth, semi-open interviews, conducted with ten students from each cohort, which were investigated under three criteria:

- students’ reactions to portfolio assessment in undergraduate studies;
- effect of portfolio assessment on students’ learning;
- impact of portfolio assessment on grading of individual students in a group project (Kuisma, 2007, p. 560).

While most of the students reacted positively to the creation of portfolios, many expressed uncertainty as to the value of the exercise, with many being more concerned that the portfolios contain “exactly what the teachers wanted to see
in them” (Kuisma, 2007, p. 564) rather than using the opportunity to reflect on their own learning, which intimates a lack of understanding of the assessment criteria. A concern was also expressed that the creation of the portfolios was very time-consuming although there was enthusiasm for the fact that the portfolios enabled individuals who were able to show initiative to gain better grades as it was felt that not all group members contributed equally to the group projects. There was general agreement that an individual grade was more equitable than all members of a group being given the same grade.

Kuisma concludes that while it appears that the use of portfolios for assessment as part of a group project was successful, she expresses concern for their reliability and validity as an assessment instrument due mainly to the lack of experience on the part of the assessors of dealing with portfolio assessment objectively. She suggests that the process might benefit from a clearer alignment of the assessment criteria with the proposed learning outcomes as well as a more rigorous application of the assessment criteria by the assessors. The study also highlights perceived limitations with the use of portfolios for assessment of learning with regard to evidence of reflective thinking, clear guidelines as to what is required of students and the timing of the compilation of the portfolio with regard to students’ overall workload.

While claiming that “Many students enjoyed doing it” (Kuisma, 2007, p. 568), Kuisma does not offer any data in support of this claim but the potential of this alternative method of assessment appears to warrant further investigation.

Student enjoyment of other non-traditional assessment methods as an antidote to the problems associated with test anxiety was also investigated in a study of 77 psychology students at a medium-size, liberal arts college in New York State, by Desrochers et al (2007b) who questioned the validity of the objective testing of individuals when compared with cooperative testing. This study also investigated student preference for each of the test conditions.

The participants were randomly assigned to one of three conditions: solitary (24 students), cooperative (27) or competitive (27) testing and the same 16 MCQs, eight factual and eight conceptual, were presented in each condition.
The teams in both the cooperative and competitive team conditions consisted of three members chosen at random. The study investigated how well each of the assessment conditions examined student knowledge, differences in students’ confidence in their answers in each condition and students’ preference for each assessment format.

After each individual answered each question and rated their confidence in the answer, the answer sheet was placed in an envelope before the correct answer was announced and the next question posed. The procedure was repeated for a team answer in the team conditions with the added element of a point allocated to the team correctly answering each question most quickly in the competitive team condition.

The results indicate that the team conditions provided significantly more correct answers than the solitary condition, the cooperative condition provided slightly more correct answers than the competitive condition and students reported that they enjoyed the team format more (Desrochers et al, 2007b, p. 294). The study cites Hinsz & Nickell (2004) in support of students’ enjoyment of working in teams more than solving a task alone and Zimbardo et al. (2003) in support of the contention that cooperative testing decreased test anxiety when compared to solitary testing (Desrochers et al, 2007b, pp. 289 - 290). Desrochers and her colleagues question why teams might arrive at more correct answers than individuals and while suggesting several reasons why this might be, conclude that further research is needed to determine valid answers. The contention that students prefer team assessment to individual testing is well supported by the study as well as by students reporting relative confidence in their answers. The study also questioned the mechanism by which team decisions were reached and concludes that while the majority of answers were reached by majority decision, there is no record of the discussion process that led to such decisions. Keeping a log of transactions during the discussion stage would be a helpful indicator of participation and the authors advocate the use of a computer-mediated environment to facilitate such a recording of these interactions. Desrochers and her colleagues conclude
that the results indicate a level of viability for assessment as part of a team that should encourage further investigation:

Placing students in teams to assess their knowledge of a subject matter appears to be a viable strategy according to our results and may provide instructors with an attractive option to solitary testing. (ibid, p. 295)

and make a credible case that making assessment enjoyable may go some way to alleviating some of the test anxiety that appears to cause a level of underperformance for some students in formal assessment (Crooks, 1988, p. 461).

While the case in favour of the empowering attributes of self-assessment was strongly made in an earlier section (Taras 2008; O'Donovan et al, 2008), Tan (2004) argues that there is a danger that self-assessment might be used to control students rather than empowering them thus creating more problems than solutions and he examines self-assessment in relation to:

- sovereign power – which pits the teacher and the student in a direct struggle for power;
- epistemological power – which allows students to share power but ties them to existing knowledge interests and hegemonies;
- disciplinary power – which focuses on student autonomy rather than student learning and can exert more rather than less control over students (Tan, 2004, p. 660).

Tan recommends that in order to enhance student empowerment in student self-assessment practices:

- power should be appreciated for its productive pedagogical potential – how can it be used for the benefit of students?
- student self-assessment should be judged in terms of its benefit to students rather than in terms of how much power/autonomy the student has enjoyed;
- the naïve assumption that students are naturally able to exercise responsibility for and control of their learning in student self-assessment should be avoided;
- academics who are considering student self-assessment should themselves self-assess their motives and agendas (ibid, pp. 660 - 661).

Have attitudes to student empowerment through self-assessment changed during the five years since the publication of Tan’s paper in 2004?
Recognising that change is occurring, in spite of indicators of the need for such change being available in the literature for a number of years, Rust (2007) asserts that “there is also a growing body of case study evidence of effective innovation and changes in practice being made” (Rust, 2007, p. 232), which are informed by the scholarship of assessment. While applauding whatever small amount of change is occurring in assessment practices, Rust claims that bad assessment practice is inherently problematic and supports this claim with an explanation of each of seven examples of what he asserts is bad practice:

- Belief that it is possible to distinguish the quality of work to a precision of one percentage point
- Belief that double-marking will ensure fairness and reliability
- The fact that most marks lack meaning unless they are stated in terms of norms, group summaries (the mean or median) or the objectives mastered
- The combination of scores, which obscures the different types of learning outcome represented by the separate scores
- The combination of scores where the variation for each component is different
- The distortion of marks by the type of assessment and the actual subject discipline studied
- The distortion of resulting degree classifications by the application of idiosyncratic institutional rules (ibid, pp. 233 - 234).

Rust asserts that whatever the reasons for such bad practices, any change will not come easily and will, in his estimation, require vigorous campaigning. Should such campaigning be the focus of any change? Or is there a possibility that by incorporating ICT into assessment the new broom might sweep clean? It would be naïve to think that by simply changing the medium of assessment to a computer-based medium, pre-existing problems might disappear and while this review has already examined some of the areas where ICT already impinges on assessment, the use of ICT in assessment is the dedicated focus of this final section.

2.6 What is the role of ICT in assessment?

Should ICT make assessment more efficient, more meaningful, more cost effective, more challenging, easier, more satisfying, more enjoyable? Employing ICT again raises questions about what the purposes of assessment are. How successful has ICT been where it has been deployed? Blin & Munro
(2007) report on an analysis of the transformation of teaching practices following the deployment of Moodle as a university-wide VLE in Dublin City University in 2004. The analysis focused on how much disruption of established teaching practices took place subsequent to the widespread introduction of Moodle and concluded that:

there is little evidence of significant impact on teaching practices (Blin & Munro, 2007, p. 476).

In spite of this assertion, the literature contains many examples where the evidence is more positive. The opportunities or benefits of ICT in assessment are highlighted in a report on two case studies, by Nicol (2007b) in which he argues that the advances in ICT should encourage greater and more diverse use of formative assessment in higher education and that the purposes of formative assessment, and of the feedback inherent in that model of assessment, should include the development of learner self-regulation, thereby increasing the probability of individual academic success. Both case studies, conducted with first-year students in two different departments at the University of Strathclyde in Scotland, were part of The Re-engineering Assessment Practices (REAP) project funded by the Scottish Funding Council which aims to increase university retention and completion rates and foster a greater appreciation of lifelong learning.

The first case study involved 78 of the available 550 first year psychology students who volunteered to take part in the pilot project although the study does not indicate what benefits these students gained from volunteering nor is there an indication of how the output from the involvement in the pilot was graded. This involvement was by way of an online discussion forum where in groups of not more than six, students composed answers to three progressively more complex questions, each answering the first question individually in 50 words, posting a group response to the second question in 100 words after engaging in online discussion and similarly answering a third question but in 300 words. Feedback was by means of access to a model answer written by the teacher and available after each answer was submitted.
The second case study investigated the use of electronic voting systems, used in combination with MCQs and certainty-based marking (CBM – this is referred to elsewhere as confidence-based marking) to provide feedback to 260 first-year students of Interactive Mechanics in the Department of Mechanical Engineering. In this study, referred to earlier (Nicol, 2007a), the statistical results of an assessment are displayed as a bar-chart to encourage group discussion before re-taking the assessment.

In both case studies, Nicol evaluates the potential of the feedback to encourage improvement through self-regulated learning by measuring how comprehensively they satisfy the seven principles of good feedback practice (Nicol & Macfarlane-Dick, 2006) and concludes that the methods used are working very successfully. Nicol further concludes that the potential of ICT to support formative assessment and feedback should not be under-estimated and that:

> The ability to monitor, critically assess and correct one's own work is a key goal of HE and of lifelong learning. (Nicol, 2007b, p. 670)

Neither of these case studies would have been possible without the assistance of ICT and both highlight benefits to students especially in relation to the immediacy of feedback from formative assessment. Is this sufficient reason to incorporate ICT into the assessment process to a greater extent?

With the advent of more available as well as more reliable technology, there are moves to use the technology more in order to measure how much learning is taking place. This raises questions with regards to the validity and reliability of the assessment, especially where there appear to be differences in the results obtained between computerised assessment and conventional testing. Horne (2007) reports on three separate small-scale studies to investigate gender differences in literacy tests in different regions of England and Wales.

In each study, involving cohorts of 71, 126 and 45 pupils chosen at random from the school register, the participants completed either the Lucid Assessment Systems for Schools (LASS) Secondary (studies 1 & 2) or the
LASS Junior (study 3) computerised test and an equivalent conventional test with an interval of four weeks (studies 1 & 3) or eight weeks (study 2) between the administration of the two types of test. The results show that there were no significant gender differences found on any of the computerised tests and that where significant gender differences existed in the results of the conventional tests, the differences always showed female pupils outperforming their male counterparts. This gender difference was particularly evident in the spelling module of the conventional tests across all three studies.

There is much discussion about whether or not gender differences in computer interest, or interest in using computers, exist and Horne investigates if such differences could possibly account for the disparity between computerised and conventional testing:

It could be suggested that fully computerised tests are more objective than conventional assessment and less susceptible to gender bias. However, it is more likely that the interaction with a computer in the studies has enhanced the motivation of the boys more than that of the girls and this could have compensated for (or masked) gender differences in performance. Several studies have shown that boys globally use ICT more both at home and at school… (Horne, 2007, p. 52)

Horne concludes that the disparity of results between computerised and conventional assessment may be due to differences between males and females in motivation, computer experience and competitiveness but that further large-scale studies are needed to establish if these findings are generalisable. Are girls unfairly disadvantaged when assessment is mediated through technology? Are boys more digitally literate? Will girls become more digitally literate with practice? Should the question of gender bias be considered in all studies where technology is used as part of the assessment process? Horne’s study suggests that there may be a problem of girls being unfairly disadvantaged when computer based assessment is used to assess learning compared to more conventional methods of assessment.

The need to encourage deep learning using active learning techniques was the driving force behind a study by Sitthiworachart and Joy (2007) to investigate web-based peer-assessment in an undergraduate computer programming class. This investigation, involving 213 first year undergraduate students enrolled on
a first year UNIX programming module in the Computer Science department of the University of Warwick, in the UK, questioned students ability to grade their peers work using ICT to maintain anonymity. This use of ICT to maintain anonymity enabled each student and a peer-marker to discuss the reasons for a particular level of marking in real-time, thus increasing the learning of both while overcoming the possibility of friendship marking (Sitthiworachart and Joy, 2007, p. 230). As part of the research, each peer-marker completed an online questionnaire at the end of each assignment and these data were supplemented by interviews.

Each script was marked by three students and each student was given three scripts to mark with a penalty imposed for failing to complete the marking assignment. Peer marks were then subjected to further scrutiny so that a student’s grade reflected the ability to mark as well as the ability to write a computer program. Two tutors also graded each script and the study reports on the investigation of the differences between the tutors’ marks and peer marks in detail.

Sitthiworachart and Joy conclude that the process of marking each other’s work, together with the task of evaluating the quality of marking of their peers, provided the students with the opportunity and ability to develop their own critical judgement skills and to take the assessor role seriously (Sitthiworachart and Joy, 2007, p. 230). The anonymity provided by the process being web-based, ensured that students were not embarrassed in highlighting others’ mistakes (no peer-pressure or friendship-marking) and encouraged them to participate due to the perceived fairness of the system. The results suggest that a web-based peer-assessment system can help students to develop the ability to make evaluative judgements as well as promoting deep learning.

This study opens a number of possibilities with regard to assessment becoming more integrated with learning (Rust, 2007, p. 229), students developing deep learning skills (Kirby and Downs, 2007, p. 477), learners being exposed to new learning opportunities (Rust, 2007, p. 232), spreading the burden of assessment (Conole & Warburton, 2005, p. 17) and the reality of using ICT to
assist in the assessment of conceptual learning. The possibility also exists that blind peer-marking could reduce the overall cost of assessment, thereby offsetting one of the costs of more widespread availability of learning.

The question of the potential of the use of formative assessment in an e-learning environment, investigated by Miller (2009) in an earlier section, from the perspective of students choosing one of four different types of feedback, is also investigated by Wang (2007) in which he differentiated students as having field dependent and field independent cognitive styles (Witkin, 1950). The 503 participants (seventh grade students, not defined by age) were evenly matched by gender (260 male and 243 female) as well as by cognitive style (256 participants in the field independent group and 247 participants in the field dependent group) where cognitive style was determined using the Hidden Figures Test (Educational Testing Service, 1962).

Wang states that the major purpose of the research was to examine the potential benefits of a new web-based formative assessment, which he has developed and which he terms Formative Assessment Module of the Web-based Assessment and Test Analysis System (FAM-WATA), on student learning. In support of the value of using meaningful feedback generated through formative assessment, Wang cites the work of Bransford et al. (2000, p. 141) that “students can improve weaknesses in learning and thinking, increase and transfer learning, and value opportunities to revise” (Wang, 2007, p. 172). In order to evaluate the FAM-WATA, two other types of formative assessment were used as controls – paper-and-pencil test (PPT) and normal web-based formative assessment (N-WATA) with the participants being divided randomly between the three: PPT – 149, N-WATA – 178 and FAM-WATA – 176.

The system (FAM-WATA) allows learners to challenge and evaluate themselves using six main strategies – 1. Repeat the test, 2. Correct answers are not given, 3. Ask questions, 4. Monitor answering history, 5. Query scores and 6. All pass and then reward.

The results show that in terms of learning effectiveness, the FAM-WATA group performed significantly better than both the N-WATA group and PPT.
group while the N-WATA group performed better than the PPT group, although not significantly so. A similar trend was observed when the results were examined by cognitive-style group but it is clear that the field independent students gained most from exposure to the FAM-WATA. Wang concludes that the FAM-WATA significantly improved learning effectiveness and that this was due to the additional instructional strategies embedded in the FAM-WATA but he does admit that this assertion needs further investigation.

While Wang has used the immediacy of a web-based formative assessment system to generate immediate feedback, Tsuei (2007) reports on a study where as part of the research into the development of a web-based curriculum-based measurement system (ECBM), the newly developed system was administered to 134 third-grade students (9 and 10 year-olds) in Taiwan during 2004/2005. The system has the potential to ensure that teachers spend less time on the administration of assessment, allowing them more time to teach. Tsuei also refers, in her report, to testing the reliability and validity of the ECBM on a further group of 163, ten and 11 year-olds, but does not discuss that dataset in any great detail. In the report, Tsuei claims that the anticipated requirements of such a system were that it would generate different types of mathematics tests, track students’ progress against a set curriculum and provide diagnostic information as well as instructional suggestions for teachers.

Tsuei suggests that the components that make up her ECBM include a mathematics curriculum-based measurement (CBM) item bank (every question from two maths text-books categorised as problems related to computation, concept or application), a test-related database (to include a teachers’ strategies database, a students’ database, a CBM tests database and an item bank database) and a CBM performance diagnostic system to provide teachers with both qualitative and quantitative information.

The research questions addressed in the study were:

How are the new features of ECBM for general educators used in class-wide ongoing assessments? What are the effects of using different types of CBM math tests and growth models on students’ mathematical achievements in the general classroom settings? (Tsuei, 2007, p. 53)
The 134 participating pupils in four class groups were assigned to groups with different types of CBM tests and different types of growth modeling (the CBM tests were either single-type or mixed-type and the modelling groups were either dynamic-growth or linear-growth) and it was within these groupings that the potential effects of ECBM were measured.

Tsuei concludes that it appears that students gain more mathematics proficiency by using mixed-type CBM tests than they do with single-type CBM tests and that the optimum gains were achieved when teachers used class-wide dynamic-growth modeling combined with mixed-type tests. As with all technology, teachers will adopt or reject changes in classroom management in terms of perceived benefits and in favour of ECBM, Tsuei claims:

ECBM was important for educational practices in that it freed teachers from the time-consuming tasks. It automatically generated CBM tests, administered scores, analysed and diagnosed students’ math performance and provided instructional suggestions. In addition, consistency in measurement across tests was enhanced, and the amount and quality of information teachers received was increased. (Tsuei, 2007, p. 51)

and concludes that innovative ideas in technology-based assessments provide benefits to both pupils and teachers. Such innovative use of ICT to reduce the amount of time teachers spend creating and administering tests as well as providing immediate feedback in the form of suggestions for future learning seems to be a very high recommendation for incorporating more rather than less ICT into assessment.

Miller (2009) also makes a strong case in favour of the efficacy of more use of ICT in assessment;

The union of formative assessment theories and CBA has produced a new assessment instrument that focuses on providing feedback to support student learning while capitalising on advances in computer technology. (Miller, 2009, p. 181)

although she does caution that students’ understanding of how to effectively use feedback, in relation to their lack of familiarity with the technology (ibid,
p. 190), might militate against the usefulness of providing the feedback in the first place, a point which echoes the sentiments of Crisp (2007, p. 578).

2.6.1 Negative aspects of using ICT in assessment

The question of there being negative aspects to using ICT in assessment was investigated. The costs, both in terms of time and financial resources, of observing student-teachers during teaching practice are quite high. This is especially true, from the perspective of time lost in reaching the remote location, if the classroom is in a school that is geographically remote. In a study into the use of synchronous digital video for observation, feedback and assessment of teaching practice, Dyke et al (2008) report on 25 observations of teaching and the descriptions and grading of lessons by remote observers compared with those of observers in the classroom. The research, which was undertaken as part of an initial teacher training pilot scheme, used the University of Southampton network of partnership centres to better understand the use of digital video to facilitate the remote observation of teaching. The project aimed to develop operational policy, procedures and recommendations for remote observation, analysis and feedback of teaching performance with the objectives of developing operational policy and procedures and evaluating the use of digital technology.

The system incorporated two cameras which could be controlled remotely by the observers, an omni-directional microphone and a monitor so that the observers could be seen at all times. The importance of the system being seen to be a two-way communication channel rather than a means of surveillance cannot be over-emphasised. The study compared an online observer’s observations with those of an appropriately trained observer in the classroom. The consultative process included a questionnaire completed by 118 trainee teachers, 22% of whom refused to take part in the process under any circumstances and this resulted in a detailed checklist of procedures being compiled. While claiming that a detailed technical specification was beyond the scope of the study, the authors highlight the importance of using compatible versions of the call management H.323 protocol.
Dyke and his colleagues conclude that the use of synchronous online observation is a viable alternative to face-to-face observations but emphasise the need for the on-line observer to know the teachers and to understand the organisations in which they teach, however, they recognise that online observation has limitations compared to in-situ observation when they ask:

Is it more difficult to place the learning in context when you arrive in a lesson by virtue of a conference call from the higher education institution? How important is it for the observer to walk across the playground, to engage in conversations in the staff room and absorb the culture of the corridors? To what extent do these experiences acclimatise the observer and enable informed judgements to be made? (Dyke et al, 2008, p. 43)

The implication is that ICT can fail to capture contextual issues, which raises the question of whether assessment should be completely objective or if some level of subjectivity might be beneficial but the authors contend that such issues should not preclude further use of this method of using ICT to enable assessment.

Having previously identified benefits of using ICT to enhance assessment, what factors preclude the universal adoption of the technology? Barker et al (2008) report on two online surveys undertaken during May 2008, in the University of South Australia, which attempted to determine which elements of paperless assignments were successful and why the system was not more fully used. In the student survey, 137 out of 1507 potential students responded, which lead to 128 useable responses while 38 staff out of a potential 92 responded. Student attitudes to paperless assignments were overwhelmingly positive with the exception of the quality and quantity of feedback they received from tutors (which is probably a reflection of staff dissatisfaction with the system) with the majority of students wanting more than just the official feedback form. For the most part, students wanted the system to be used more across the university.

The responses from staff indicated that the expectations from the 1990s of using the technology to manage the collection, marking and return of student assignments had not been met, with no more than 37% of staff using the
system as anything more than an electronic drop box. It is quite possible that many of the problems identified as issues by staff:

… eye strain, followed closely by neck and back pain as well as stress on shoulders and elbows … (Barker et al, 2008, p. 54)

could be resolved by some additional training in such basic features as changing font-size, using a customised zoom-view and text-to-speech features.

The issue of lack of familiarity with the technology is also mentioned:

… however technology literacy appears to be the major obstacle with this online submission system and the ability to mark online … (ibid)

and while a large number of comments from staff dealt with the lack of ability to utilise such recommended strategies as using change tracking, inserting comments in students’ work or typing feedback in a different font or colour, the ready availability of non-judgemental help-desk should not be underestimated. The authors conclude that until such time as these issues are resolved, electronic management of assessment (EMA) will continue to “mark time”.

This conclusion is a far-cry from the optimism that accompanied the initial enthusiasm for greater use of ICT in assessment during the decade from the mid-nineties but does reflect to some extent the degree to which that enthusiasm has failed to translate into widespread adoption of technology enabled assessment (Conole & Warburton, 2005, p. 28). While recognising that the uptake is less than widespread, a clear majority of the literature attests to the benefits to learners of more immediate feedback, the increased learning opportunities afforded by peer-assessment and self-assessment, the potential of collaborative assessment to be more enjoyable and less anxiety provoking, the advantages of using assessment to facilitate more learners adopting a deep learning rather than surface learning approach and the potential of continuous assessment to reduce some of the test-anxiety provoked by formal end-of-course written examinations all of which are made possible or more readily available with the aid of ICT. An antipathy to change on the part of
teachers/tutors will only be overcome either when the perceived benefits outweigh the costs (Doyle & Ponder, 1977, p. 9) or change is imposed by administrators constrained by ever-dwindling resources.

2.7 Chapter Summary

In this chapter the published work of other researchers investigating the assessment of learning, and how the introduction of ICT has affected or is likely to affect existing models of assessment is reviewed. The review grappled with various definitions of assessment before accepting that its multi-faceted nature defies narrow definitions. Attempts to categorise some of these facets led to a delineation of different methods of assessment which appear to encourage surface learning over deep learning although most commentators appear to agree that deep learning is better learning and should therefore be encouraged more (Tian, 2007, p. 392; Crooks, 1988, p. 447).

The dichotomy of formative versus summative assessment was examined in detail with the result that while the advantages of formative assessment are many and varied, summative assessment continues to be widely recognised as the biggest single influence on what is learned (Haigh, 2007, p. 458). Whether or not formative assessment and summative assessment should be combined in a single assessment instrument is hotly disputed throughout the literature but it appears that dynamic assessment, in which the assessment is completed in class and incorporates collaboration as well as confidence rating, can successfully combine these two types of assessment (Sainsbury and Walker, 2007, p. 109).

The problems associated with implementing relatively recent forms of assessment such as peer-assessment (Sitthiworachart and Joy, 2007; Vu and Dall’Alba, 2007), self-assessment (Kirby and Downs, 2007; Taras, 2008) and portfolio-assessment (Kuisma, 2007) are examined with a recognition that the most important single aspect common to these last three and becoming more relevant to all forms of assessment, is the issue of assessment criteria. The relative importance of learners acquiring a thorough understanding of the
criteria of assessment is cited frequently throughout the literature and is likely to become even more important as more innovative forms of assessment become more prevalent (Vu and Dall’Alba, 2007; Kirby and Downs, 2007; Taras, 2008; O'Donovan et al, 2008).

This chapter also looked at the increasing use of ICT in the assessment process. There appears to be agreement in the literature that one of the biggest advantages of any assessment being computer-based or computer-assisted, is its immediacy. This immediacy appears to be particularly relevant when the assessment is formative as the advantages to the learner of getting feedback sufficiently early for the feedback to be acted on cannot be overstated (Miller, 2009, p. 182). The literature also looked at the apparent negative aspects of attempting to railroad assessment to make it amenable to being used with ICT (Dyke et al, 2008; Barker et al, 2008).

The relevance of this review of the literature is acknowledged in the framing of this study and reflected in the next chapter on the description of the methodology used.
3 Methodology

3.1 Introduction

This study was undertaken in an attempt to investigate the extent to which first year undergraduate pre-service teachers were willing to engage with a self-directed, online course on ICT in education that included both online formative assessment as well as online summative assessment and to what extent that engagement changed students' attitudes towards ICT as a tool to enhance teaching and learning.

These initial questions were expanded as a result of questions and other topics that emerged from the research to include:

- How is assessment related to learning?
- What factors militate against a course being run online, especially when the course includes both formative and summative assessment?
- Were there factors that discriminated against sectors of the cohort?
- What is the role of ICT in assessment?
- What competences indicate computer literacy?

3.2 Discussion of overall methodological approach

In determining which research methodology might best help to answer the research questions, it was decided to use an exploratory case study. Cohen et al (2007, pp. 254 – 255) citing Yin (1984) identify exploratory case studies as “a pilot to other studies or research questions” (Cohen et al, 2007, p. 254) but equally quote Adelman et al (1980) cautioning against “using case studies solely as preliminaries to other studies” arguing that “case studies exist in their own right as a significant and legitimate research method” (ibid, p. 255).

Further arguments in favour of case study as a legitimate research method include Sturman’s (1999, p. 103) assertion that rather than being a loose connection of traits, a distinctive aspect of case studies is that human systems
have a comprehensiveness that warrants in-depth investigation, and Hitchcock & Hughes’ (1995, p. 316) proposal that case studies are distinguished less by the methodologies that are employed than by the objects which are explored. This study is an attempt to capture the wholeness of the extent to which the participants were willing to engage with a self-directed, online course as an alternative means of presentation of content and the assessment of that content using both formative assessment and summative assessment. Case study was chosen because the observer did not have, nor did he wish to have, control over the events. The course with its online tools was made available for students use. It was not known in advance how well the students would engage with the content, whether the formative assessment would be used or ignored, whether those who used the formative assessment would take cognisance of the feedback and whether the extent to which students reflected before answering the open-ended questions would be evident in their answers.

Case study methodology may be likened to the effect of throwing a pebble into a calm pond. The pebble will cause many ripples to radiate from the point of impact and the responsibility of analysing and reporting on the effects of the ripples is that of the observer. Cohen et al (2007, p. 254) caution on the danger of the observer over-interpreting the observed events and situations in the case study, and suggest that the events and situations be allowed to speak for themselves. It is important that the researcher be aware of the tendency to bias in interpreting the data and recognise the responsibility to present the data in such a way that the reader can see for themselves how the researcher came to a particular conclusion. In other words, the reader must be in a position to check the author’s interpretations.

Cohen et al (2007, p. 254) cite Geertz (1973) in portraying the rich vivid description of events relevant to a case study as “thick description”. Blending such a description with the analysis and interpretation of the events and situations relevant to the case is a defining characteristic of case study especially when the data gathered focus on the participants of the case and seek to present their perceptions of events and situations being investigated. There is however a danger that inference may be mistaken for knowledge and
Cohen et al (2007, p. 257) citing the work of Dyer (1995) caution that it is the duty of the researcher to discriminate between these two so that the reader is not led astray. In suggesting that case studies “strive to portray what it is like to be in a particular situation”, Cohen et al (2007, p. 254) propose that this portrayal is more likely to be optimised by employing many types of data. This optimisation was achieved in the present study by requesting that each participant complete online questionnaires at the commencement and end of the study, by observation of the students by the tutor, by analysing each student’s submitted content in response to open formative assessment questions, by the students’ summative grades and student participation in an open, semi-structured discussion forum which was audio recorded.

The data collected were both quantitative and qualitative.Twenty six questions were posed in the pre-study questionnaire (Appendix 2), which was completed after students read a brief introduction to the course (Appendix 4) and before any course content was accessed. Ten of the questions were open-ended (including student’s name), thus seeking qualitative data, two dichotomous questions – one to determine the student’s gender and another to determine if the student had previous experience of using computer-based assessment while the remaining 14 questions were multi-level using three or four point Likert response scales. Student responses to these questions were intended to provide a baseline of knowledge, competences, skills, abilities and opinions as well as providing a baseline against which to measure changes in awareness of and attitudes towards ICT as a tool to enhance teaching and learning.

In the post-study questionnaire (Appendix 8), which was administered after the online summative assessment but before the group discussion, of the 27 questions posed 11, were open-ended, four were dichotomous and 13 were multi-level using three, four or five point Likert response scales. The student responses to this questionnaire were intended to give an indication of students’:

- level of engagement with the online course;
• level of satisfaction with the course and how relevant they found it;

• level of enjoyment of online learning and assessment as well as looking for critical feedback which might lead to improvements in how the course would be presented and assessed in the future.

Both questionnaires were piloted with two previous cohorts of first year student teachers and changes to the composition of both reflect the quality of data collected during those iterations.

The formative assessment tasks available online were made up of eleven objective tests, providing quantitative data and eleven essay type questions which provided qualitative data. These qualitative data in particular were referenced as corroboration for some of the tutor’s observations. The summative assessment which consisted of ten MCQs drawn at random from an item bank (Appendix 7) provided quantitative data and these were used extensively when comparing student use of the LMS (including completion rates) as well as perceived changes of attitude. Student contributions to two online discussion fora provided further qualitative data as did the open discussion groups held with each class.

The tutor’s observations were unstructured and informal inasmuch as the tutor avoided all opportunity to employ didactic teaching methods, strongly reflecting the tutor’s status as a participant in the study (Cohen et al, 2007, p. 258). Cohen et al (2007) refer to two principle types of observer, the other being non-participant observers and further refer to different types of case study in relation to both the type of observer as well as the level of covertness (or otherwise) of the observer. In the current study, the observer made no attempt to cover his observation, using the introduction to the pre-study survey to introduce himself and his research and re-iterating his interest in learning at every opportunity, making frequent reference to the teacher-as-learner paradigm.

This concept of observer-as-participant is reflected in the research design in that the tutor encouraged students to make frequent use of the Internet to find new material and to feel free to ask for guidance at any time. Being conscious
of the possibility of individual lethargy, the tutor frequently responded to students’ queries with further questions. It is also acknowledged that while there was only a single observer and that the tendency for observer bias cannot be eliminated, it is emphasised that the tutor’s observations were only one of the many research tools already mentioned and that the research data is not overly reliant on either the researcher’s observations or any other single research tool.

3.2.1 Strengths and weaknesses of case study

In examining the claimed strengths and weaknesses of case study, reference is made to the summary of possible advantages adapted from Adelman et al. (1980):

- Case study data, paradoxically, are ‘strong in reality’ but difficult to organize. In contrast, other research data are often ‘weak in reality’ but susceptible to ready organization. This strength in reality is because case studies are down-to-earth and attention-holding, in harmony with the reader’s own experience, and thus provide a ‘natural’ basis for generalization.
- Case studies allow generalizations either about an instance or from an instance to a class. Their peculiar strength lies in their attention to the subtlety and complexity of the case in its own right.
- Case studies recognize the complexity and ‘embeddedness’ of social truths. By carefully attending to social situations, case studies can represent something of the discrepancies or conflicts between the viewpoints held by participants. The best case studies are capable of offering some support to alternative interpretations.
- Case studies, considered as products, may form an archive of descriptive material sufficiently rich to admit subsequent reinterpretation. Given the variety and complexity of educational purposes and environments, there is an obvious value in having a data source for researchers and users whose purposes may be different from our own.
- Case studies are ‘a step to action’. They begin in a world of action and contribute to it. Their insights may be directly interpreted and put to use, for staff or individual self-development, for within-institutional feedback, for formative evaluation; and in educational policy-making.
- Case studies present research or evaluation data in a more publicly accessible form than other kinds of research report, although this virtue is to some extent bought at the expense of their length. The language and the form of the presentation is (we hope) less esoteric and less dependent on specialized interpretation than conventional research reports. The case study is capable of serving multiple audiences. It reduces the dependence of the reader upon unstated implicit assumptions and makes the research process itself accessible. Case studies, therefore, may contribute towards the ‘democratization’ of decision-making (and knowledge itself). At its best, they allow readers to judge the implications of a study for themselves (Cohen et al, 2007, p. 256).

Cohen et al. (2007, p. 256) also list the strengths and weaknesses of case study from Nisbet and Watt (1984) and this research is examined with regard to that
list. The strengths include that the report is written in everyday, nonprofessional language thus making the results more easily understood by a wide audience (including non-academics). Unique features (such as all students not having 24/7 access to the Internet) that might hold the key to understanding the situation are highlighted and there is a danger that such features might be lost if larger scale data were used. The surveys and open-ended questions looked for the participants’ opinions, data that is strong on reality unless it is assumed that students were being less than truthful. It is contended that the cohort is more or less representative of first-year undergraduates and as such they provide insights into the experiences and abilities across all first-year programmes in the university as well as throughout the country. The research was undertaken by a single researcher. The extent to which students engaged with the course was an uncontrolled variable and while there was no anticipation of how comprehensive that engagement would be, it turned out to be an integral part of the research. It is hoped that the results are immediately intelligible and that although inferences are drawn, it is contended that such inferences are supported by the findings.

The weaknesses from the Nisbet and Watt (1984) list (Cohen et al, 2007, p. 256) include an acceptance that the results may not be generalisable although it is contended that they can provide guidance for further research. The research is not easily open to cross-checking, which suggests that it may suffer from selectiveness, bias and subjectivity although every effort has been made to avoid these pitfalls. Equally, the problem of the research being prone to observer bias is acknowledged although the observer’s awareness that this possibility existed and was resisted should also be recognized.

Cohen et al (2007, p. 253) suggest that case studies are set in contexts that enable boundaries to be drawn around them. In this study, the cohort itself set the boundaries. All first-year student-teachers were required to take the course which was one element of EN4002, a multi-element module, and the inclusion of the whole cohort obviated the need for sampling. Although far from homogeneous, the cohort was composed entirely of first-year student-teachers and the lack of homogeneity is examined in the Findings chapter.
3.3 The data

3.3.1 Data gathering

Three hundred and three (303) students were registered to participate on the module, which ran from February to May in the Spring semester and 289 of these sat the online, summative assessment. The changes to the module reported here were a modification of the first steps in the development of a completely revised module begun in 2004. The research methodology designed to evaluate the module had two main aims, it firstly aimed to gauge students’ level of participation in the e-learning platform used as part of the programme which was achieved by examining students’ use of the online formative assessment inherent in the online content and secondly the research aimed to explore the impact of the programme on the students’ attitudes towards ICT as a tool in teaching and learning.

Prior to commencement of the module all students were requested to complete an online questionnaire. This sought information about the module participants such as age, gender, education background, students’ perceived level of ICT skills, current use of ICT and their experiences of using ICT at post-primary level.

Throughout the course of the project, students’ participation was monitored. Access to and use of the LMS was recorded through the system logs throughout the semester, providing evidence of frequency of visits to each page, length of time spent on each page, frequency with which tasks were attempted and response to each task. In addition, problems experienced by students and other queries were recorded as part of the research. On completion of the module all students were invited to complete a second questionnaire. This garnered feedback on their experience of the e-learning platform and course content, their opinions of the supporting LMS used and their opinions on the relevance of the course material and activities. The other elements of the survey sought the participants’ views on ICT in education, their opinions on its possible use in their subject areas and what further
training needs, if any, they determined might be of benefit to them. A further important aspect of the post-study survey was that it gave students the opportunity to give feedback on their impressions, satisfaction and enjoyment of the course.

The pre-study survey was completed by 286 participants, the post-study survey was completed by 281 participants, with 275 students completing both, although the 293 students who completed at least some of the tasks in the online course form the cohort. The findings are based on collated data from both questionnaires, students’ responses to the questions poses in the online formative assessment, the students’ grades achieved in the online summative assessment, transcripts of the open discussion groups, the researcher/tutor’s observations and ongoing records of students’ participation in the module as gleaned from the daily logs which are an inherent feature of the LMS.

3.3.2 Data analysis

The large amount of qualitative data from the pre-study and post-study questionnaires was initially read to determine what common themes they contained. The themes that did emerge within each individual question were subjected to manual coding to facilitate analysis. The manually coded qualitative data were then combined with the quantitative data before being analysed using SPSS 16.0 for Windows, which was used to extract frequencies for each question on the two questionnaires and to cross-reference specific questions. Access times for each of the online tasks were extracted from the tracking facility of the LMS and were similarly analysed using SPSS.

3.4 Validity of the research methodology

In an attempt to ensure that evidence is valid, Cohen et al (2007) emphasise that triangulation can be a useful technique where a researcher is engaged in a case study (Cohen et al, 2007, p. 143), although they also advise that case studies do not have to demonstrate the positivist view of reliability that applies to other forms of research (Cohen et al, 2007, p. 257). On the basis that
triangulation is a method of ensuring validity, Bassey (1999) concurs with this latter viewpoint:

The concepts of reliability and validity are vital concepts in surveys and experiments – but not in case study research (Bassey, 1999, p. 74).

Despite Bassey’s contention that the need for reliability and validity is not vital to case study research, the present study sought to optimise its validity by employing many types of data such as questionnaires, students’ submitted content, students’ summative grades, the transcription of semi-structured discussion groups as well as the tutor’s observation of the students.

3.5 Ethical considerations of the proposed research

Several ethical questions were considered over the course of the study. During the initial computer lab, all students were invited to participate in the research by completing the pre-study, online questionnaire. Students were informed that the information was strictly confidential and would be used solely for research purposes. It was emphasised that the inclusion of students’ names was discretionary but that it would be helpful in the correlation of the post-study questionnaire. A guarantee was given that students names would not be included in any published data and that any comments quoted would be presented anonymously.

During the final computer lab session for each group, all participants were again invited to participate in the discussion group. The purpose of the discussion was outlined and the participants were invited to opt out of the discussion either by leaving the room or by feeling free to not contribute. Permission was given to record the discussions and students were assured of anonymity and confidentiality.
3.6 Chapter Summary

This chapter provides the rationale for using exploratory case study methodology to seek answers to the specific research questions posed in the introductory chapter. The research tools used to collect data from the students as well as about their level of interaction with the LMS are described and the methods used to extract and analyse the data are explained. Issues of validity and reliability as well as ethical considerations were also examined.

The next chapter describes the findings in terms of the participants, their engagement with the course and to what extent the engagement with the course changed their attitudes to the usefulness of ICT in education.
4 Findings

4.1 Introduction

This study examined two research questions. The primary research question was to determine the extent to which first year undergraduate pre-service teachers were willing to engage with a self-directed, online course on ICT in education by utilising online formative assessment as well as online summative assessment. The secondary research question was to determine to what extent students’ engagement with a self-directed, online course on ICT in education had an influence on their attitudes towards ICT as a tool to enhance teaching and learning.

The first section of this chapter describes the results of the investigation into the primary research question. The first subsection describes the participants in this study and investigates their perceptions of themselves as well as their knowledge, skills and abilities. This is analysed from the perspective of how those perceptions, knowledge and abilities have an influence on how much the students can benefit from computer-based, self-directed learning which includes online formative assessment as well as summative assessment and how ICT can be used as a tool to enhance teaching and learning.

The second subsection analyses how the participants were introduced to the course and charts their first tentative steps within the concept of self-directed learning while the third subsection looks at the face-to-face elements of the course with particular emphasis on how students applied reflective practice to their investigations of four genres of software in common use in education.

The fourth subsection investigates the participants’ engagement with the course both from a quantitative perspective – which tasks were attempted and completed, which tasks were re-visited, comparing level of engagement in relation to summative grade achieved as well as by responses to the pre- and post-study surveys and from a qualitative perspective by examining the content of students’ responses to the open questions in the course. The
researcher’s observations permeate and inform all sections in this chapter, but never as a primary source.

The second section of this chapter describes the results of the investigation into the secondary research question by documenting perceived change.

After the initial presentation of the online course in 2005, a concern was raised that there was little evidence that deep learning had taken place and it was decided that it would be beneficial if it could be shown that some level of deep learning had taken place, if this was the case. Accordingly changes were made to the presentation and assessment of the course content with the intention of ensuring that students would need an understanding of the material rather than using simple recall to complete the assessment. The mechanisms used to achieve this outcome included multiple choice questions with at least one detractor that was very similar to the correct answer, formula scoring and an exercise, unique to the medium, of critically analysing a particular web page presented from three different perspectives.

The changes made caused more problems than they solved, with the formula scoring in particular being cited as particularly cruel and heartless by the student-deputation who demanded remedial action from the course director. Changes were again made before the 2006/2007 implementation and being conscious of the negative reaction to the formula scoring, continuous assessment was discontinued in favour of an online, invigilated end-of-course test. While the 2006/2007 cohort is the subject of the current study, the course was also presented the following year and elements of the findings with regard to the 2007/2008 cohort are referenced in the Discussion chapter.

4.2 Primary Research Question Findings

4.2.1 The participants

Who were the students? Initially, 303 students were registered for the course and 289 of those completed the online, invigilated assessment although the
293 students who completed at least some of the online tasks form the cohort, as reported in the Methodology chapter. The pre-study survey was completed by 286 participants, the post-study survey was completed by 281 participants with 275 of these students completing both questionnaires.

These findings are based on collated data from the two questionnaires, the ongoing records of students’ participation in the module, the students’ summative grades, transcriptions of the audio recordings of the post-test group discussions and the researcher’s observations. The diversity of the cohort can be seen across many headings including age, subjects studied at school, level of engagement with the course, ability to take part in discussions and previous versus current and anticipated use of the technology.

![Figure 4.1 – Age profile of cohort](chart)

The age-profile of the cohort is shown in Figure 4.1 confirming that the vast majority (87.4%, n = 256) are school-leavers, 10.2% (n = 30) are mature-students while no age-profile is available for the seven students who did not complete the pre-study survey. Are some students disproportionately disadvantaged or advantaged by age? Are mature-students in particular disproportionately disadvantaged by having grown up without ready access to computers? Computer use in secondary school is not particularly high with “Never” or “Now and again” accounting for 70% (n = 204) of the cohort but these two categories of use in school account for 100% of mature-students. Is
it a problem that seven of the 12 respondents who consider themselves to be slow typists are mature-students? Neither of these two factors were voiced as problems either during the group discussions or in the comment section of the post-study survey and in terms of summative assessment, mature-students gained a disproportionally large percentage of the 80%+ grades – while mature-students account for 10.2 % (n = 30) of the cohort, they account for 16% (n = 19) of those who gained an 80% grade or better.

In terms of engagement with the course, except for some minor variations, mature-students as a group did not stand out as in any way exceptional within the cohort with the exception that they did have a greater tendency to contribute to group discussions. This tendency to greater verbal contribution as part of a group is probably a reflection of maturity or self-confidence in general and is not considered to be significant to the current study except that if such contribution enhances learning then there may well be a benefit to providing primary and second level students with more opportunities for group discussion.

### 4.2.2 Gender Bias

What differences between males and females influence students’ engagement with an online, self-directed course? Gender break-down of the cohort is 64.5% (n = 189) male and 35.5% (n = 104) female (or approximately 2:1, male:female) but this break-down is not uniform across the age-groups with a higher ratio of female students in the school-leaver category (1.7:1) with the balance favouring males amongst mature-students (2.8:1) as well as the age-unknown category (6:1).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Science</th>
<th>Technical</th>
<th>Science &amp; technical</th>
<th>Neither science or technical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39</td>
<td>39</td>
<td>94</td>
<td>4</td>
<td>176</td>
</tr>
<tr>
<td>Female</td>
<td>84</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>99</td>
</tr>
<tr>
<td>Total</td>
<td>123</td>
<td>41</td>
<td>105</td>
<td>6</td>
<td>275</td>
</tr>
</tbody>
</table>

*Table 4.1 – Leaving Certificate subjects cross-referenced by gender*
Students were asked to list the subjects that they had taken for Leaving Certificate and 275 participants complied. The subjects were categorised into four groupings i.e. one or more science subjects (but no technical subject), one or more technical subjects (but no science subject), at least one science subject and one technical subject and neither a science nor a technical subject. These subject groupings were chosen to try to determine if the greater exposure to ICT of students who took technical subjects at Leaving Certificate level transferred to a greater engagement with the online course as a result of project work completed using ICT. A comparison of these subject groupings shows a preponderance of females taking at least one science subject and no technical subject (68%) while the number of females taking a technical subject (either with or without a science subject) is extremely low at 9% (n = 13), summarised in Table 4.1.

This gender imbalance (as a percentage of all students taking this course) is a reflection of the situation in the programmes being pursued by these students where only 6% (n = 8) of the 129 students doing Engineering teaching or Construction Studies teaching are female while Science teaching (67%, n = 57) and Physical Education (PE) teaching (50%, n = 36) favour female participants. This perceived gender imbalance is not discernable throughout the remainder of the data collected with the exception of typing skills (which is reported separately) and in the summative grade gained in the online assessment. The number of females gaining a 100% grade at 50%, (n = 7) is disproportionate to the gender balance of the cohort and those gaining a 90% grade (44%, n = 18), while less disproportionate at 1.2:1 is more biased towards females than the overall gender ratio of 1.8:1.

When engagement with the course is analysed with reference to gender, a definite bias is noted. Whereas the male to female ratio of the cohort was 1.82:1, the ratio of participants who completed each of the ten online units, that contained an element of formative assessment, varied from 1.7:1 for the first available unit (Ubiquitous technology - Unit 2) to 1.06:1 for the final unit (Benefits of ICT in Special Educational Needs - Unit 9). Table 4.2 shows a steady downward trend in overall participation as the course progressed except
for a renewed spike for Unit 6 (the first unit in Topic 3). More importantly, the
table clearly shows that while participation by female students was decreasing
(except for the spike), it was decreasing more slowly than for males, which
accounts for the changing male to female ratio. The table shows the relative
percentages of male and female students completing each unit, with relevant
student numbers in brackets, and clearly shows the overall decrease in
participation from 265 students for Unit 2 to 165 for Unit 9, a decrease of
almost 38%.

<table>
<thead>
<tr>
<th></th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
<th>Content quiz</th>
<th>Searching quiz</th>
<th>Unit 5</th>
<th>Unit 6</th>
<th>Unit 7</th>
<th>Unit 8</th>
<th>Unit 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>63/167</td>
<td>63/162</td>
<td>61/142</td>
<td>61/139</td>
<td>58/110</td>
<td>55/96</td>
<td>57/120</td>
<td>56/109</td>
<td>55/102</td>
<td>52/85</td>
</tr>
<tr>
<td>Female</td>
<td>37/98</td>
<td>37/96</td>
<td>39/91</td>
<td>39/90</td>
<td>42/79</td>
<td>45/90</td>
<td>44/87</td>
<td>45/84</td>
<td>48/80</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
<td>258</td>
<td>233</td>
<td>229</td>
<td>189</td>
<td>175</td>
<td>210</td>
<td>196</td>
<td>186</td>
<td>165</td>
</tr>
</tbody>
</table>

*Table 4.2 – Percentages completing each task (number of students in brackets)*

Similarly, attendance at the labs dedicated to investigating other educational
software was disproportionately biased towards females with the ratio varying
from 1.62:1 to 1.57:1 but this gender bias reached its apex during the
contribution to the two online discussion fora where female contribution to
both fora exceeded 52% (0.88:1 and 0.89:1).

The possibility that the extent of the gender bias was distorted by the relative
number of students in each of the subject area programmes was also
considered but when the programmes were isolated, the extent of the gender
bias became even more pronounced. The composition of the Science and PE
teacher programmes by gender was 91/64 (or approximately 3/2) female to
male whereas participation (measured by the number of students completing
all ten of the online tasks) was 60/20 female to male and the higher summative
grades achieved (taken as 90% or 100%) was 23/10 female to male.

It is recognised that an investigation of the underlying reasons for the
decreasing rates of participation as the course progressed could be very
informative but the scope of the study did not allow for this or any level of
individual follow-up.
4.2.3 Suitability

How well suited was this cohort to participate in a self-directed, online course? Is prior access to computers, such as during secondary school, reflected in current use? Is a minimum level of competence across a range of computer applications a requirement for successful online self-directed learning? Is successful online self-directed learning subjective or can it be measured as a perceived understanding of the content of a course? Is the ability to sit the online summative assessment an indication of computer literacy? These questions are analysed and discussed in detail in the Discussion chapter and that analysis and discussion is informed by the following findings.

In response to the question (in the pre-study survey) on the frequency of computer use in secondary school, the largest category of “Now and again” accounted for 58% (n = 171) of respondents and when taken together with the 33 participants who claimed to have “Never” used computers in secondary school accounts for 70% of the cohort. In spite of this lack of use at school, 86% (n = 251) of the cohort now claim to use computers either “Regularly” or “Very often” and this rises to 89% (n = 260) in response to frequency of use of the Internet. This points towards a student population at ease with technology if not quite justifying these students being referred to as “digital natives” (Prensky, 2001).

However, being at ease with technology is not of any great benefit if all students do not have access to a computer. This does not arise while students are on campus (in theory at least) but not all students have access to a computer or to the Internet all the time. Those who do not have full access include the 4.8% (n = 14) of the cohort who claim they do not have such access to a computer and the 8.1% (n = 23) who claim that they do not have full access to the Internet. Within these parameters, the question must be raised as to the suitability of presenting a core course online. Is it acceptable that not all students have off-campus access to the course? Are the 23 students who claim not to have any off-campus access to the Internet being discriminated against, or is the fact that the university provides on-campus computer and Internet access sufficient? These 23 students do not stand out as
a group when cross-referenced with the other responses to the questionnaires although it is noted that none of these students were among the 5% (n = 14) of the cohort who received full marks in the summative assessment while at the other end of the scale, 17% (n = 4) of the group gained only a passing grade compared to 8.5% (n = 25) of the cohort as a whole. Neither did any of these students comment adversely about this lack of access, either in the post-study survey or in the group discussions. This lack of access seems not to have detracted from this group’s engagement with the course. The group made up 8.1% of the cohort and maintained this proportional representation plus or minus 1% except for the Searching Quiz where the proportion fell to 5.9% (n = 11) and the discussion forum in Topic 3 where the proportion soared to 13.2% (n = 9) of the 69 students who posted a comment in that discussion forum.

4.2.4 Use of the technology

What do students use technology for? Tutor observation indicates that entertainment is very high on the list of what students use computers for. Sports websites, social networking and Youtube were most commonly observed during class. No restrictions were placed on students’ use of the Internet but in order to encourage responsible use, accountability was encouraged by advising students that accessing any “unsuitable” material would require the student to speak to the class for two minutes on his/her reasons for accessing such material. No definition was given for “unsuitable” material and the tutor never felt the need to apply the sanction. A taste of the type of sites that the students frequented is given in Unit 5 of the online course, in response to the invitation to choose a website and comment on it under specified criteria. In attempting to group the responses to this task thematically, it became obvious that there was only a very low level of homogeneity. A sporting interest was discerned in 24% (n = 40) of the sites mentioned but the variety of sports included soccer, athletics, horse-racing, motor-sport, GAA, basketball, rugby, hockey, gymnastics, water-sports and surfing while soccer and GAA dominated. The other themes that emerged were www.ul.ie (8%, n = 14), social networking sites (11%, n = 19),
youtube.com (a relatively small 4%, n = 7), technology – which included mobile phones, service providers and search engines (12%, n = 20) and news media (12%, n = 20). Three sites related directly to education but the largest proportion (26%, n = 45) were sites of personal interest that did not fit any of the quoted themes, ranging from www.concern.net to http://www.sawdustalley.co.uk/.

When queried on their main use of computers, 53% (n = 174) of the cohort advised that they used them either for email or a combination of email and coursework. A further 13.3% (n = 39) claimed as their main use a combination of coursework and entertainment, 12.6% (n = 37) coursework only and 6.5% (n = 19) entertainment only. A further nine students used computers mainly for research and the remaining eight individuals used them for a combination of entertainment and emailing. No student mentioned taking part in online discussions, contributing to wikis, creating web pages, writing a blog or any level of collaboration that might lead to the creation of a community of practice (CoP).

In order to try to get some measure of the level of computer literacy that they had attained before undertaking this course, participants were asked to rate their own competence across five common applications and while competence was generally found to be good to very good in word processing, email and Internet use, it fell off considerably for spreadsheet and presentation software use as Table 4.3 indicates.

<table>
<thead>
<tr>
<th>Application</th>
<th>Very competent</th>
<th>Fairly competent</th>
<th>Not very competent</th>
<th>Not at all competent</th>
<th>No response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word processing</td>
<td>86</td>
<td>169</td>
<td>27</td>
<td>3</td>
<td>8</td>
<td>293</td>
</tr>
<tr>
<td>Email</td>
<td>82</td>
<td>147</td>
<td>46</td>
<td>7</td>
<td>11</td>
<td>293</td>
</tr>
<tr>
<td>Internet</td>
<td>111</td>
<td>158</td>
<td>12</td>
<td>1</td>
<td>11</td>
<td>293</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>10</td>
<td>95</td>
<td>132</td>
<td>43</td>
<td>13</td>
<td>293</td>
</tr>
<tr>
<td>Presentation</td>
<td>14</td>
<td>108</td>
<td>113</td>
<td>49</td>
<td>9</td>
<td>293</td>
</tr>
</tbody>
</table>

*Table 4.3 – Self-determined competence across five common applications*

These results give a further indication that this cohort cannot easily be described as “digital natives” in view of the revelation of the claimed lack of competence in the use of spreadsheet (60%, n = 175) and presentation software (55%, n = 162) when the responses for “Not very competent” and
“Not at all competent” are combined. The case of the individual who claimed to be “Not at all competent” in his use of the Internet is noted in passing.

A concern frequently raised by detractors of greater use of technology in the classroom is that of data entry – the criticism being that a lack of facility or speed in typing could result in some students being disadvantaged. The responses of participants to the question on typing skills (again self-determined) would give some credence to this argument as only 66% (n = 188) have determined that their own typing skills were either “Very good” or “Good” although only 4% (n = 12) claimed that their ability to type was “Very slow”. This perceived lack of ability is skewed more towards males as the ratio of males to females for “Slow” or “Very slow” typing skills was greater than 5:1 compared to the overall gender ratio of just under 2:1.

4.3 The learning

4.3.1 The first computer lab

The course was presented as a blend of computer-based, self-directed learning using online formative assessment as well as summative assessment, small-group investigation of four distinct types of educational software in a computer lab, an invigilated, online examination and a group discussion. The online element contained ten formative assessment tasks designed to provide a mixture of content relevant to the use of ICT in education as well as two online discussion fora. The computer labs were of two hours duration, limited to a maximum of fifteen students per class, with each student time-tabled for a new lab session every two weeks. The first series of labs, which was attended by 278 students, was used as an opportunity to introduce the students to the LMS - http://paulo.ul.ie/. Without preamble, students were directed to the self-explanatory introduction (Appendix 1) appropriately called How to use Moodle (Read this first). This page explained what was required to successfully complete the course, indicated which assessment tasks were formative and also explained the format of the summative assessment. The explanatory page purposefully did not include any explanation of the purposes
of, or differences between formative and summative assessment. Two situations which prevented students from logging-on to the LMS quickly became apparent - a very small number of students who had registered too late to be included in the spreadsheet from Student Services were quickly added to the system individually and a rather large number of students who insisted on entering their own password instead of the generic "password" as advised by the tutor.

Although the next task was entitled COMPLETE THIS FORM NEXT, most students did not do so automatically, either asking what was to be completed next or waiting to be asked if they had already done so. The form in question was the pre-study survey (Appendix 2) which questioned the participants on a range of topics, competences and opinions.

It was intended that the pre-study questionnaire would provide a baseline of student knowledge, competences, skills, abilities and opinions and it was hoped that the responses would also provided a baseline against which to measure changes in students’ awareness and attitudes.

4.3.2 The tasks

After completing the pre-study survey, students were encouraged to read the following two tasks – “Help” (Appendix 3) and “Introduction” (Appendix 4) before beginning the two lessons – Unit 2 (Appendix 5) and Unit 3 (Appendix 6). Although all 278 students who attended the first lab read the “Introduction” (or at least opened the single page), only 179 of these opened the “Help” page. The full complement who attended the first lab completed Unit 2 but a further ten students who did not attend the lab started the unit but did not complete the associated formative assessment. Only 270 of these students completed Unit 3 even though all 278 of them did open the first page of this task.

Before they started to complete the assessment tasks associated with these two lessons, all students were reminded that the assessment was formative and that they should therefore approach it as being for their own benefit. Students were encouraged to reflect on their opinions in those assessment tasks where their
opinions were sought and they were further encouraged to try to make their submissions as succinct as possible although they were assured that their submissions would be read no matter how long. There was a rich variety of responses and a sample of these responses is given. Unit 2 contained two open-ended questions – “What, in your opinion, are the added benefits of converging a mobile phone with a digital camera? Or perhaps you think that adding digital cameras to mobile phones was a bad move.” and “Will ICT play a role in schools in the future? How do you see the technology being used in schools in the future?” The responses to the first question were overwhelmingly in favour of converging the two items and although no respondent claimed that this was a bad move with no benefits, 21% (n = 60) saw that there were some disadvantages with invasion of privacy being quoted most commonly. The response of one who saw some disadvantages as well as benefits is represented by:

A difficult question to answer! The benefits are trivial and of novelty rather than benefit. Personally, I own a camera/video phone. I really like it, but I've found that my use of the camera has slowly waned over the last few months. If and when I do use it, it is almost exclusively for making funny images and videos. Not to say that I don't enjoy it, but it simply doesn't have a major role in my life...and I struggle to see who indeed needs a phone with a built-in digital camera! So yes, perhaps the introduction of camera phones was a bad idea...privacy is no longer a human right it seems!

while one of the responses that claimed only benefits was:

It is useful to combine these because of the ability to send pictures, and not just voice and text messages to others. This enhances the quality of information we can send via mobile phones. Also, having a camera on your phone means you are more likely to take pictures on the spot - usually people don't carry a camera unless on holidays, but they nearly always have a mobile with them. This has resulted in pictures/movie clips that have captured crimes, although it also might be considered by some as more opportunities for others to invade your privacy. One downside is that I have loads of pictures stored in my camera doing nothing - whereas I used to always get film developed. I think they sit there because I am not quite sure what to do with them.

The responses to the second question indicate a good awareness of how the technology might be used in schools in the future with many students giving practical examples. No student indicated a conviction that the technology would not have an impact on school life while many argued cogently that the ubiquity of the technology in everyday life could not be ignored in education such as:
yes ict [sic] will play a major role in schools in the future because that is the way the world is developing. technology [sic] will be used for everything pupils will use computers for mathametic [sic] equations, history lessons will be thought through computer and as the programs become more user frienndly [sic] towards pupils with less complex combinations to complete a simple task, the use of technology taking over the traditional hand written tasks is inevitable. Librarys [sic] will remain but will never be used and will eventually fade away and disappear [sic]. modern [sic] jobs are becoming more and more technologicial [sic] based so the increase use of technology use in schools will benefit the future careers of the pupils. But it has to stop somewhere other wise pupils will be able to recieve [sic] an education from home using the internet therefore communication and interactive skills will deplite [sic].

Unit 3 contained just a single open-ended question – “Are schools providing students with the digital literacy needed in society? Please take the opportunity to substantiate your previous answer here” where the “previous answer” referred to the students’ responses to an objective question on whether they believed that schools were doing all in their power to provide students with an acceptable level of digital literacy. The responses to this objective question were 31% (n = 83) that schools were doing all in their power to provide students with an acceptable level of digital literacy and 69% (n = 187) that digital literacy is improving in spite of a lack of direct action in Irish primary and secondary schools, but not all responses reflect this divide clearly. When the responses were categorised by theme 13% (n = 34) were of such a general nature that they could not be deemed to support either argument, e.g.:

activities [sic] students are required to do in schools need to adapt to the changing needs in the world around them. schools [sic] should be engaging students in activities that require them to properly research the information they need. students [sic] should be taught how to recognise correct information and to organise it in such a way that they can interpret it in their own way and make sense of it themselves.

27% (n = 74) were deemed to support the contention that schools were doing all in their power to provide students with an acceptable level of digital literacy as exemplified by:

i belive [sic] that schools are doing all they can to help with computers as when i was in primary school i [sic] was proivded [sic] with a “dreamwriter” computer. their [sic] was 32 available for the school adn [sic] could be used for any class. this [sic] is where i [sic] fist learned my computer skills. i [sic] did projects and research on these computers. the [sic] school didn't have to proovide [sic] these but they did and i [sic] had computer skills going into secondary school. in [sic] my secondary school i [sic] did a basic computer course and the E.C.D.L. once [sic] again the school didn't have to provide this service but they in my opinion were trying to improve the digital literacy [sic].
and the remaining 60% (n = 162) were deemed either to support the contention that schools were not doing all in their power to provide students with an acceptable level of digital literacy or that digital literacy is improving in spite of a lack of direct action in Irish primary and secondary schools, of which the following is a representative example:

There are certain subjects that are compulsory [sic] in schools. Computer [sic] classes or the use of other digital media are not one of these subjects. Today pupils are being given an opportunity [sic] to use computers in schools but any digital literacy they develop is usually a result of experimenting with different programs and internet use. Teachers can pass on some digital literacy [sic] to their pupils but only [sic] what they have learned themselves. There are no teachers trained to specifically [sic] teach computer classes or the use of other digital media.

When students had completed these two units, the researcher questioned each student on their understanding of why they had received a zero grade and when they invariably could not explain why (no empirical data is available on this but the observer’s impression is that less than 5% of the cohort understood without hesitation the reason for the zero grade), he questioned them on their understanding of the differences between formative and summative assessment. At that point, each student was encouraged to use the Internet to find definitions for both of these types of assessment that they could comfortably explain in their own words. Explanations were expected to refer explicitly to feedback and grades and most students quickly saw the connection between a zero grade and no grade and that the assessment that they had just completed was formative (as had been flagged in How to use Moodle (Read this first)). Although there is no empirical evidence to support the contention, the observer contends that this small excursion into enquiry based learning was appreciated by most of the participants many of whom observed that it was enjoyable, satisfying and achieved a clear understanding of the differences between formative and summative assessment.

4.3.3. The second and third computer labs

The second and third computer labs are presented as a subsection because they followed a similar pattern although different content was covered in each lab.
The students were invited to form groups of three to five for the purpose of investigating different types of software that are commonly used in education. The first of these was on presentation software using a PowerPoint animation with colour and sound where potential uses and benefits in a classroom situation were discussed with as little involvement as possible from the tutor. A straw-poll in each class showed that all students had attended lectures where a PowerPoint presentation formed part of the lecture but that on average only one-in-eight students had themselves made a presentation that included PowerPoint. All groups agreed that while a PowerPoint presentation could be made very interesting, the inclusion of a presentation could not, of itself, make a boring lecture interesting.

During each of these two labs, the small (3 to 5) groups were given the opportunity to investigate genres of software commonly available for use in classrooms. In the second lab these genres were “Drill-n-Practice” and “Tutorial” software and in the following lab “Problem-solving” and “Simulation” software were investigated. The students were introduced to each of the software packages independently so that all groups were investigating the same software at the same time. The tutor refrained from “spoon-feeding”, encouraging the groups to “press the buttons” to find out for themselves what each package was capable of, bearing in mind that they would be offered the opportunity to complete an online questionnaire, on the effectiveness and usefulness of the package, after they had completed their investigations.

The “Drill-n-Practice” software was the Irish language Before-You-Know-It package and the second genre of software investigated in that lab - the “Tutorial” software was “GCSE English”, while in the following lab the “Problem-solving” software was “Crocodile Clips - Circuits” and the “Simulation” software was “Body Works – 3D Journey Through Human Anatomy”. Before students began the online questionnaire it was emphasised that the questionnaire was intended to encourage individual reflection on the group investigation but that in order for this exercise to have real value, students should try to imagine how this genre of software might be applied to
their own subject area rather than commenting on the benefits and drawbacks of each of the software genres for the specific subject area covered. This stipulation was introduced to try to determine what level of awareness students had of what they were investigating and the responses were analysed from this perspective amongst others. While 35% (n = 79) of respondents referred to their own subject area in the responses to the first question, this had reduced to 8% (n = 18) by the third question on “Drill-n-Practice” software and to 5% (n = 11) for the same question on “Tutorial” software.

The online questionnaire for each genre of software contained six questions and student responses to the first question on the effectiveness of the software were categorised indicating that 85% (n = 191) students found “Drill-n-Practice” software effective. This dipped to 75% (n = 167) for “Tutorial” software but rose again to 92% (n = 237) for “Problem-solving” software and 93% (n = 240) for “Simulation” software.

During the third computer lab, the investigation of the two genres of software was followed by an open discussion on Special Education Needs (SEN) so as to raise students’ awareness of this area as well as introducing the possibilities of how ICT could help to allow more pupils categorised as having special needs to participate in mainstream education. These discussions frequently finished with an investigation of the potential of self-directed learning for gifted children when the tutor asked each class group if it was reasonable to expect gifted children to take responsibility for their own learning and extended this question into the possibility that first-year university undergraduates might likewise take responsibility for their own learning. The consensus was that while most students were quite willing to accept some responsibility for their own learning, very few could envisage a learning culture that did not include some level of “spoon-feeding”.

4.3.4 Blended learning

At the same time that the abovementioned discussions and investigations of software were happening face-to-face in the computer labs, the online learning
was also continuing. During these four weeks, students completed two further topics with varying degrees of participation. Topic 2 contained two quizzes, two lessons and an online discussion forum while Topic 3 contained four individual lessons and another online discussion forum.

Within Topic 2, participation rates show a distinct reduction from one task to the next with the number completing each task being lower than the previous task as well as being lower than the number starting each task as Table 4.4 indicates.

<table>
<thead>
<tr>
<th>Task</th>
<th>Searching lesson</th>
<th>Content quiz</th>
<th>Searching quiz</th>
<th>Analysing lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
</tr>
<tr>
<td>Number</td>
<td>273</td>
<td>241</td>
<td>247</td>
<td>240</td>
</tr>
<tr>
<td>%</td>
<td>93</td>
<td>82</td>
<td>84</td>
<td>82</td>
</tr>
</tbody>
</table>

*Table 4.4 - Fall-off in participation rates of Topic 2 tasks*

A similar trend of diminishing participation can be observed for the four tasks in Topic 3 as Table 4.5 indicates.

<table>
<thead>
<tr>
<th>Task</th>
<th>Safety lesson</th>
<th>School-use lesson</th>
<th>Benefits lesson</th>
<th>SEN lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
<td>Start Complete</td>
</tr>
<tr>
<td>Number</td>
<td>260</td>
<td>215</td>
<td>228</td>
<td>199</td>
</tr>
<tr>
<td>%</td>
<td>89</td>
<td>73</td>
<td>78</td>
<td>68</td>
</tr>
</tbody>
</table>

*Table 4.5 – Fall-off in participation rates of Topic 3 tasks*

The data from the two previous tables indicate a difference between the number of students starting and completing each task. As the final element of each task is a formative assessment task, these findings have considerable implications for the usefulness of online formative assessment as a tool in student learning and are considered in the Discussion chapter. The online discussion forum in each of the above topics is analysed separately because in response to queries from the students the tutor confirmed that while the lesson and quiz tasks contained content that might be included in the summative assessment, no such benefit applied to the discussion fora, a fact that is reflected in the participation rates. It was however emphasised that the benefit of reflective practice inherent in contribution to online discussions might be its own reward.
The subject of the Topic 2 discussion was “By the end of the 20th century it was no longer possible to view literacy as based on words or even on word-based texts. - What does literacy in the information age now encompass?” and while 43% (n = 126) of the cohort opened the discussion page (the tracking facility in Moodle is not sufficiently sophisticated to discern if any or all of these students read any or all of the discussion posts), only 26% (n = 76) of the cohort posted their own comment. The majority of these contributions, 79% (n = 60), were “stand-alone” posts rather than comments on existing posts and an example of these was:

I am not sure if I would refer to computer literacy in the same way I would “reading and writing” literacy, they are very different things. It would be hard, though not quite impossible, to get through life without being able to read and write. Whereas many people (the older generation especially) get through day to day life with little computer technology. This is not to say that it isn't important because I [sic] do strongly believe it is, and will continue to become more and more necessary [sic] as time goes by. When we become the older generation our computer literacy will probably be seen as “basic”. Even in teaching computer literacy has never been more important, however, how effective can it be to start learning now? We should be very competent [sic] with computers at our age, in this day in age, but the time is not spent on it schools. In neither primary nor secondary (in my experience at least).

The subject of the Topic 3 discussion was “The increased penetration by ICTs into all areas of social life - not least education - is driven largely by capitalism’s relentless search for new markets ... Investing in computers is, so parents are told, a way of investing in your children's future. (Ferneding, 2003, p. 25) Do you agree with this statement? Is using computers a better way of doing things?” and again the number of students who posted a comment, 24% (n = 69) was smaller than the number who opened the discussion page, 29% (n = 86). As with Topic 2, the majority of these contributions, 90% (n = 62), were “stand-alone” posts, an example of which was:

Why don't we all own houses on the moon? Is it because we can't [sic]? I don't think so. We are the most sophisticated and intelligent organisms in the universe (I hope) and there is nothing that we cannot do if we put our minds and our money to it. The problem is that investors know that there is no market for moon houses so will not be willing to spend billions of dollars on a huge risk. Consumer technology on the other hand, well that has a massive market. Just think about all the times we decide we need a new mobile phone. So yes, the world's [sic] technological development, including computers, is absolutely driven by capitalist big-wigs but who are we to complain? We want and love this technology and are willing to pay good money for it and these money banks are willing to supply it, so what's the problem? Everyone has to get their cut and if you're some sort of socialist anti-globalisation demonstrator then you get out there and see if you can do any better. Or how about we all go and forage for some berries in the wild!
The majority, 66% (n = 50), of students who posted a comment on the Topic 2 discussion also posted on the Topic 3 discussion which means that a total of 30% (n = 88) of the cohort contributed to either one or both of the online discussions. The break-down by gender, tabulated for all of the tasks that contained some element of formative assessment in Table 4.3, did not include these two online discussions. Those data indicated that the highest level of participation by female students was 47% (n = 81) for Unit 9, the lesson on the Benefits of ICT in Special Education Needs but that level of participation was surpassed in both of the online discussions where 53% (n = 40) of contributors to the online discussion forum in Topic 2 were female and 52% (n = 36) of the contributors to the Topic 3 forum were female.

4.3.5 Access times

In recognition of a major difference between an online self-directed course of study and traditional classroom/lecture hall learning, attention is drawn to the possibility of accessing online learning at all hours of the day and night. Use was made of the tracking facility of the LMS to determine at what times the online units/tasks were accessed and how access times changed as the course progressed. The deteriorating rates of participation between the start and end of the course have already been documented but this section is more concerned with highlighting patterns of change.

Three categories of access-time were designated to evaluate the extent of access and to facilitate its analysis, and are summarised in Table 4.6. The number of students accessing each task was taken as the number who completed each task rather than the number who began each task and the difference between these is examined separately in the next section on Formative Assessment. As might be expected, Units 2 and 3 had Standard Access times of 94.2% (n = 262) and 91.5% (n = 249) respectively, reflecting

<table>
<thead>
<tr>
<th>Standard Access</th>
<th>Early or late</th>
<th>Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 a.m. to 6 p.m. weekdays</td>
<td>After 6 p.m. and before 9 a.m. on weekdays</td>
<td>Midnight Friday to midnight Sunday plus Bank Holidays</td>
</tr>
</tbody>
</table>

*Table 4.6 – Summary of access time categories for the online units and tasks*
the fact that most students completed these units during the first computer lab and are therefore not considered in the comparison shown on Figure 4.2. Whereas there was a distinct reduction in the number of students accessing the online content during Standard times (except for a blip between Units 5 & 6) as the course progressed, access during non-standard times is not as straightforward. Weekday access during early morning and late evening fluctuated only marginally between a low of 45 students (15% of the cohort) and a high of 55 students (19%), while weekend access showed a larger increase from a low of 23 students (8% of the cohort) to a high of 37 students (13%) between two of the tasks in Topic 3.

Access times for the two online discussion fora are shown separately in Table 4.7, both because the number of students contributing to them was relatively small overall and because the access times patterns for both fora were quite different to the mainstream units.

<table>
<thead>
<tr>
<th></th>
<th>Topic 2 Discussion</th>
<th></th>
<th>Topic 3 Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>Standard Hours</td>
<td>40</td>
<td>52.6</td>
<td>34</td>
</tr>
<tr>
<td>Early or Late</td>
<td>17</td>
<td>22.4</td>
<td>15</td>
</tr>
<tr>
<td>Weekend</td>
<td>19</td>
<td>25.0</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76</strong></td>
<td><strong>100.0</strong></td>
<td><strong>69</strong></td>
</tr>
</tbody>
</table>

*Table 4.7 – Summary of access times for the online discussion fora*
As was previously stated in the section on Blended Learning, there was a discernable falling-off of participation as the course progressed and this fall-off is most noticeable during Standard Access times although this decrease is slightly offset by a marginal increase in the number of students accessing the course during non-standard access times. This reduction in rates of participation is examined in more detail in the next section on Formative Assessment.

4.4 The assessment

4.4.1 Formative assessment

In order to determine how useful the formative assessment was to them, the students were asked in the post-study survey to rate their estimation of the relevance of the tasks on a five-point Likert scale ranging from “Very relevant” to “Not relevant”. A total of 272 students responded to this question and their responses are summarised in Table 4.8. This relatively high level of claimed relevance – 67% (n = 181) of the students who responded to this question claimed that they found the formative assessment tasks to be either “Very relevant” or “Relevant” – is not supported by the level of correlation between the number of formative assessment tasks completed and the grade achieved in the online summative assessment. Pearson correlation coefficients were calculated for the grades achieved in the online summative assessment with the ten formative assessment tasks available in the online course – .047 for a one tailed significance of .215 – and also with the alternative variable of the ten formative assessment tasks together with the four available tasks on the
different genres of software investigated during the second and third computer labs – .051 for a one tailed significance of .196. These values indicate that there was little or no correlation between the number of formative assessment tasks completed and the grades achieved in the online summative assessment. The implications of this finding are considered in the Discussion chapter.

The number of students beginning each task compared to the number who completed the associated formative assessment is compared in Table 4.9, which also shows the difference between these two for each task as well as that difference as a percentage of the number of students starting each task.

<table>
<thead>
<tr>
<th>Task</th>
<th>Start</th>
<th>Complete</th>
<th># not completing</th>
<th>As % of Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubiquitous Technology</td>
<td>288</td>
<td>278</td>
<td>10</td>
<td>3.47</td>
</tr>
<tr>
<td>Information Age</td>
<td>278</td>
<td>270</td>
<td>8</td>
<td>2.88</td>
</tr>
<tr>
<td>Searching lesson</td>
<td>273</td>
<td>241</td>
<td>32</td>
<td>11.72</td>
</tr>
<tr>
<td>Content quiz</td>
<td>247</td>
<td>240</td>
<td>7</td>
<td>2.83</td>
</tr>
<tr>
<td>Searching quiz</td>
<td>217</td>
<td>195</td>
<td>22</td>
<td>10.14</td>
</tr>
<tr>
<td>Analysing lesson</td>
<td>246</td>
<td>179</td>
<td>67</td>
<td>27.24</td>
</tr>
<tr>
<td>Safety lesson</td>
<td>260</td>
<td>215</td>
<td>45</td>
<td>17.31</td>
</tr>
<tr>
<td>School-use lesson</td>
<td>228</td>
<td>199</td>
<td>29</td>
<td>12.72</td>
</tr>
<tr>
<td>Benefits lesson</td>
<td>223</td>
<td>189</td>
<td>34</td>
<td>15.25</td>
</tr>
<tr>
<td>SEN lesson</td>
<td>211</td>
<td>170</td>
<td>41</td>
<td>19.43</td>
</tr>
</tbody>
</table>

Table 4.9 – Summary of students starting and completing each task in the online course

These data show that the non-completion rate was highest for Unit 5 – Analysing, in Topic 2, and the probable reasons underlying this fall-off are also investigated and discussed in the Discussion chapter.

4.4.2 Summative assessment

As one of the elements in the multi-element EN4002 module, the ICT in Education course accounted for a summative grade of 15%. Although the summative assessment was completed online, it was invigilated (by the tutor) and took place during the first half of the fourth computer lab. The assessment was comprised of ten MCQs chosen at random from a bank of questions (Appendix 7) and the passing grade was set at four correct answers (40% of the available grade). The correct answers to all questions were contained either in the content of the ten tasks that included some formative assessment (in the online portion of the course) or in the content presented face-to-face in the
second and third computer labs. A screen-print of the first two questions of an actual assessment page is included in Figure 4.3 as an example:

![Figure 4.3 – Two sample questions from the summative assessment](image)

The seating layout of the computer lab meant that students could see their colleagues' computer screens but the probability that any two students got the same ten questions in the same order (while not impossible) was remote due to the questions being chosen at random by the LMS.

The integrity of the assessment process was safeguarded by password protecting it, with the password being divulged to students only directly before they sat the assessment and being changed as soon as all students in the computer lab had opened the assessment page. This not only prevented access to the assessment page by students outside of the lab but also ensured that those students sitting the assessment could not open a second copy of the assessment (again reducing the possibility of cheating). A subsequent analysis of the tracking facility of the LMS confirmed that the assessment page was never hacked unless the hacking was so sophisticated that the hacker also managed to erase all trace of his/her presence.

Out of 289 students who sat the invigilated assessment, 3% (n = 8), did not receive the passing grade (40%) and a decision was made to allow these students to re-sit the assessment with the stipulation that no matter how many questions they answered correctly, the maximum grade awarded was the passing grade and all eight students achieved that grade so all students who sat
the assessment got at least a passing grade. A summary of the number of students attaining each grade (including the eight students who achieved the passing grade on the second attempt) is presented in Table 4.10.

<table>
<thead>
<tr>
<th>Grade</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>25</td>
<td>38</td>
<td>49</td>
<td>58</td>
<td>64</td>
<td>41</td>
<td>14</td>
</tr>
<tr>
<td>%</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>20</td>
<td>22</td>
<td>14</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 4.10 – Summary of students attaining each grade in the summative assessment

The grades achieved in the summative assessment were analysed from the perspective of the level of student participation or non-participation. For this analysis, 14 tasks were taken into account, i.e. the ten tasks from the first three topics of the online portion of the course and the four online surveys completed during the second and third labs. Four students (just over 1% of the cohort and all male) sat the assessment without completing any of the tasks and one of these scored 90% (nine out of ten correct answers), two of them scored 60% and the fourth scored 50%. Of the two students who completed just one of the tasks (one male, one female) the male scored 100% while the female scored 60% and of the three students who completed just two of the tasks (all male), their respective scores were 100%, 70% and 40%. These high grades, together with a low level of engagement with the course begs the question of whether the assessment was too easy, but this possibility was eliminated by reference to the fact that all students did not get 90 or 100%.

All fourteen of the tasks were completed by 34% (n = 97) of the cohort but there appears to be no correlation between the number of tasks completed and summative grade achieved as all grades from 40% to 100% inclusive are represented within this group and this apparent lack of correlation is addressed in the Discussion chapter. The sub-group of eight students who achieved a 40% grade, within the group who completed all 14 of the available tasks, included three of the students who achieved the passing grade only at the second sitting. An indication of the number of tasks completed is summarised in Table 4.11 and as most of these sub-groups referred to less than 10% of the cohort, adjacent sub-groups have been amalgamated.
The completion of tasks was also analysed by gender, and female students demonstrated a greater engagement with the course than their male colleagues where 59% (n = 57) of the students who completed all 14 tasks were female giving a gender ratio of 0.70:1 compared to a gender ratio of 1.82:1 for the cohort in general. In all other sub-groups of the number of tasks completed, male students out-numbered females by at least the general gender ratio.

### 4.4.3 Comparison with module grade

Student grades for the multi-element module (EN4002), of which this course was one element, were compared with the grades that students received in the online summative assessment. While correlation between the two variables at a Pearson correlation coefficient of .283 with significance (1-tailed) of .000 is at the lower end of statistical significance, correlation is significant at the 0.01 level (1-tailed). Table 4.12, which displays the overall grades for the module vertically as columns and the grades for the online summative assessment horizontally as rows, indicates that the three students who gained an “A2” grade in the module (the highest awarded) gained either an “A1” or an “A2” in the online course and the most heavily populated grades in the module – “B2” and “B3” at 61 and 68 respectively – approximate relatively accurately to the most heavily populated grades in the online module – “B2” and “C1” at 64 and 58 respectively. In both instances just four adjacent grades account for the

<table>
<thead>
<tr>
<th>Tasks completed</th>
<th>0 to 5</th>
<th>6 to 8</th>
<th>9 or 10</th>
<th>11 or 12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>24</td>
<td>39</td>
<td>45</td>
<td>51</td>
<td>33</td>
<td>97</td>
</tr>
<tr>
<td>%</td>
<td>8</td>
<td>13</td>
<td>16</td>
<td>18</td>
<td>11</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 4.11 – Summary of numbers of students completing number of tasks

<table>
<thead>
<tr>
<th>A2</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>D1</th>
<th>D2</th>
<th>F</th>
<th>NG</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>A2</td>
<td>1</td>
<td>9</td>
<td>13</td>
<td>12</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>B2</td>
<td>-</td>
<td>14</td>
<td>14</td>
<td>19</td>
<td>8</td>
<td>5</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>C1</td>
<td>-</td>
<td>7</td>
<td>10</td>
<td>19</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>C3</td>
<td>-</td>
<td>4</td>
<td>12</td>
<td>12</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>D2</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>2</td>
<td>13</td>
<td>6</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>D3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>-</td>
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<td>7</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>40</td>
<td>61</td>
<td>68</td>
<td>45</td>
<td>29</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>26</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4.12 – Comparison of grades for module (columns) with grades for online course (rows)
majority of all grades – in the overall module grades B1, B2, B3 & C1 account for 74% (n = 214) of all grades while in the online course grades A2, B2, C1 & C3 account for 73% (n = 212).

Pertinent questions raised by this comparison such as “How could a student gain 100% in the online summative assessment and receive an “F” in the module overall?” or “What might cause 10% (n = 30) of the cohort to fail a multi-element module?” are discussed in the Discussion chapter.

4.5 Secondary Research Question Findings

4.5.1 Understanding of e-learning

The 264 responses to the open-ended question, “What is your understanding of e-learning?” were categorised by theme and it is accepted that the categorization is highly subjective and influenced by the researcher’s bias but based on the following criteria:

- Very good understanding – involves teaching and learning or self-directed learning or includes assessment;
- Good understanding – contains more detail than “Moderate understanding”;
- Moderate understanding – refers to the Internet or computers or online learning but with no extra detail;
- Poor understanding – more than “No understanding” but not mentioning the Internet, computers or online learning;
- No understanding – students’ own claims of having no understanding of the term.

Within these parameters, the results are presented with an example of one quoted response in support of each category:
“Very good understanding” – 9% (n = 23):

Is this a loaded question? e-learning? It does exactly what it says on the tin. For me e-learning is a university in itself. A system that enables the student to better facilitate their educational needs and the teacher to better educate themselves in order to facilitate the needs of their students.

“Good understanding” – 18% (n = 47):

That students use computers to learn about topics and achieve a greater understanding in different fields.

“Moderate understanding” – 46% (n = 122):

im [sic] not completely sure but i [sic] presume it is learning through the use of computers and the internet.

“Poor understanding” – 6% (n = 15):

e learning allows students develope ther [sic] computer skills which are vital for getting jobs in the future as everything is being completed on computeres [sic] anymore;

“No understanding” – 21% (n = 57):

I don't really have any pre-conceived ideas of e-learning so I suppose I don't have an understanding of it.

Was this relative lack of understanding (27%, n = 72, of the cohort admit to little or no understanding) of e-learning a factor in this cohorts enthusiasm for the benefits of ICT in education?

4.5.2 Use in education

In spite of the evidence that these students are far from being “digital natives”, the perception that computers can be of benefit in education was almost unanimous with only one of the 285 students who responded to the question...
“Do you think computers can be of benefit in education? In what way?” stating that he was “Unsure” of any benefit. Examples of this near unanimity are:

Yes I do think computers can be a benefit in education because I feel that they are extremely useful in researching projects, finding out facts on various topics, finding fun educational games such as the games on the Discovery Website. Plus, computers in education allow us to keep up to date with other countries and their standard of education around the world, at the click of a button.

Computers can be a benefit as they give students an opportunity to access a lot of information and resources in a very easy and quick way. Also by introducing students to computers in school and raising their levels of competency with them then they are well prepared for using them in the work force, if that's the career path they chose, but also in society in general. This may be as simple as using a computer for leisure purposes or booking tickets etc.

Yes. i [sic] think computers could play a vital role in education if there are proper facilities available for the students. computers and the internet give the student a link to a ever growing wealth of information. this information could be used to help the students in completing projects or even help as a study aid coming up to exam time. the internet, if used correctly could assist the student in his /her studies and prove to be a very helpful aid in finding information on his or her chosen topic.

When the open responses to the question of potential benefits of computers in education were developed into themes, the benefits were deemed to be:

“Production tool” 44% (n = 126), e.g.:

Yes they can because word processing is extremely important to students in relation to typing out assignments [sic]. I also think it is very important for students to have a least some knowledge of computers, especially in todays [sic] modern world.

“Access to information” 30% (n = 85), e.g.:

the internet is a good way of finding out extra information and ideas, also pictures for resources can easily be accessed through the internet. It is also good to give pupils the initiative to look up work on computers, it broadens their learning as they can access more information. Also computer skills are very important in life today.

“Self-directed learning” 20% (n = 58), e.g.:

Definitely, younger people today would be much more enthusiastic about the prospect of working from a computer instead of reading from a book. It can be used as variation and another method of helping pupils help themselves.
while the remaining 6% (n = 16), were categorised as benefiting only teachers or being interpreted as claiming to not know what the benefits might be.

These 285 responses were also categorised by trying to determine whether the proposed benefits would favour teachers (14%, n = 41), learners (48%, n = 137) or both teachers and learners equally (38%, n = 107) to try to establish what students’ priorities were but the relatively large proportion favouring equal benefit detracts from the 3:1 ratio in favour of benefits for learners over benefits for teachers.

The students were also questioned on what they perceived to be the disadvantages of using ICT in education and again the open responses (n = 275) were developed into the following themes: “Traditional is better” 25% (n = 69), an example of which was:

If ICT is used to replace regular teaching. For example, if a teacher used PowerPoint presentations exclusively and did no teaching but just asked the pupils to follow the presentation, I believe that this could be a drawback to ICT [sic] in teaching, even though I [sic] realise that this is a very extreme example.

“Equality” 18% (n = 49), e.g.:

yes there are disadvantages to using ICT in education. Well for starters not all schools may be equipped with enough computers in order to teach a class in ICT, and not all schools may have broadband.

“Classroom management/control” 34% (n = 96), e.g.:

Yes of course there are disadvantages to using ICT in education because some pupils will not go onto the website that they were told to go onto and therefore, may go into restricted sites during class time (e.g. BEBO). If this happens, these pupils will waste class time and furthermore, they won't learn what the rest of the class is learning and consequently, they won't benefit out of the class.

and

there can be some disadvantages e.g. if you are getting the whole class to use computers they could be playing games on them instead of doing what they are supposed to be doing. It could also happen that the computers may not be working for a lesson, if you have your lesson prepared on the computer this would be a huge disadvantage.
“Skills” 10% (n = 28), e.g.:

Yes some students may not be able to get to grips with a computer or may not have an interest in computers. For it to be a success I feel students should be professionally trained as something simple like word processing can become very frustrating if your typing skills are not particularly good.

No disadvantages could be seen by 11% (n = 30) of the cohort, e.g.:

I believe that there are very few disadvantages in using ICT. Most of the time computers are used to the students advantage, in finding information and typing up projects. Disadvantages only arise when the computer is misused. This misuse of the computer can be easily stopped by using programs to prevent access to certain internet sites.

and 1% (n = 3) did not cite any disadvantages or claimed to be unsure what the disadvantages might be.

4.5.3 Probable use

Having found out that the participants were aware of at least some of the advantages and disadvantages of the use of ICT in education, it was decided that an important corollary would be the discovery of the possible extent of their intended use. Although probable use was posed as an open-ended question, “Would you use ICT as part of your teaching and if so, in what way?”, the responses were generalised as:

“Yes” – 86% (n = 237) of the cohort, of which the following is an example:

I would say so yes - if it happened that there was a computer in every classroom I was to teach in, I would feel a lot more comfortable allowing the pupils to use it if I knew how to use it myself.

“No” – 7% (n = 18), e.g.:

no i wouldn't pupils learn better when they have text books in front of them rather than straining to read lumps from the computer although i would have a computer by my side for rapid research and for visual motion aids
“Maybe” – 5% (n = 15), e.g.:

I probably would use it sometimes but not a lot as I have no patience with computers, and I find working with computers quite tedious.

while 2% (n = 6) claimed to not know.

These responses were further categorised into the following themes:

“An extra resource” – 29% (n = 79), an example of which was:

Yes i [sic] would. I would allow my pupils to access educational sites such as science on the net. They could also complete classroom activities on the computer.

“Research” – 23% (n = 64), e.g.:

I think so. I find its [sic] a good method of teaching for students as there is a growing necessity for computers in our every day lives and i [sic] think its assential [sic] for computers to be introduce [sic]. computers can be used for reserech, [sic] assignment work and project presentation ect. [sic]

“A stimulating resource” – 19% (n = 51), e.g.:

I would be open to the idea. As an Access to University student hoping to start LM094 Woodwork teaching degree in September, I would see ICT as a valuable resource especially in the teaching of Technology, Architectural Technology and Woodworking Skills. The idea of bringing YOU TUBE into the woodwork room may be outlandish to some, but if it works, why not!

“A teaching aid” – 6% (n = 17), e.g.:

yes i [sic] would use ICT. i would use it to show video clips and powerpoint slides which would help me teach a class

“Assessment” – 5% (n = 13), e.g.:

i'd [sic] like to try at some stage given the correct skills of what i [sic] will use. perhaps slideshows, presentations, videos from the web that may be useful to the classes i [sic] will teach, also, simply obtaining unusual assessments etc that i [sic] may be unaware of
A further 19% (n = 52) of the cohort (across all of the general categories mentioned above, including the six students who did not know whether or not they would use ICT in their teaching) did not specify any particular use.

Overall, these students are very positive in their views in that the majority intend to use ICT as part of their teaching, although the 86% (n = 237) of the cohort who appear to be sure that they will use ICT as part of their teaching is not as high as the near unanimity (99%, n = 284) of the cohort who claim that they believe that the use of ICT can be of benefit in education.

### 4.5.4 Post-study attitude

When questioned on their confidence that ICT could or should be used in their subject areas as part of the post-study survey, 97% (n = 267) indicated that ICT could be used and this reduced to 94% (n = 253) of the cohort who indicated that it should be used. It is postulated that of itself this should not be interpreted as a change in attitude as the pre-study question referred to ICT in education in general, whereas these questions refer to each student’s own subject area. How should change in attitude be measured? Is it sufficient to accept the responses to the question “Have you changed your views on the benefits or disadvantages of ICT in education as a result of the course?” posed in the post-study questionnaire? The qualitative responses to this question were initially categorised into yes/no themes indicating that 72% (n = 189) of the cohort claimed that they had changed their views, as exemplified by:

> I believe it has given me a more nuanced approach [sic] to the question. I feel more confident about the benefits to students of using internet searches, and how you could help them evaluate content - and about moving away from memory work and into content evaluation and analysis. I also have a much better understanding of the different types of software out there, especially for special needs. At the same time, I see ICT as a tool, not as the answer to all educational problems.

while the responses of the other 28% (n = 75) were interpreted as indicating that they had not changed their view, e.g.:

> I havent [sic] changed my views as such but i [sic] am alot [sic] more aware of where and when i [sic] could use this to my advantage.
Further analyses of these responses prompted a re-categorisation of the themes that were suggested by the responses. One such theme was that the response reinforced a previously claimed positive disposition:

I have always thought that ICT in education could be very beneficial to students but this course has highlighted to me that it is much more beneficial and effective than i [sic] previously thought.

a view that accounts for 19% (n = 56) of the responses while 3% (n = 8) of responses were deemed to indicate that a negative predisposition was being reinforced:

No i [sic] still feel computers in the classroom and education should be limited.

The response previously quoted as exemplifying a change of view is an example of the 61% (n = 179) of responses deemed to indicate a positive change in the re-categorised themes while 7% (n = 21) were deemed to indicate a negative change, no change in attitude or a category that seems to suggest that the student’s response to this question contradicts the student’s response to the previous question in the survey. Is this categorisation by theme of student responses valid? Does it give a true picture of the extent to which individuals underwent a change of attitude towards ICT as a tool to enhance teaching and learning as a result of having engaged with the course? Although they are recognised as being outliers, how much can the three individuals who respectively completed two, one and none of the tasks but achieved 100%, 100% and 90% summative grades be said to have engaged with the course? Only one of these three (male) students gave a response to the question on change of views and his answer:

no i alway [sic] saw it as an important part of learning esp [sic] coming from a dyslexics [sic] point of view some thing it can be alot easier to access [sic]

was interpreted as being among the 28% (n = 75) of responses indicating that they had not changed their view, although it is recognised that this view is not
in any way representative of the remainder of the cohort and is quoted only as the response of an outlier.

Pre-study and post-study attitudes were analysed by comparing students’ responses to the question in the pre-study survey “Do you think computers can be of benefit in education? In what way?” and the aforementioned question “Have you changed your views on the benefits or disadvantages of ICT in education as a result of the course?” posed in the post-study questionnaire. Negative responses to the latter accounted for 22% (n = 58) of the students who responded to this question but comparison with each student’s response to the former question indicates that 21% (n = 12) of this group had indeed changed their views. An example of this comparison is:

yes; for research and powerpoint presentations (pre-study question)
no as i [sic] cant stand computers in a classroom as for the software teaching the pupils (what are teachers being paid for) (post-study question)

while an example of no change of view is:

i [sic] would be lost with out [sic] one and if it wasnt [sic] for a program called dragon which reads for me (pre-study question)
no i alway [sic] saw it as an important part of learning esp [sic] coming from a dyslexics point of view some thing [sic] it can be alot easyier [sic] to axcess [sic] (post-study question)

Conversely, when the responses to the same two questions are compared for students who are quite definite that their views have changed (n = 120), it appears that 17% (n = 20) of them have not in fact changed their views at all as represented by the following:

yes. i [sic] think computers could play a vital role in education if there are proper facillities [sic] available for the students. computers [sic] and the internet give the student a link to a [sic] ever growing wealth of information. this [sic] information could be used to help the students in compleating [sic] projects or even help as a study aid coming up to exam time. the [sic] internet, if used correctly could assist [sic] the student in his /her studies and prove to be a very helpful aid in finding information on his or her chosen topic. (pre-study question))

yes i [sic] find now that i [sic] would be more willing to introduce ict in my teachings in second level education (post-study question)
while an example of the responses from a student supporting the contention of a changed view is:

I think computers can be advantaus [sic] in education with respect to presentations; lecture style notes; creating exams; researching and should be used in order to provide a variety of stimulus to intellectually stimulate the students. (pre-study question)

Yes as I have realised the various types of technological techniques that may be integrated into the classroom other than powerpoint presentations! I now also comprehend that ICT may be depended on and become over-used within the classroom as a substitution for traditional teaching methodologies. (post-study question)

The two previous categories analysed the responses of students who were quite adamant that their views either had changed or had not changed. A third category, where students did not claim to be as sure of a change of view (n = 84), required a more subtle analysis and students’ claims of a greater awareness of the issues was interpreted as a change of attitude and the potential bias of this approach is acknowledged. Within these parameters, 83% (n = 70) of responses in this category were interpreted as indicating that a change of attitude had occurred by virtue of a greater awareness as exemplified by:

Yes a major benifit [sic] they can be used for reserching [sic] information which may make a boring topic alot [sic] more intresting [sic]. (pre-study question)

I havent [sic] changed my views as such but i [sic] am alot [sic] more aware of where and when i [sic] could use this to my advantage. (post-study question)

while the following are two examples of no change of view:

Definitely; younger people today would be much more enthusiastic about the prospect of working from a computer instead of reading from a book. It can be used as variation and another method of helping pupils help themselves. (pre-study question)

I think my views were challenged but they haven't been changed (post-study question)

This interpretation of the data indicates that 69% (n = 182) of the cohort changed their attitudes towards ICT as a tool to enhance teaching and learning as a result of having completed this self-directed, online course on ICT in education.
4.6 Student feedback

In an attempt to determine a level of feedback from students, the last three questions in the post-study survey (Appendix 8) asked if the course was suitable, the experience enjoyable and a blank space inviting any other comments. The vast majority (90%, n = 237) of respondents were unequivocal in determining that the course was suitable for online presentation and assessment, while the responses of a further 6% (n = 15), such as:

It did work well, but the assessment should not have been based purely on a few minutes work without consideration of earlier work completed

were interpreted as indicating that the respondent found the course to be suitable but with reservations. The comments of the remaining 4% (n = 11) were interpreted as indicating that the participants were either unsure of the suitability or were adamant that it was definitely not suitable represented by:

no, i [sic] felt the asessmen[t sic] needed to be given more information on the topic as not much study or research could be done for it

The question on how enjoyable the students found the experience to be used a five-point Likert scale to provide choices varying from “Very enjoyable” to “Terrible” and no student found the experience to be “Terrible” as Table 4.13 demonstrates. The third measure of student feedback was a blank space for students to add “Any other comments” and 27% (n = 75) of the cohort availed

<table>
<thead>
<tr>
<th>Q14. Was the experience enjoyable?</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very enjoyable</td>
<td>37</td>
<td>12.6</td>
<td>13.5</td>
<td>13.5</td>
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<tr>
<td>Enjoyable</td>
<td>129</td>
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<td>OK</td>
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<tr>
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<td>10</td>
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<td>3.6</td>
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</tr>
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<td>Total</td>
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<td>No response</td>
<td>18</td>
<td>6.1</td>
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</tr>
<tr>
<td>Total</td>
<td>293</td>
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<td></td>
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</tr>
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</table>

Table 4.13 – Responses to the pen-ultimate question “Did you enjoy this e-learning experience?”

of this opportunity. When the qualitative responses of these 75 students were categorised by theme, 31% (n = 23) were interpreted as “Very Positive”, 57%
(n = 43) as positive while the remaining 12% (n = 9) as either “Ok”, “Negative” or “Very negative”. The single “Very negative” comment was:

get rid of this section of the module and replace with software in education classes in lab format

while examples of the other categories of responses include:

Test is too stressful! (Negative)

To make this software more pupil friendly more games and activities [sic] should be included because all the readind [sic] on these computer screen gives people headaches. (Ok)

I liked this class. This was the first one that I took where all of the activites [sic] were actually online. My other computer class back at home did not have online assessments and lessons like this one, so I enjoyed being able to do it at my own pace. (Positive)

Not really, although i [sic] do think that this module could become a lot more important in the next few years; as ICT is phased into schools more and more. I believe that in the next ten years or so, it will be impossible to get a job as a teacher if you have no knowledge of ICT. Therefore i [sic] think that this module could also be developed to become a bigger part of the college teaching course/curriculum; and that it could be made a bigger part of the education module; if not a separate [sic] module in itself, because i [sic] can't see in ten years time people getting jobs without a good knowledge of ICT. It is becoming more and more apparent even now that schools are looking for more varied forms of teachers and teaching, and this is probably the main area to be looking into. (Very positive)

The implications of this feedback are considered further in the Discussion chapter.

4.7 Chapter Summary

In this chapter the findings of both research questions have been presented. The extent to which students engaged with the course was documented using:

- students’ quantitative and qualitative responses to the questions posed as part of the formative assessment which seem to indicate a moderately strong engagement with the course;
• students’ grades gained in the online summative assessment and how those grades appeared to show a distinct lack of correlation to students’ engagement with the course;
• the data gleaned from several online surveys together with audio recordings of student participation in the open, semi-structured discussion groups show students who are enthusiastic about the benefits of ICT in education as well as perceived usefulness of the technology in their own subject areas;
• the researcher’s observations which confirm all of these findings;

to demonstrate that such engagement was both widespread and enlightening.

The extent to which their engagement with the course contributed to changing students’ attitudes towards ICT as a tool to enhance teaching and learning was also investigated and suggests that a majority of students did experience a positive change of attitude. It is recognised that this second research question is more subjective than the primary question and it is realised that the interpretation of the qualitative data is subject to bias although the researcher contends that his awareness of the tendency towards bias went a long way towards reducing that tendency.

In the next chapter these findings are analysed and discussed to try to determine which factors encourage engagement with a self-directed, online course and whether such engagement might create more problems than it purports to solve.
5 Discussion

5.1 Introduction

The previous chapter presented the findings under subsections that determined who the participants were, the level of gender-bias found, the participants’ experience of using ICT, rates of participation both with the online course and face-to-face labs as well as the summative assessment, to paint a picture of a level of engagement with the course. The findings on the extent to which the course changed students’ attitudes towards ICT as a tool to enhance teaching and learning were based on a comparison of students’ expectations of the benefits of the use of the technology before starting the course and their revised expectations having experienced the course. This chapter will look at those findings to determine how successful the students’ engagement with the course was, what value students gained that might enhance their effectiveness as teachers and the implications of these findings for second-level and third-level education in general and teacher education in particular will also be discussed. This discussion is also concerned with what has been learned about using LMS software in a blended way to support and enhance student learning and how this might be improved in future.

5.2 Provision

The findings clearly indicate that most of the students have an easy familiarity with the technology at the superficial level of using the Internet for entertainment (and to a much lesser extent for scholarly research), sending and receiving email and using word-processing applications (almost exclusively Microsoft Word) to write assignments. However, this familiarity does not include an aptitude for creating or manipulating spreadsheets, databases or presentation software not to mention any concept of how the technology might be seamlessly integrated into everyday learning and teaching. This situation begs the question as to how representative these students are of their peers (in the wider world as opposed to within this course of pre-service, teacher education) and while the extent to which these students reflect the wider reality of the use of ICT in second-level education was not a key research
question that the research aimed to pursue, it is nonetheless an interesting finding to emerge. The extent of this experience seems to be confined to a basic introduction to computers during first year of second-level education and a more intensive involvement (in the acquisition of skills) if the transition year model was pursued. However, there appears to be no use of technology in the senior cycle unless one or more technical subjects is taken and while it might be expected that the greater exposure of those taking a technical subject at Leaving Certificate level would lead to more engagement with the online course, this appears not to be the case.

While Gleeson et al (2001) report on an increase in computer usage in Irish schools in the previous decade, this increase does not seem to have affected the current cohort. A possible explanation for this incongruity may lie in the educational experience of this cohort of students. Entry to third-level is based on the students’ performance in the Leaving Certificate exams. Teacher education programmes at third-level remain popular, therefore the high demand increases the academic standards required for entry. As a result, the programmes tend to attract high achievers from second-level education. In preparation for the Leaving Cert, these students are generally exposed to quite traditional classroom practices. Research into the nature of classroom teaching in Irish post-primary schools has long highlighted the influence of state assessment, which leads to very didactic teaching (Gleeson et al, 2001, p. 2). In these classroom contexts the primary focus is on the memorisation of information in preparation for state assessment.

Within such an environment there is a limited use for a technology which might push learning to a more student centred model. In their analysis of computer use in six IT rich Irish schools Gleeson et al (2001) concluded:

the present emphasis on a didactic pedagogy needs to be replaced by one where active learning, pupil collaboration and inquiry are prioritised and rewarded … The dominance of the expository paradigm of teaching and learning, particularly at post-primary, represents a major barrier to the successful integration of ICT into teaching and learning in the Irish situation. Unless this issue is addressed, it is unlikely that the meaningful integration of ICT into learning will occur and ICT use may be mainly confined to computer applications, some project work for non-examination classes, some use with SEN students and improving the quality of teachers’ classroom presentations. (Gleeson et al, 2001, pp. 7-8)
Is this the prevailing situation in most schools? If so, it might go some way to explaining the ICT skill-base of the majority of the cohort, emphasising that their digital literacy has been acquired in their own time rather than at school, has much to do with using the Internet mainly to access entertainment and accordingly is at best patchy from the perspective of using ICT for teaching and learning. Is this in turn an indictment of schools? Should post-primary schools in particular be doing more to ensure that all school-leavers have at least some digital literacy? The findings seem to suggest that these students have missed the opportunity to develop a comprehensive technological literacy and that perhaps schools no longer see the need to provide such provision given the proliferation of ICT in pupil's lives outside of the classroom.

5.2.1 Implications for second-level

Is it surprising that a majority of this cohort expressed frustration and even anger with what they perceived as being a lack of focus on the part of post-primary education in providing them with digital literacy? One student expressed this frustration thus:

Schools are not showing pupils how to use computers properly they give them the basics, such as typing but apart from that it is very poor. Pupils should be shown how to use spreadsheets, word processing power-point etc. and how to access the internet properly to get the correct information. Today pupils are learning how to use computers from home use, by searching the internet etc. It's time the government did something about it and maybe introduce computers to the curriculum or else we're going to have allot of people in later years who cannot function in the workplace because they are not digitally literate.

Given the level of inertia within government policy, it is probably more surprising that this frustration is not more widespread. Is it acceptable to expect second-level education to provide students with the skills that are needed to participate in the workforce or in third-level education? In a paper on the development of ICT in Irish schools, McGarr (2009a, p. 1103) cites the reported views of a school principle:
It is simply inexcusable that schools which should be preparing children for tomorrow’s world have only a basic access to technology... This sorry state has come about primarily because of a complete lack of policy and a funding strategy by the Department of Education to ensure the development of technology in our schools. There has been no direct investment in software and hardware in schools since 2002... This is a lifetime in terms of technology. Although most schools now have broadband, they are now forced to use clapped-out computers, many of which cannot access the information superhighway. (Monaghan, 2006, p. 14)

and concludes that:

…it is unlikely that the recent announcement of future investment in ICT in schools will have any significant effect across the curriculum and instead may play a role in preserving its use within existing discrete subjects. (McGarr, 2009a, p. 1106)

5.2.1.1 Integrating ICT in second-level

Is there an underlying fear amongst teachers of the potential of ICT within second-level education? The possibility of second-level teachers’ authority being undermined by almost unlimited access to information must be at least considered. Equally, the possibility exists that a large shift to self-directed learning amongst teen-agers would reduce the perceived need for teachers in their traditional role as transmitters of knowledge. This possibility might go some way to explaining the failure to adopt a more integrated approach to the use of ICT in the classroom amongst teachers in spite of the fact that “a very high percentage (59%) of the teaching workforce had availed of [the] training” (McGarr, 2009a, p. 1102). Or is it possible that the reasons for the apparent slow uptake of the use of ICT in second-level are more complex?

There is a perception that second-level teachers feel vulnerable to being seen to know less than their pupils, a perception that is highlighted by the infrequent exceptions to this general rule, such as the following quote:

I don’t worry about children knowing more than me – you learn from one another. As long as you’re willing to work in partnership with children, they respect that. It gives them a lift, the same as if they have read something you haven’t. They see that you’re learning all the time, never stop, for life. I don’t mind saying I don’t know. (Kennewell et al, 2000, p. 98)
This quote is from a science teacher in a chapter that examines the relatively slow uptake of integrating the use of ICT in teaching and learning at second-level. In seeking reasons for such slow uptake, Kennewell et al (2000, p. 90) refer to what they call the “balkanised school” and depict inter (subject) departmental rivalries in terms of battles (for subject time) with the school depicted as a battleground. Kennewell and his colleagues also contend that an unwillingness to change established pedagogical practices, to allow teachers to integrate ICT into their subject areas, is to a large extent responsible for this perceived low level of penetration of ICT in secondary schools.

Financial constraints also appear to play a part. Provision of up-to-date computer hardware and software, in spite of a relatively large investment in the past decade (McGarr, 2009a, p. 1103), continues to be far from reaching saturation level and the cost of providing replacement cover for teachers engaged in training as well as the substantial cost of the training itself continue to be under-resourced. A further limitation to the widespread use of ICT in second-level education continues to be the propensity of the equipment to stop working at critical moments and this is complicated by the non-availability of easily accessible (or indeed any) technical support. In the current economic climate, it seems unlikely that this situation will improve in the short-term intimating that the potential for change in the use of ICT in teaching and learning at second-level, in the face of such inertia, appears to be quite small.

5.2.2 Implications for third-level

While there is certainly a case to be made that the use of ICT in third-level (globally) bears no resemblance to its (lack of) use in Irish post-primary schools, such use is far from ubiquitous, especially in Irish third-level colleges. Blin and Munro (2007) contend that ICT has failed in its promise to expand opportunities for lifelong and flexible learning, and appears to have had little effect on practical issues such as decreased funding and increasing student numbers. Citing Conole’s (2004) claim that “e-learning is still marginal in the lives of most academics” Blin and Munro contend that:
Although technology is now common place in most higher education institutions there is little evidence of significant impact on teaching practices … (Blin and Munro, 2007 p. 476).

Within the cohort participating in the current study, many bemoan their own lack of digital literacy but apart from a lack of familiarity with the use of spreadsheets, presentation software and using the Internet for scholarly research (as opposed to social networking) they do not appear to be disadvantaged to any great extent. That the university faculty appear to take it for granted that there is very little if any requirement to provide tutoring in these skills, does however raise questions. The situation where second-level education does not provide a set of skills that are taken for granted in third-level, seems to have created a small but significant digital divide. There is also the possibility that school-leavers who do not continue to third-level education are at a serious disadvantage with regard to their future employability due to a lack of digital literacy. What might the long-term implications of e-learning developing further at third-level be if the situation at second-level doesn’t change? Will third-level institutions find themselves in the position of having to provide a level of instruction in ICT that they had not planned or budgeted for? This will not, however, be a problem if the current cohort is representative of the greater student population as these students have demonstrated a tenacious adaptability in the use of ICT as part of their studies, in spite of the aforementioned lamenting of a lack of digital literacy.

5.2.3 Implications for teacher education

Recognising that the use of ICT within second-level education in Ireland is at best modest and being aware that this situation is unlikely to change in the short-term (McGarr, 2009a, p. 1106), the requirement for the current generation of pre-service teachers to take anything more than a passing interest in the relevance of ICT to teaching seems to be somewhat premature. If, however, teacher educators fail to act, and do not spend at least some resources in making student-teachers aware of the potential of ICT in teaching and learning, change would almost certainly take even longer.
Pre-service teachers appear, in general, to not have any models of how ICT can be used in teaching and learning from which they might draw inspiration. Two possible reasons why this situation has arisen may be that firstly a majority of these students appear to have very little if any experience of using ICT in an educational way as part of their own learning and secondly it is quite probable that the teaching and learning that they have experienced is both traditional and very didactic in its orientation and as a result, any suggestion as to how ICT might be used tends to revolve around that model. This situation is probably frequently exasperated by the fact that in spite of having never used ICT as part of their teaching and learning, these students have clearly been successful in education which in turn probably reinforces their perceptions of traditional teaching and learning as a highly successful model.

5.3 Benefits of ICT in teaching and learning

Having established that while the students in this cohort are far from being technophobes, and recognising that their relative knowledge and experience of how ICT can be used in education is quite limited, brings into question the basis on which 99.6% (n = 284) of these students are adamant that “computers can be of benefit in education”, in response to the question “Do you think computers can be of benefit in education? In what way?”. This almost ubiquitous belief in the potential benefit of computers in education appears to be based on opinion rather than experience because the majority, 87.4% (n = 256), are school-leavers who for the reasons outlined at the beginning of this chapter have had little or no experience of how ICT might be incorporated into education (Gleeson et al, 2001, p. 7) and although some of the students’ opinions seem to be quite insightful, most of them are a little short on detail on the question of “how?” computers might be used. A flavour of these opinions from the pre-study survey is given based on a single example of each of the categories of student use of computers in post-primary school bearing in mind that 70% (n = 204) of the cohort indicated that their computer use in secondary school was either “Never” or “Now and again”.

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yes i [sic] think they would be very benefical [sic] in education because from my experience i [sic] had to learn it outside of schools. pupils [sic] need to knoe [sic] the basics at the very least, because any job they go into or hobby has some relation to it (Never used computers in post-primary school)

Yes because the Internet has a vast amount of useful information on it and also because it varies the stimulus for the pupil. (Used computers now and again)

yes. today [sic] everything can be done useing [sic] computers they enhance the quality of life by makeing [sic] tasks easier. It makes learning easier for childrenen [sic] by letting them interact with sites on revelent [sic] subjects enhancing there [sic] learning. (Used computers regularly)

Yes, because they can be used for such a wide range of things such as accessing the internet to research interesting topics and school related subjects. They can be used for efficiently typing out projects and letters as well as power point, excell [sic] and much more. It can really improve the standard of teaching and is a great resource that I think should be used to its full advantage. (Used computers very often)

Why, in the absence of experience of the use of ICT in teaching and learning is this cohort so enthusiastic about what they perceive to be the benefits of using computer technology in the classroom? It does not appear to be blind enthusiasm for ICT in general, because in response to the question on the perceived disadvantages of ICT in education in the pre-study survey, the qualitative comments of 34% (n = 96) of the cohort were interpreted as indicating that the students were concerned with issues of classroom management or control as exemplified by:

If students do not have sufficent [sic] skills in differenciating [sic] between useful material from quality sources and other less useful material they may become overburdened by the vast quantities of information available at their fingertips. They may also start to use unreliable information which may misinform them to some extent, thus giving them a base of false knowledge.

while the responses of a further 25% (n = 69) were interpreted as indicating that the area of most concern was that traditional teaching was seen to be better, of which the following is an example.

Yes, students and teachers alike may become dependent on ICT in education and forget about the older forms of teaching like handwritten notes and experimentation. Classes should not always be based around audio and video presentation as this can often graasp [sic] the attention of the students, however it can lose their concentration just as easy [sic].
Is it possible that students’ enthusiasm for the use of ICT in education is based on a perception that the technology is clearly seen to be successful where they have encountered it to their personal lives? This success can be seen in the ubiquity of mobile phone ownership, especially in the proliferation of texting as a form of communication (a show of hands during the first computer lab for all students suggested that approximately 90% of the cohort are sufficiently adept at texting that they can compose texts blind, while the phone is hidden under the desk or in a pocket).

It is also possible that the media’s portrayal of ICT as being successful in and of itself and the wealth of positive comment into the usefulness of ICT being placed in the public domain by the ICT industry, either as comment or as publicity, have had an influence on these students’ perceptions. The positive publicity surrounding ICT in general is in stark contrast to the extent to which computer technology appears to have failed to have an influence in education (Cuban, 1993, p. 188), which is not nearly as well publicised.

Successful use of the technology can also be seen in the extent to which computers are used as part of their university studies as indicated by 72% (n = 210) of the cohort (in response to a question on current use of computers in the pre-study survey) who admit to using computers mainly for coursework as the following examples demonstrate:

- e amil [sic] access or college assignments
- Typing projects, email
- Project-work, emailing

and the 23% (n = 66) who admit to using the Internet both for accessing entertainment and social networking as suggested by the following examples:

- mainly for college work but also for use of the internet to keep in contact with friends through bebo etc
- email, bebo...research if i [sic] need it for assignments or teaching
- writing up projects, research and occasionally for entertainment
The findings contain no data to suggest that successful use of the technology in their personal lives has in any way influenced students’ enthusiasm for the potential benefits of ICT in education and it is mentioned here only as a possible explanation for that enthusiasm. This enthusiasm is not confined to the students’ responses to the pre-study questionnaire as the findings indicate that 97% (n = 267) consider that ICT can be used in their subject area and 94% (n = 253) think that it should be used. All of the students who believe that ICT should be used in their subject area offer some insight into how or why they think this can be achieved, such as:

I think it would be relevent [sic] to geography if there was some form of tutorial software out there or if I could get some simulation software to show pupils visually how complex processes like the water cycle, wind, and erosion work

however, none of the 14 students who think that ICT should not be used in their subject area, offer any explanation for their hesitation.

In the case of those students who plan to teach Technical Graphics it is relatively easy to understand their certainty with regard to their intended use of ICT, as changes to the syllabus to include CAD (computer aided design) have been publicised for some time. Several students both of PE teaching and Biological Sciences refer to Bodyworks, the simulation software package investigated as part of the course, in their anticipated use of ICT. This is an interesting manifestation of learning as no student in this cohort (by their own admission) had encountered this software package prior to starting the course. Similarly, some of the students of Physical Sciences teaching mention that they intend to investigate ways of incorporating problem-solving software into their teaching, while students of Engineering and Construction Studies teaching see potential in using simulation software to explain complex procedures as part of their teaching.

In view of the perceived overwhelming enthusiasm for the potential benefits of ICT in education, a pertinent question must be how these views are likely to change as the students’ understanding of the complexity of teaching and learning changes. As these students progress through the teacher-education
programme, they will be exposed to different concepts with regard to the multiple roles of teaching and learning with greater emphasis on the facilitation of constructive enquiry. Is it possible that a better understanding of different concepts might change their perceptions of ICT in education from being used to support the role of the teacher to being used to support constructivist learning?

5.4 Student use of the course

To what extent did this course lend itself to being readily used by the students? Certainly, from the logistics perspective, students did not encounter problems with accessing the course (the tracking facility of the LMS indicates that students logged in and completed tasks at all hours of the day and night including weekends) and the LMS software was stable as well as never yet having caused the server to crash. The availability of computers and the provision of Internet access, identified as first-order barriers by Ertmer (1999, p. 51), are well supported by an efficient and pro-active information technology department (ITD) within the university. Equally, second-order barriers (ibid.) inasmuch as the term might apply to students’ willingness to use the technology, appear not to be a problem as the rates of participation in the findings indicate. A possible problem in this area was highlighted by the students themselves when they claimed to be not sufficiently digitally literate to optimise their learning as the following indicates:

I personally am not very [sic] computer literate so it took a while to grasp all the different functions

but this situation was far from common. In the light of neither access to the technology, nor students’ willingness to engage with the technology being barriers, why is ICT not used more at third-level? While it is believed that it is appropriate that this question be raised and a suggestion that faculty often fail to recognise the value to teaching and learning of using ICT more, it is contended that realistic answers to this question are beyond the scope of the current study.
A potential problem relative to access was highlighted in the findings when it became apparent that 8.1% (n = 23) of the cohort did not have off-campus access to the Internet but that this lack of access does not appear to have had any adverse effects on the members of the group from the perspective of participation. Some concern might be expressed that none of the members of this group were amongst the 5% (n = 14) of the cohort who received full marks in the summative assessment while at the other end of the scale the proportion of this group gaining just a passing grade (40%) was higher than the cohort average. Similarly, concern might be expressed that because this group did not have 24/7 access to the online material, there was a danger that they may have felt discriminated against, but only two such concerns were raised (by two different students) in the post-study survey, one as the student’s comment on the most negative aspect of using the software:

was the fact that you had to do it outside your assigned lab as i [sic] do not have the internet at home i [sic] used to have to come into the college to do it

and the second such comment was one of the six “Any other comments” (at the end of the post-study survey) that were interpreted as “Negative”:

The course was very compressed time wise, rather than understandind i [sic] found myself just trying to remember for the test. Hard to study for the test in my free time as i [sic] only have internet acess [sic] in the college.

while the fact that the matter was never raised in any of the group discussions would seem to indicate that this potential problem never became a significant problem.

The question of whether female students apply themselves to learning more assiduously than their male colleagues was also analysed within the overall question of students’ use of the course. The case for this assertion can certainly be made in relation to the findings, as the data show that girls performed better in the assessment, attended more frequently and participated more in the activities. The claims of gender bias are based on the overall gender constitution of the cohort which was 64.5% (n = 189) male and 35.5% (n = 104) female.
The question of why female students apply themselves more to their learning than males is recognised as being valid, as well as germane, and appears to be deserving of a level of research that was beyond the scope of the current study. Horne (2007, p. 52) suggests that there may be a problem of girls being unfairly disadvantaged when computer based assessment is used to assess learning compared to more conventional methods of assessment but that probability is not supported by the current study which clearly shows that the majority of female students are not disadvantaged by the assessment being computer-based.

The findings of this study do not shed any light on the reasons for this gender bias although the grades gained in the summative assessment (females made up 50%, n = 7, of the 14 students who gained a 100% grade) are in line with females outperforming males in most Leaving Certificate subject results in recent years.

One measure of performance is the proportion of students who achieve high A or B grades. By this measure females outperformed males at Higher level in 2008 in all major languages, in mathematics, all sciences, humanities and arts, all business subjects. Male comparative under-participation and attainment is a major national issue. (The Irish Times, February 10, 2009)

Because of the possibility that the question of gender bias might have been distorted by the relative gender imbalance across the different subject areas, the findings also looked at the situation within Science and PE teaching which were both female dominated programmes, and found that within these programmes, the gender bias was even more pronounced, but other than observing that this is so, questioning why this situation prevails is beyond the scope of the current study.

5.4.1 Factors that facilitated or inhibited student use

Students accessed the LMS at all hours of the day and night including weekends and while the findings show that 34% (n = 97) of the cohort completed all 14 of the available tasks and 79% (n = 226) completed at least nine of the tasks this raises questions as to why all (or at least more) of the
students did not access and complete all of the tasks. Some possible answers are supplied by the students themselves in response to a question in the post-study survey that asked them to indicate the negative aspects of using the system and these include that it was repetitive, boring, more difficult to read from the computer screen than from a book, not relevant to own subject areas, too challenging, not challenging enough, too much reading, not enough activity, too time consuming and more.

Should each of these claimed negative aspects be taken with a pinch of salt or should an attempt be made to act on some of them? How much reading is too much reading for first-year, pre-service teachers? Are some students always likely to disagree on whether some elements are too challenging or not challenging enough? Could all of the formative tasks be made so interesting or informative that all of the students enrolled on a course would want to complete them? Would re-introducing continuous summative assessment, which was discontinued as part of the most recent changes to the course, make a difference?

In-classroom continuous assessment would have the advantage of increasing attendance as well as decreasing the potential of test-anxiety associated with high-stakes end-of-course testing (Crooks, 1988, p. 458) and would have the further advantage of adding an element of variety which many students might find motivating (Haigh, 2007). Could in-classroom continuous assessment be expanded to the extent that it could be seen to be enjoyable? Introducing an element of collaboration (Crooks, 1988, pp. 458-459) where students had an opportunity to discuss the likelihood that one of several possible answers to an MCQ was the most feasible before deciding on the optimum answer might make the assessment enjoyable through the enhanced social interaction (Sainsbury and Walker, 2007). Using EVS “clickers” (Nicol, 2007a) would allow responses to be recorded thus becoming part of each student’s permanent record and adding CBM (ibid.) would reduce the likelihood of guessing as well as encouraging students to reflect on their answers to determine the reliability of the reasoning behind those answers which in turn might increase students’ confidence in their own knowledge (ibid.).
Can assessment be enjoyable? Can all learning be made so intrinsically interesting that strategies designed to encourage learning would become redundant or will there always be a need for certification to encourage learning? The correlation of effort with reward is discussed in a subsequent section.

5.5 Learning

What level of learning did students achieve on this self-directed, online course? Later in this chapter the whole issue of the correlation of the number of tasks completed compared to the summative grade gained is investigated, but firstly the question of the level of (non-) interaction between students in the online discussion fora is examined.

In response to queries from the students, the tutor confirmed that while the lesson and quiz tasks contained content that might be assessed in the summative assessment, no such benefit could be applied to the online discussion fora, of which there were one each in Topics 2 and 3, and this lack of benefit, it is believed, is reflected in the relatively low rates of participation in the discussion fora. It was however emphasised to the students that the benefit of reflective practice inherent in contributing to online discussions might be its own reward. The subjects of these discussions were “By the end of the 20th century it was no longer possible to view literacy as based on words or even on word-based texts. - What does literacy in the information age now encompass?” in Topic 2 and “The increased penetration by ICTs into all areas of social life - not least education - is driven largely by capitalism's relentless search for new markets ... Investing in computers is, so parents are told, a way of investing in your children's future. (Ferneding, 2003, p.25) Do you agree with this statement? Is using computers a better way of doing things?” in Topic 3.

The findings show that the majority of these contributions, 79% ($n = 60$) in Topic 2 and 90% ($n = 62$), in Topic 3 were “stand-alone” posts, meaning that each contributor added their own two cents worth without reference to what their colleagues had previously contributed which led to similar points being made repeatedly as the following two posts indicate:
I would say that modern literacy not only encompasses being able to read and write but also must cover technological literacy. By this I mean that in the 21st century we are surrounded by technology and we are now living in a society where even the most basic everyday tasks now involve some sort of technology.

and

nowdays [sic] literacy is not just [sic] about being able to read and write you also need [sic] to be literate in technology. we [sic] use technology on a daily bases [sic] and so need to be competent in it. it [sic] varies from things like pc's and mobiles and atms. everything [sic] is forever developing and we need to keep up with it

Why did the majority of participants in the discussion fora choose stand-alone contributions over interactive posts? There is a strong sense that this is mainly because of inexperience as this was a new departure for most of the participants. That being the case, the tutor stands accused of not asking sufficient questions to be aware of such inexperience. If such inexperience was the cause of the discussion fora lacking interactivity, and the tutor had made himself aware of this shortcoming, he might have improved the situation by providing more guidance.

In hindsight, there was a certain naivety on the part of the researcher that by providing the tools of discussion fora, the students would be sufficiently interested in the discussion topics that they would develop an online debate without further encouragement.

On the rare instances where contributors reacted to previous postings, the beginnings of a discussion could indeed be discerned as the following interaction demonstrates (names have been omitted to preserve anonymity while the relevant timeline and relative position of the contributions have been retained):
No, as by the end of the 20th century literacy was more than reading and writing, computer literacy had come into the equation and now people are focusing just as much time and money on this type of literacy as well as reading and writing.

I disagree. Not enough time is spent on making the youth of today computer literate. Certainly not the as much time as is dedicated to reading and writing! I think the future of the 21st CENTURY depends on even more focus being put on teaching the youth to become more computer literate.

I believe that the issue of computer literacy is dependent on a number of factors including whether there are appropriate facilities and trained teachers in a school. But computer literacy also relies on if the students have access to computers outside of school in order to enhance their learning.

I totally agree. I feel in today's world if we had enough money we would all use the computer and other technology around us to learn our literacy. I can honestly say when I was doing my leaving cert I didn't use a book for studying I went to the internet to get the information I needed. I just shows we are relying on technology far more now than 50 years ago even 10 years ago and this is why more people are using technology for to improve their literacy.

Unfortunately, this interaction came to an end after just four postings and while other interactions in this topic ran to five and nine postings, those interactions lacked the disagreement that helps to engender real discussion and the beginnings of an online community of practice (CoP) to help improve student learning (O'Donovan et al, 2008, p. 215). What might such a community look like? How might it benefit or engender learning?

### 5.5.1 Learning through a CoP

What is a community of practice? Wenger et al (2003) describe communities of practice as:

… groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting in an ongoing basis. (Wenger et al, 2003, p. 4)

and Molphy et al (2007) modified this definition to include the possibility that

“Communities of practice are also learning environments.” (Molphy et al, 2007, p. 711)
In an ideal world, the learning gained from being a member of a CoP would be its own reward (Wenger et al, 2003, p. 4), but in the real world of third-level education, students expect that learning is rewarded by certification or at least a summative grade that is accumulated towards certification. Whilst recognising that this aspect of any learning is important (if not the most important from the student’s perspective), assessment (and consequently, grading) will not be dealt with immediately. Of more immediate interest are the elements that might successfully contribute to an online CoP.

Molphy et al (2007) identified “Skype, blogs, wikis, video clips, and mp3 sound bites” (Molphy et al, 2007, p. 710) as feasible elements of an online CoP where the members were widely, geographically dispersed. It is proposed that two of these elements – blogs & wikis – together with the aforementioned discussion fora would be sufficient to implement a CoP whilst recognising that the possibility of face-to-face interaction should not be eliminated. The first three elements are suggested because they are amenable to some level of assessment and while it is not envisaged that any face-to-face interactions would directly form part of any assessment, it is hoped that one or more of the other elements might subsequently (or even contemporaneously) be used to capture the outcome of any such face-to-face interaction.

It is envisaged that the students would be part of a consultative process to decide on the criteria of assessment (Shepard, 2000; Nicol and Macfarlane-Dick, 2006; O'Donovan et al, 2008; Taras, 2008; Boud, 1991; Sithiworachart and Joy, 2007; Kirby and Downs, 2007 & Nicol, 2007a) thus empowering them and transferring the locus of control from the lecturer to the learners (Tan, 2004; Taras, 2008 & O'Donovan et al, 2008). The case for the resultant grading process being peer-assessment based is compelling (O'Donovan et al, 2008, p. 211) and the rating mechanism included in the Moodle LMS discussion Forum module would facilitate such assessment. While the wiki and blog modules within Moodle do not contain such a rating mechanism, it is suggested that student contributions in either of these media might be sign-posted as a one-line post in a discussion forum and that these posts could be used to facilitate the rating of the blog or wiki contribution.
How much familiarity do these students have with blogs or wikis? The findings highlighted that when queried on their main use of computers, no student mentioned taking part in online discussions, contributing to wikis, creating web pages, writing a blog or any level of collaboration that might lead to the creation of a community of practice. This implies that this cohort has little or no familiarity with either wikis or blogs, but even a cursory glance at Facebook (the social networking site with which this researcher is most familiar) indicates that most of the users are well able to express themselves and to react to the opinions of others through the medium of online posts. While the extent of this cohort’s use of social networking sites is not supported by empirical data, tutor observation suggests that students’ use of Bebo and Facebook, while in the computer labs, was very high. Can first-year student-teachers discipline themselves sufficiently to transfer these skills to creating a blog, contributing to a wiki or posting comments and reacting to the comments of their peers on an online discussion forum where the topic under discussion is their own learning? Accepting that there is no shortage of ability raises the question of incentive and it is contended that, whether or not the students can be encouraged to engage in learning for its intrinsic value, a meaningful grade would be seen as more than adequate incentive.

Questions might well be raised as to how the university should construct such a community of practice or whether the students on this (or any other) course are sufficiently familiar with each other to benefit from such a learning space. It is speculated that rather than being party to the construction of a CoP, tutors’ responsibility should be directed more to encouraging and enabling the students to construct the CoP for themselves with the tutors’ role evolving to one of facilitator or guide while also taking on the mantle of teacher-as-learner, to better participate in the CoP. Ground-rules, with appropriate sanctions, would have to be agreed in advance to ensure that healthy debate did not descend into name-calling or bullying. With regard to students’ lack of familiarity with each other, it is postulated that the shared interest of demonstrating that learning is taking place, with a consequent attainment of high grades, would quickly overcome any such lack of familiarity and that in
fact acquaintances would blossom as a result of the opinion-based nature of interactions.

5.5.2 Why learn through a Community of Practice?

The modularised structure of the university’s model of teaching, learning and assessment appears not to lend itself to the type of long-term engagement and exposure to concepts and ideas that might benefit from being developed and nurtured within the shared learning space that could be engendered by a community of practice. Typically, learning is followed by assessment, from which a grade is earned which leads to certification. Without specifying that a goal of providing online discussion fora might be the creation of an online CoP, the course organisers hoped (naively, in hindsight) that the online discussions would create a level of interaction amongst the students that would effectively have made the debate that might have ensued indistinguishable from a CoP. Might students be more willing to engage in a CoP if that engagement earned them a grade? Might students have been more willing to engage in a CoP if the advantages of doing so had been explained to them?

The examination of the feasibility of students participating in a CoP as a learning environment (Molphy et al, 2007, p. 711) must be tempered with the recognition that the learning environment from which this cohort comes is almost exclusively one of individual learning. Within such an independent learning model, students are responsible only for their own learning and besides being a solitary process that learning is also seen as being very competitive. It is quite possible that changing to a cooperative model of learning, where collaboration rather than independence is given primacy, such as a CoP, might take too long for the concept to produce tangible results. There is however a strong possibility that these students are sufficiently adaptable to adopt such different learning practices. An indication of this adaptability can be seen from the fact that although these students had no previous experience of self-directed learning, the level of participation in the course was quite high in spite of the fact that this level of participation reduced as the course progressed. A subsequent cohort taking this course (2007/2008)
went much further towards the creation of an online CoP, using online discussion fora, when the incentive of their contributions being graded by the tutor was added. It is contended that if participation in the online discussion fora was given greater encouragement, as well as a higher grade, the creation of a true community of practice would ensue.

5.6 Correlation of participation and reward

5.6.1 Correlation of learning through formative assessment and reward

The findings highlighted that there appeared to be little or no correlation between the number of tasks completed as part of the available formative assessment and the grade achieved in the online summative assessment. This finding prompts the question of why this is so and a number of possibilities are considered:

- Crisp (2007) is correct in her contention that students either do not take cognisance of the feedback inherent in formative assessment or do not understand how the feedback might be used to improve;
- The researcher failed to convey the importance of using the formative assessment to benefit their learning to students who might never have previously encountered formative assessment;
- There are insufficient questions asked as part of the formative assessment;
- The questions in the formative assessment are not sufficiently probing;
- The feedback provided as part of the formative assessment is inadequate;
- The summative assessment is not valid.

It is contended that with the benefit of hindsight, the first five of these six possibilities should be considered to have contributed to the perceived lack of correlation between the number of tasks completed as part of the available formative assessment and the grade achieved in the online summative
assessment. The possibility also exists that the summative assessment was not valid but the researcher contends that this is less likely than a combination of the other factors.

5.6.2 Correlation of effort (as participation) and reward

As mentioned in a previous section, teacher-education programmes tend to attract high achievers from second-level education and this is evident from the findings which demonstrate that 78% (n = 226) of the cohort achieved a grade C3 or better in the online summative assessment while this rose to 88% (n = 254) getting a similar grade or better in EN4002, the module of which ICT in Education is an element. The findings also show that 34% (n = 97) of the cohort completed all 14 of the tasks that contained material that could form part of the summative assessment, while 63% (n = 181) completed eleven or more tasks and 79% (n = 226) completed at least nine of the tasks. These findings indicate relatively good level of engagement with the course and moderately good grades.

As was reported in the previous chapter, these findings caused two questions to be posed – “How could a student gain 100% in the online summative assessment and receive an “F” in the module overall?” and “What might cause 10% (n = 30) of the cohort to fail a multi-element module?” and the answers are straightforward. As a multi-element module, there is a requirement that every element of the module be attempted and a consequence of not complying with this requirement is failure in the module. The student who received full marks in the online summative assessment and an “F” grade overall did not submit any Philosophy of Education essay. More importantly, however, this student’s performance raises other questions about the authenticity of the online summative assessment as he was one of the three students who completed just two of the 14 available tasks. Although this student’s reward to application ratio was exceptional, it was not unique as another (male) student who achieved full marks in the online summative assessment completed only one of the available tasks and confirmed his academic prowess by scoring a “B1” on the module overall. A third male
student, who achieved a remarkable reward compared to his apparent effort at engagement on the online summative assessment, managed to achieve a 90% grade without completing a single task either on the online course or the face-to-face labs and he also demonstrated good overall ability by scoring a “B3” for the module in general. Were these three high-scoring but apparently low-engagement students (1% of the cohort) outliers?

At the other end of the scale another three students who failed the assessment at the first sitting were among those who completed all 14 of the available tasks, completed all of the formative assessment and attended all three of the face-to-face computer labs. It seems unreasonable that this combined 2% of the cohort should take away from the validity of their learning from the other 98% for whom the course of study appears to have been successful. This in turn raises the question of how success is measured. Is it plausible that for the latter three students who engaged fully with the course but failed to achieve a passing grade at the first sitting, the course might be deemed to have been a successful learning experience? While the conventional measure of success in learning is the level of grade achieved, should this measure be applied to a self-directed course of study? Is it possible that engaging with a concept, raising pertinent questions or expressing an opinion about the concept, for instance as part of an online discussion forum, can be considered to be learning and that the subsequent completion of a piece of summative assessment is merely a formality to confirm the learning?

The findings do not provide answers to these questions and these questions in turn beg the further question of whether the summative assessment was not valid, but this possibility is refuted by reference to the fact that not all students managed to achieve 90% or 100% in the online summative assessment as should be the case if the summative assessment was too easy. There is however, further evidence of a lack of correlation between the number of tasks completed and the grade achieved, as found in the range of grades achieved by students who assiduously completed all 14 of the available tasks, where all grades from 40% to 100% inclusive are represented. Do these findings call into question the validity of the learning and the authenticity of the
assessment? Other questions raised by the apparent lack of correlation between effort and the summative grade achieved must include:

- Does this show that the course wasn’t of any real benefit at all and it was just a matter of luck as to whether you could guess the correct answers to the questions in the online summative assessment?
- Does it show that participation in the additional elements such as the discussion groups, attending the face-to-face labs and completing the formative assessment tasks add no value at all to the programme?
- Did the online summative assessment assess the students’ in-depth complex knowledge and understanding that was required in the programme or did it just assess recall?
- Were the course organisers being over-optimistic that participation in the discussions and other activities would result in complex and deeper knowledge being acquired?

It is contended that, based on student feedback (discussed at length in the next section);

- the course was of intrinsic benefit and the majority of students did not depend on luck to achieve their summative grade;
- the additional elements had an inherent value, even if this was not recognised or understood by all students;
- complex knowledge and understanding was assessed (see Appendix 7);
- while the course organisers recognise that they were indeed being over-optimistic that participation in the discussions and other activities would result in complex and deeper knowledge being acquired, such knowledge was nonetheless acquired by at least some of the cohort.

As a result of the apparent lack of correlation between effort (as engagement with the course) and the grade achieved, the findings were also analysed to quantify the level of correlation between the grades that students achieved for the summative assessment associated with the online course and corresponding grades for the module of which the course was an element. The
findings highlighted that while correlation between the two was far from perfect, the tendency towards correlation was strong with some notable exceptions. A strong correlation can be drawn between the 22% (n = 62) of the cohort who achieved either a B2 or B3 for the module overall and achieved equivalent grades in the online course while the most notable exceptions include the student who achieved an A1 in the online course and a C2 in the module or the student who achieved a B1 grade in the module but only a D2 in the online course. It is also worth mentioning that similar discrepancies exist among the other elements that are part of the module with some corresponding grades fluctuating widely such as a student getting a D3 in Digital Video or Philosophy of Education essay and gaining a B1 in the overall module.

5.6.3 Correlation of effort and satisfaction as reward

The correlation of effort and satisfaction is considered in terms of student feedback as highlighted in the findings. That feedback was overwhelmingly positive in the case of students’ determination of the suitability of the course for online presentation and assessment (90%, n = 237, considered it to be suitable) as exemplified by the following response:

Yes, i [sic] do think it was. The online presentation part was very effective and it was very different to the norm of lecturing, which made it more interesting. Also it gave people the option of doing the practical parts at home, which was very good if someone missed a class, or preferred to do it from home. This gave them the option of going to class, or if they felt comfortable they could stay at home. I think the assessment was effective too, although maybe if there were more questions, it would be more effective at showing the knowledge of the classes. In [sic] some cases simple logic could be used to answer the questions, or someone who didn't have a notion could pass by guessing the answers, whereas it would be more difficult if there were more questions. On the whole though, i [sic] found the module very useful and effective, not just for me but i [sic] think it helped everyone in the class, in becoming more confident with computers and in giving them teaching ideas.

although it is noted that this response demonstrates the student’s misunderstanding of the mandatory nature of the computer labs (he missed one lab) and it is also noted that this student completed only six of the available 14 tasks but still achieved a 100% summative grade in the online course as well as gaining a B2 grade in the module overall. While it is accepted that a relatively high percentage of the students who achieved an A or B grade in the
summative assessment did not complete all 14 of the available tasks (119 students achieved an A or B grade and 35%, n = 42, of these completed all 14 of the tasks), it is contended that the positive response to this question of the suitability of the course can be claimed as a measure of overall satisfaction with the course. Interestingly, one of the 2% (n = 7) of responses interpreted as indicating that the course was not suitable for online presentation and assessment:

I don’t [sic] think so it tested your knowledge not your ICT skills.

inadvertently vindicates the focus of the course on knowledge rather than skills.

While the other two elements of student feedback were not as overwhelmingly positive as the responses on the question of suitability (only 60%, n = 166, described the experience as “Enjoyable” or “Very enjoyable” and 88%, n = 66, wrote comments that were interpreted as being either “Positive” or “Very positive”), they do indicate a very high level of satisfaction with and enjoyment of the course. This high level of satisfaction is mentioned as justification of the claim that the course should be seen as successful in its own right even if the underlying concept of creating an online community of practice was neither recognised (by the course organisers) not achieved.

5.7 Improvements

The genesis of this project was an attempt to take an existing course and present it online as well as developing an assessment tool that was transparently fair, valid and authentic. This was a genuine attempt to integrate ICT into learning and assessment that in hindsight raises questions about the limitations of the perceptions of how ICT might be used in education by those involved in this attempt at change. That there are elements of the course that could be tweaked to make them better is not in doubt, for instance adding confidence based marking (CBM, Nicol, 2007a) to the online summative assessment, but real improvement would probably best be achieved by
implementing an online community of practice as outlined earlier in the chapter.

5.8 Chapter Summary

The discussion of the findings looked at the depth of the students’ engagement with the course through four lenses, viz. experience of the use of ICT in teaching and learning, enthusiasm for the potential benefits of ICT in education, use of the discussion fora and the significance of the summative grade achieved as compared to the perceived success of the course. The possibilities of developing an online community of practice were probed in response to the perceived shortcomings of trying to convert an existing course of study to an online self-directed course being highlighted by the analysis. This discussion will inform the recommendations offered in the final chapter.
6 Conclusion & Recommendations

6.1 Introduction

This study investigated the factors that influenced the level of engagement of a cohort of first-year student-teachers with a self-directed, online course of study and to what extent that engagement caused the students to experience a change of attitude towards ICT as a tool to enhance teaching and learning. Analysis of the data collected from online questionnaires, historical tracking of the learning tasks completed, opinions expressed in response to open-ended questions, summative grades achieved and the researcher’s observations suggest that in spite of a very limited exposure to both ICT and its use in education, this cohort of students continue to see great potential for ICT as a tool to enhance teaching and learning and have demonstrated a profound adaptability to accommodate self-directed online learning.

The findings indicate that while these students could not easily be described as “Digital Natives” (Prensky, 2001), they should be in a much stronger position than their predecessors to make more and better use of ICT in the classroom. A number of factors which will, however, continue to militate against the potential use of ICT in teaching and learning at second-level are the projected lack of up-to-date equipment, appropriate software and available technical support. A potentially greater problem however, is pre-service teachers’ lack of a credible model of using ICT in teaching and learning that can be seen to be at least as useful as the traditional model of teaching with which they have total familiarity.
6.2 Conclusions

1. First year student-teachers are willing and able to engage with a self-directed, online course of study but their willingness to engage with their peers through online discussion fora appears to be less well developed.

2. There is a need for scaffolding (Vygotsky, 1978, p. 86) to help students overcome the uncertainty due to their inexperience of self-directed learning.

3. Students’ enthusiasm for the use of ICT in education as proclaimed both before and after undertaking the online course of study is widespread, but their enthusiasm for the benefits of ICT in education appears to be based on opinion rather than experience.

4. Students’ familiarity with and ability to use ICT is less than ubiquitous in all areas other than word processing, using email and using the Internet for entertainment.

5. The majority of this cohort subscribe to the perception that post-primary schools are not doing enough to encourage digital literacy.

6. More than 90% of students have 24/7 access to ICT and those who do not have full access do not appear to be adversely affected in terms of participation. In some cases this access is confined to the university’s ICT provision.

7. A gender bias in favour of female students is discernable both in terms of participation and performance.

8. Students’ grades for a self-directed, online course of study are generally in line with their overall grades although a lack of correlation between the number of tasks completed (effort) and the grade achieved (reward) was discerned.

9. A change of attitude towards ICT as a tool to enhance teaching and learning as a result of having completed this self-directed, online course on ICT in education was discerned in a majority of the cohort.

10. This study cannot conclude that conceptual learning can be assessed using CAA.
6.3 Recommendations

The role of education is changing. The traditional model, where the most obvious learning outcome is the ability to recall, has in recent decades been superceded by the need to encourage the ability to think. Active learning encourages critical thinking (Oros, 2007). The case in favour of active learning continues to gain widespread support worldwide as the writing of Dewey, Piaget, Vygotsky and others gains currency. While active learning gives the learner the right to determine which learning styles suit them individually, the flip-side of that coin is that learners must take responsibility for their own learning. Recognising that learners can take more responsibility for their own learning (Lunenberg and Korthagen, 2003, p. 29), allows learners to also take responsibility for the personalisation of e-learning technology (Conole et al, 2008, p. 519). The personalisation of e-learning technology includes how the technology is used as well as which elements of the technology are used, but learners can only make choices in such matters if the content that they wish to learn is available electronically and they have the skills to use the electronic tools.

How much content can be made available electronically and are there cogent reasons why all content should not be made available electronically? Is there a danger that by making all content available electronically, for consumption by learners at a time and place of their choosing, the worst aspects of the transmission model of learning will be reinforced (McGarr, 2009b, p. 319), or can classroom (lecture) time be used more productively if the content has previously been learned or at least viewed? It is anticipated that ICT will be used both to present content (Conole et al, 2008, pp. 511-512) as well as for the more productive use of face-to-face time such as in-class continuous assessment (Nicol, 2007a. p. 53; Sainsbury and Walker, 2007, p. 104).

The following recommendations are intended to address the situation where ICT can be used to enhance learning:
1. It is recommended that any future presentation of an online self-directed course of study would include an expanded online discussion fora element and that students’ contributions to such discussions would attract a meaningful grade.

2. It is further recommended that the potential learning opportunity inherent in student participation in such discussion fora be emphasised to the highest degree. It is contended that an online self-directed course of study with integrated online summative assessment can be used to enhance learning although it is accepted that further research is needed to determine the validity of both the online summative assessment and formative assessment.

3. The combination of online discussion fora, together with blogs and wikis which can facilitate the provision of an online CoP is recommended as the mechanism by which conceptual learning can be enabled and assessed with the assistance of ICT, as outlined in the Discussion chapter.

6.3.1 Reasoning behind the recommendations

In an attempt to determine whether conceptual learning can be assessed using computer assisted assessment this study asked two research questions which sought to find out the extent to which first year undergraduate pre-service teachers were willing to engage with a self-directed, online course on ICT in education which made widespread use of formative as well as summative assessment, and to what extent students’ engagement with a self-directed, online course on ICT in education changed their attitudes towards ICT as a tool to enhance teaching and learning. The findings indicate that students’ engagement with the course was high but not comprehensive and that the majority of students changed their attitude towards ICT as a tool to enhance teaching and learning as a result of their engagement with the course. A claimed change of attitude by students can at best be seen only as an indicator, as the ultimate test of any such change of attitude will only be seen when these
students have an opportunity to put their learning into practice, initially during the teaching practice that is an integral component of the programme and ultimately in their careers as teachers.

The module of which the course was an element is no longer presented to first-year student-teachers but was presented in 2007/2008, the year following the investigation of the current study. That final presentation of the course incorporated a redistribution of the available grade to include a portion for attendance at the mandatory computer labs as well as a portion for contributions to the online discussion fora, as was mentioned in the Discussion chapter.

The level of use of the discussion fora as reported in the findings would not appear to justify the recommendation of an online community of practice as an alternative learning opportunity but as previously stated, this is more a reflection of the researcher’s lack of awareness of the potential of an online CoP than a lack of aptitude on the part of the students. The prevalence of networks as learning environments (family, clan & tribe) has existed since prehistory but the informal nature of the learning inherent in such networks might well be seen as less than useful within the context of teacher education or higher education in general. It is contended that the facilitating element that can transform casual networks into formal communities of practice, is ICT.

However, it is accepted that this contention would also benefit from further research, especially in a scenario where student contributions to a CoP attracted a substantial grade.
References:


Welcome to the online ICT (Information & Communications Technology) in Education course.

This course forms part of the EN4002 module and is delivered online to provide you with an experience of web-based learning. We hope you enjoy the experience and that it gives you an opportunity to explore just one of the ways in which ICT can be used in education. It is broken into a series of units. Each unit leads on to the next and you will be expected to complete questions and quizzes on the material as you go along. The material is broken down in a week-by-week basis. The material for the given weeks will be accessible only during the specified dates. **Outside of those dates they cannot be accessed.** So remember to complete all necessary questions and activities by the end of the specified week.

Attendance at the computer labs in SR2-031 is **mandatory**. The summative assessment will take place online in the computer lab during the final hour of the fourth lab. The formative assessment used during the first three topics is designed to help you get the maximum grade in the summative assessment therefore take your time completing the given questions and activities. Each topic contains about two hours of activities which you are encouraged to complete in your own time. Remember that you can access the units from any location (as long as you have a computer with internet access), provided that you do so within the timeframe given.

If you have any difficulties using Moodle, post your query on the 'Discussing Moodle problems' forum and an answer to your query may be posted by others. You can also ask the tutor in the computer lab.

If at any stage you are not sure what to click next, try "EN4002".

Close Window
Appendix 2

Pre-study survey

Dear Student,

My name is Greg Scanlon and I’m a postgraduate researcher researching e-learning in the university. This will probably be your first experience of web-based learning and in order to evaluate how good the online module is, I’d like to get some initial information from you. Any information you submit on this survey will be strictly confidential and only I will have access to it. You don’t have to include your name in the survey but I would appreciate if you did as I will be asking you to complete a second survey on completion of the course and I would like to compare students’ views at that time. If you have any questions in relation to my research please feel free to email me at greg.scanlon@ul.ie

Yours sincerely,
Greg Scanlon.

Please complete the questions below and submit the form by pressing the 'Submit Comments' button at the bottom of the page.

Name: 
Age: 
Gender: 

Leaving Cert subjects:

Q1. Programme Choose one required

Q2. How often did you use a computer in your post-primary school never now and again regularly v often

Q3. Please give details/comments on your experience of using computers in your school

Q4. Do you have regular access to a computer outside UL during term? yes, all the time yes, weekends only/at home no

Q5. Do you have access to the Internet outside UL during term? yes, all the time yes, weekends only/at home no

Q6. How often do you use a computer? never now and again regularly v often

Q7. What do you MAINLY use a computer for?

Q8. How much do you use e-mail? never now and again regularly v often

Q9. How often do you access the Internet never now and again regularly v often

Q10. Where do you mainly access the Internet in UL?

Q11. How competent are you using the following applications?
a) Wordprocessing very competent fairly competent not v competent not at all competent
b) Email very competent fairly competent not v competent not at all competent
c) WWW very competent fairly competent not v competent not at all competent
d) Excel very competent fairly competent not v competent not at all competent
e) Powerpoint: very competent  fairly competent  not very competent  not at all competent

Q12. How are your typing skills?  Very good  Good  Slow  Very slow

Q13. Do you think computers can be of benefit in education? In what way?


Q15. Would you use ICT as part of your teaching and if so, in what way?

Q16. Have you ever used computer-based assessment before?  Yes  No

If yes, in what way?

Q17. What is your understanding of e-learning?
Appendix 3

Help page for online course

HELP page

Here's some advice on using the web if you're a bit rusty at it!

To copy a web address

- Highlight the address – it should be highlighted in blue
- Click on Edit – Copy
- Put the cursor in the place where you want to copy (for example in one of the quiz text boxes)
- Click on Edit – Paste
- OR you can use Ctrl C (hold down both keys at the same time) for copy
- And Ctrl V (hold down both keys at the same time) for paste

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To copy text to Word

- Highlight the text you want to copy
- Copy as above
- Open Word
- Paste as above
- Save the text as a Word document

NB: You need to give the source of any quotes or any ideas that you take from the web. If you do not give the reference, this is digital plagiarism, which is a form of academic cheating and is subject to disciplinary procedures in the University of Limerick

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Finding the home page of a web site

You may come across a web site with no direct links to a Home Page and you want to access the Home Page to check out whether it is likely to be accurate and comes from a reputable source.

For example:

If you come across the following web page when searching for “digital literacy”

http://www.uwm.edu/~vkuhn/Digital%20Literacy%20Forum.html

it is hard to find the link to the Home Page

Click on the address so that it is no longer highlighted

Now remove the end part of the address – you are then left with

http://www.uwm.edu

and you can see that the web page is part of the University of Wisconsin
To find a word within a long page without having to read through the text

- Click on Edit
- Click on Find
- Key in the word you wish to find

To Save an image

- Highlight the image – Copy and paste as before
- OR – Right Click on the image – Click on Save as – and save the image on the desktop

You can make suggestions for further HELP advice on the Forum. Useful suggestions will be added to the HELP page.

Close Window
Appendix 4

Introduction in Topic 1

Welcome to this first unit

The ubiquitous presence and utility of ICT in modern life are having a significant impact on the way we live, and even on the notion of an educated person. It has led to the concept of a knowledge society – sometimes also called the learning society or information society. There is a widespread awareness that these developments have profound implications for education, and that schools must change ... (OECD, 2001, p.9).

Consider all the ways in which you have used information and communication technologies (ICT) in the last week. You might be able to recall an email you sent to a friend or a document you printed from the Internet, perhaps you have used an ATM machine today to withdraw money. While it has changed some of our day-to-day activities, it is significantly changing the society in which we live. Technology is changing the workplace, it is changing how we communicate with each other and it is also changing what we do in our leisure time.

As well as changing the world in which we live, it is also influencing schools. Schools have always used educational technology to enhance the educational experience of pupils, from televisions to overhead projectors different devices have been used in schools over the past century. Computer technology is now influencing how and what we learn and will have significant implications for Irish classrooms in the future. It is essential that as a student teacher you are aware of the benefits of this technology in education and how it can enhance the learning experience of your pupils. This online course aims to enable participants:

- To clarify the ubiquitous and changing nature of ICT and explain the nature and importance of convergence in relation to digital technologies.
- To give examples of converging technology; to compare the different skills required in relation to information gathering and evaluation in the present information age with those of previous times.
- To outline the key issues to be considered when evaluating a web site.
- To consider the reasons for and methods of checking web-based information for accuracy and objectivity, and apply these methods to specific websites.
- To use search engines to locate relevant websites, using appropriate keywords, phrase searches and Boolean operators, including both web and image searching.
- To consider the meaning of successful searching.
- To explain the meaning of digital literacy and the digital divide, with particular reference to the implications for computers in schools.
- To outline the benefits of using ICT in education, with particular focus on pupil centred activities for enhancing learning.
- To introduce the range and variety of assistive technology, giving some indication of its potential use in helping the learning of people with special needs.
- To introduce a critique of the use of computers in schools.
- To outline guidelines for parents and children on safe use of the internet and to explain the purpose of an Acceptable Use Policy in schools.

The module is broken into a series of units. Each unit must be successfully completed before moving to the next and you must complete all units to successfully complete this part of the module. In each unit you will be asked to complete activities and answer questions. The module includes four tutorials at which attendance is mandatory. The final tutorial will include the online assessment for the module which will form part of the final grade awarded for this module and remember that negative marking is used in multiple choice questions so as to reduce the inclination to just guess the answer.

Appendix 5

Ubiquitous technology - Unit 2, Topic 1
Ubiquitous technology - Unit 2

Aim of the Unit: To clarify the ubiquitous and changing nature of ICT and explain the nature and importance of convergence in relation to digital technologies.

Advances in technology are progressing at a rapid pace and it is increasingly influencing the way we live and work. It is only 60 years since the chairman of IBM, Thomas Watson, claimed that “I think there is a world market for maybe five computers”, and less than 30 years since the President of the DEC, Ken Olson believed in 1977 that “there is no reason anyone in the right state of mind will want a computer in their home.” Yet despite their predictions the technology continually developed and its use has become ubiquitous or widespread in society.

Mark Weiser, a researcher at Xerox PARC, coined the term ‘Ubiquitous Computing’ in the late 1980s. It refers to the process of seamlessly integrating computers into our world. As we move towards a more ubiquitous computing environment, the presence of computers is becoming less conspicuous and will eventually blend into our everyday lives. When using a PC the user’s attention is, in general, focused on the screen. As computers become ubiquitous they will cease to be the focus of activity, allowing them to fade into the background. As well as personal computers (PCs), ubiquitous computing includes computer technology found in microprocessors, mobile phones, digital cameras and other devices.

The development of the phone is a very good example of this continuous advancement of technology. Examining its development reveals several interesting insights.

Case Example: The development of the telephone

Photograph of old-style public telephone box in scenic setting

Phone boxes must seem strange to small children. For them, phones are small devices that people carry around in their pockets, the notion of going to a small ‘house’ on the side of the road to make a phone call must seem strange. But this was the only way to make a phone call for most of the 20th century.

Photograph of large mobile phone

While mobile phones have now made phone boxes largely redundant, it's not a long time ago that mobile phones were large bulky and very expensive. Indeed when we look at old mobile phones it can be funny to see how basic they were. However, in the space of about 10 years they have become widespread and owned by nearly every member of the population over the age of 10. They are now ubiquitous. The commission for communications regulation in Ireland (COMREG) reported that in 5 years from 1999 to 2004 there was a surge in mobile phone ownership from 1 in 5 adults to 4 in 5 as indicated in the graph. By December 2005 they reported that mobile phone use in Ireland had reached 100% with 4.05 million mobile subscribers nationally.

Graph showing increasing mobile phone ownership from 1999 to 2005

Graph showing mobile phone ownership surpassing fixed lines

But new mobile phones are no longer just mobile versions of old phones. They can now send and receive picture, video and sound and can also access the Internet. This begs the question are they mobile phones with built-in cameras or digital cameras with built-in mobile phones? Perhaps they are something completely different. What we are seeing in technologies such as phones, televisions, computers and cameras is convergence.

But new mobile phones are no longer just mobile versions of old phones. They can now send and receive picture, video and sound and can also access the Internet. This begs the question are they mobile phones with built-in cameras or digital cameras with built-in mobile phones? Perhaps they are something completely different. What we are seeing in technologies such as phones, televisions, computers and cameras is convergence.

What is convergence? When we talk about convergence in relation to digital technologies it refers to the merging of different technologies. It particularly refers to convergence between the broadcasting and telecommunications sectors.

For example, if you take a mobile phone from about three or four years ago it would have had the ability to send and receive calls and text messages. Phones today have built in video cameras, radios, mp3 players, Internet browsers, games and other features. That’s real convergence!

The computer is another device that is changing rapidly. When we consider Information Technology (IT) we often think of computers as machines on desks with a screen, mouse and keyboard. This model of a computer has been in existence for about 30 years and we have become accustomed to it.

But computers have also been subject to convergence. They are now no longer fixed machines used like electronic typewriters. They can now be small and portable. While retaining all of its original functions, a computer can also access the Internet, send video, audio and pictures to other computers, play, record and edit music and video and conduct numerous other functions.

Probably the best example of this converging technology is the PDA (Personal Digital Assistant) or handheld PC. They have combined original computer functions such as email, Internet browsing and word processing with a mobile phone and a games console.
So when we talk about Information and communications technology we do not just mean computers on desks. Its use is now widespread and not always as obvious as we would think.

But why do technologies converge? We could, for example, embed a radio in a torch but what are the benefits of doing this? This combination may increase sales of these devices as there is a novelty value in combining both but what are the benefits of such a device. Is there a pressing need for a torch with a built-in radio? Convergence of technologies must bring some added benefit, i.e. there should be greater benefit to the new device than just a combination of the individual devices.

Let's take the example of the mobile phone to test your understanding of this unit.

*Combining a digital camera with a mobile phone is an example of the ubiquitous nature of ICT.*

*Combining a digital camera with a mobile phone is an example of convergence.*
Ubiquitous technology - Unit 2a

Technological and Social Determinism

Looking at the development of various technologies and questioning how and why they were developed leads to two very important terms known as ‘Technological Determinism’ and ‘Social Determinism’. They sound very technical but in essence they are two ways at looking at how technologies develop. For example, let’s ask a very basic question:

Why was the mobile phone invented?

Some will argue that the development of the mobile phone was a natural progression of telecommunications technologies. That is, it was inevitable given the advances in electronics and telecommunications. This viewpoint assumes that technological development is disconnected from human influence.

Some people see technological inventions as ‘eureka’ moments that happen in society and effect society after they are invented. Somehow the development of technology takes it own autonomous course of development and society then finds ways of using this technology. In this context the negative effects of technology are an unfortunate consequence of these new inventions and discoveries. This view of technological development is known as technological determinism.

However, technological determinism is a very simplistic way of viewing the development of technology. Technology does not develop itself in some organic evolutionary way. Humans develop technology. We, as a society, decide to develop the technologies that we consider to be important (or commercially lucrative).

Let us take the development of nuclear energy. This was not miraculously discovered by some random scientist working on some other project. It was developed by teams of scientists paid by governments to develop the technology. So in essence, society decided to explore and develop nuclear energy. And why was there such a drive to discover how to harness the new technology? As in most examples of technology, the development of nuclear energy happened at a time of global instability where countries were competing against each other for a competitive advantage in warfare and defence.

Take other examples: Why do we spend so much money on researching cures for diseases that kill relatively small numbers of people in the western world rather than exploring cures for diseases that kill millions in the developing world. For example, why was viagra invented before a cure for malaria?

Why did we discover how to fly in space before eradicating world hunger?

These examples show that technology does not simply develop without any influence from people and society. Individual people, commercial companies and governments determine the direction and development of technologies. This is known as ‘social determinism’ and as you can probably guess, it is an alternative way of viewing the development of technology.

Investigate these two websites on Technological and Social Determinism before assessing your knowledge.


http://atschool.eduweb.co.uk/trinity/social.html

The use and ownership of mobile phones has increased dramatically over the past decade. Which of the following statements would a person believing in technological determinism chose as the reason for this increase?

The introduction of a third mobile phone licence in the Republic of Ireland has caused these changes.

There was always a demand for mobile phones, society was just waiting for the technology to be invented.

The reduction in price of phones coupled with increased marketing by mobile phone companies made them attractive to people. They were considered essential only after people became dependent on them.
Ubiquitous technology - Unit 2b

The Effects of technology on society

Unfortunately technology doesn’t always do what it says on the tin. Technological developments can often solve specific problems but at the same time cause many other unforeseen problems. Sometimes by judging the success of technological developments over a longer period of time we can more clearly see their influence on society. In the case of Henry Ford’s production line it was seen as at the time as a very good technological invention but the division of labour into basic tasks meant that unskilled workers could do the jobs and therefore the skilled craftsmen were replaced. Since the work required little expertise, workers could be cheaply replaced with little effect on the production line. The production line therefore diminished the value of the worker and made them dispensable, inevitably wages dropped. Since they did not possess specialised skills they had no bargaining power and could easily be sacked and replaced.

On a broader societal level the saving achieved through the use of the production line significantly decreased the cost of his cars, making them much more accessible to the masses. The number of cars increased significantly and continues to rise. While in 1900 the petrol-powered motorcar was seen as a technological step up from horse drawn transport, the pollution from its exhaust emissions and from its manufacture threatens the environment we live in. It also runs on a dwindling supply of fuel (Oil) and contributes to over 400 deaths every year on our roads in Ireland. With these facts in mind can we now consider it to be such a great technological development?

Similar negative effects of communication technologies can be seen today. ‘Happy slapping’ incidents as a result of picture and video features on modern mobile phones was not envisaged at the time of their development. As well as being a very positive development the internet has been used by paedophiles to share information and images. No technology is therefore inherently good or bad but rather neutral, and its benefits, or otherwise, is ultimately determined by individual use.

It is easy to divide technological developments into negative and positive outcomes. Sometimes technological developments have unforeseen outcomes that are neither positive nor negative. Consider how newspapers have been affected by the proliferation of web browsers, satellite television and other forms of instant communication. Their ability to deliver breaking news has caused them to change their focus. They now prioritise the quality of their analysis of events rather than their up to the minute reporting of events as they unfold.

Within this context consider how information and communication technologies will impact on schools? Will schools be different in the future? Will ICT play a large role in the education of students? What will drive this change? Will it come from a pressing need for the technology or are other interests at work?

Will ICT play a role in schools in the future? How do you see the technology being used in schools in the future?
Appendix 6
The Information Age - Unit 3, Topic 1

This unit can be accessed at http://paulo.ul.ie/course/view.php?id=34 using “guest1” as both Username and Password.

The Information Age - Unit 3

The information age – What is it? What are its implications?

With all this technology at our fingertips we now live in an age where information is easily accessible. We can access information on mobile phones, on desktop computers, on laptops, PDAs and televisions. But the greatest change that has occurred in the past ten years is that the information is at our fingertips whereas in the past we had to access it in libraries or from newspapers.

Photograph of student at a computer

Here's some examples:

· A farmer in a field can find out the latest weather forecast or lamb prices in the local mart from his/her mobile phone.

· You can find out the score of the Munster hurling final from a laptop on the Eiffel tower. You could even watch the match live if you had the right technology.

Information is now everywhere and easily accessible, hence the term ‘The Information Age’.

The amount of information we can access is also expanding rapidly. When I typed in ‘the computer’ to Google, an Internet search engine, I received 864 million sources in just 0.29 seconds! 12 months ago it was 372 million sources in just 0.13 seconds!

What are the implications of this surge in information? If we have such ready access to all this information do we need to remember information so that we can regurgitate it at anytime? We seem to prioritise that skill in our schools, but does this new technology change this? It would seem that a more important skill to have would be the ability to access the right information and to critically assess its quality. As far back as 1980, Philip Hills identified the possible implications of this technology. He felt that:

Future courses may not be examined by testing the limits of an individual’s memory but instead may challenge a student’s strategies for obtaining information quickly, for ordering it into a logical sequence, for arriving at conclusions from given facts and for accurate and rapid problem solving (Hills, 1980, p. 45)

The ability to access information and make judgements about its accuracy and relevance is known as ‘Information Literacy’. Think about it, there’s no point in having the skills to surf the web if you cannot identify the bogus websites from the accurate ones. If we are to reap the benefits of the information age this is probably one of the most important skills required.

Just as the industrial societies set themselves the aim of ensuring that all citizens were properly versed in the three Rs, the emergence of the knowledge-based society implies that every citizen must be 'digitally literate' and have basic skills in order to be on a better footing in terms of equal opportunities in a world in which digital functions are proliferating. (European Commission, 2000, p.4)

The other important aspect about all this readily accessible information is that it is not just in the form of printed text. We have always associated information as printed text with the occasional picture or diagram. Therefore a literate person was someone that had the ability to read and write text. But the use of digital picture, video and sound also allows us to present information in other ways. Doesn’t that therefore change what we mean by being a literate person?

Photograph of young woman using laptop outdoors

By the end of the 20th century it was no longer possible to view literacy as based on the word or even on the word-based text. Literacy today is essentially multimedia, composed of an amalgam of words, pictures, sounds and moving image

The term digital literacy is now used to describe the new type of literacy we need in this information age. It is the ability to understand, evaluate and use information in multiple formats from a wide range of sources. In schools we must expose pupils to this type of information so that they can use it effectively in life. Another part of digital literacy is ensuring that we can use the digital tools used to create, present and manipulate this information. We should also expose pupils to these technologies.

“One of the most important challenges to an educational system is to empower the young with the intellectual tools of the culture” (Davis et al, 1997, p. 16).

Read the article by Jamie McKenzie at http://www.fno.org/jun02/digitallit.html

We combine text, visual, and media literacies as we try to make sense of this news story. We hope to understand how the words and images combine to represent reality, but we also apply critical thinking skills to consider the extent to which coverage of this story has been sensationalized. Does the New York Times coverage bring us closer to the truth than the CNN coverage? Does it matter whether it appeared online, on paper or via satellite transmission?
Is the task of understanding news coverage substantially different just because the story appeared in digital format? Hardly.

The skills we apply when attempting to make sense of our worlds (information literacy) include analysis, interpretation, inference and synthesis. These have been a challenge and a struggle since the times of Socrates. They are not new skills.

The packaging and the digital spin are the main new ingredients.

Are you and your peer-group digitally literate? Click one of the options below and substantiate your answer on the following page.

*It is evident that digital literacy is improving in spite of a lack of direct action in Irish primary and secondary schools.*

*It is evident that schools are doing all in their power to provide students with an acceptable level of digital literacy.*
## Question bank for summative assessment

1. Only one of the following statements can be supported by the content of this course but which one?
   - a. Ubiquitous technology is the widespread use of technology in all aspects of life and work.
   - b. Ubiquitous technology refers to the trend of decreasing technology in size.
   - c. Ubiquitous technology refers to the development of more environmentally friendly technologies.
   - d. Ubiquitous technology refers to digital rather than analogue technologies.

2. Only one of the following statements can be supported by the content of this course but which one?
   - a. The information age is a term used to describe a time of widespread information available at our fingertips.
   - b. The information age is a term used to distinguish computers from the industrial age.
   - c. The information age refers to a time of the expansion of the Internet.
   - d. The information age refers to a period of economic growth in Ireland from 1998 to 2005.

3. Only one of the following statements can be supported by the content of this course but which one?
   - a. The information age is a term used to describe a time of abundant publication, consumption, and manipulation of information, especially by computers and computer networks.
   - b. The information age is a term used to distinguish computers from the industrial age.
   - c. The information age refers to a time of the expansion of the Internet.
   - d. The information age refers to a period of economic growth in Ireland from 1998 to 2005.

4. Only one of the following statements can be supported by the content of this course but which one?
   - a. Digital literacy is a term used to describe the new type of literacy we need to access and analyse various forms of information.
   - b. Digital literacy is a term to describe one’s ability to use Microsoft applications.
   - c. Digital literacy refers to ones ability to use the computer to search for successful sites on the internet.
   - d. Digital literacy is a term used to describe literacy in developed technologically rich countries.

5. Only one of the following statements can be supported by the content of this course but which one?
   - a. Digital literacy is a term used to describe the ability to use digital technology, communication tools or networks to locate, use and evaluate information.
   - b. Digital literacy is a term to describe one’s ability to use Microsoft applications.
   - c. Digital literacy refers to ones ability to use the computer to search for successful sites on the internet.
   - d. Digital literacy is a term used to describe literacy in developed technologically rich countries.

6. Only one of the following statements can be supported by the content of this course but which one?
   - a. A Boolean search allows you to limit an Internet search to certain phrases and words.
   - b. A Boolean search refers to a search for information in a traditional library without the use of a computer.
   - c. Boolean searches are searches that allow you to use exact phrases to find sites of very high relevancy.
   - d. A Boolean search is a slang term for an internet search using Google.
7. Only one of the following statements can be supported by the content of this course but which one?

- a. A Boolean search refers to a search formed by joining simple terms for the purpose of limiting or qualifying the search.
- b. A Boolean search refers to a search for information in a traditional library without the use of a computer.
- c. Boolean searches are searches that allow you to use exact phrases to find sites of very high relevancy.
- d. A Boolean search is a slang term for an internet search using Google.

8. Only one of the following statements can be supported by the content of this course but which one?

- a. The relevance of websites can be determined by checking the source of the site, the credibility of the author, the time since publication and the accuracy of its content.
- b. The name of an Internet site as well as its year of publication are the most important indicators of its accuracy and authenticity.
- c. The usability of a website along with its overall design and aesthetic qualities are the most important indicators of educationally valuable and worthwhile websites.
- d. All websites should not be used in research as they can contain bogus information which is misleading and inaccurate.

9. Only one of the following statements can be supported by the content of this course but which one?

- a. We should view all websites as complex messages as they may contain hidden messages through the combined effect of text, images, video and sound.
- b. The internet is a highly regulated medium and websites are subject to very high standards.
- c. Embedded multimedia can be used to influence the reader's opinion so people should only use text based websites.
- d. Techniques used to attract user’s attention to websites are generally harmless and users should not worry about it.

10. Only one of the following statements can be supported by the content of this course but which one?

- a. There is growing concern about Internet safety with the increasing accessibility to the Internet through various technologies available to children.
- b. Internet safety refers to the need to use computer technology safely to avoid repetitive stress injuries in the lower back and arms.
- c. Concerns over internet safety have largely been eradicated through the use of filtering software in schools.
- d. Internet safety is only a problem if you use sites like Bebo and MySpace.

11. Only one of the following statements can be supported by the content of this course but which one?

- a. The Digital Divide is a term used to describe the gap between people that have and have not access to the Internet and related technologies.
- b. The digital divide was a term used to describe the concern people once had about the cost of technology. Computers are now very cheap and it no longer applies.
- c. The Digital Divide is a term used to describe the gap between people that can access broadband in their homes and those that can’t.
- d. The Digital Divide is a term used to describe the gap between people that use technology in a meaningful way for educational purposes and those that use it only for entertainment.

12. Only one of the following statements can be supported by the content of this course but which one?

- a. The NCTE is an agency established to oversee the development of ICT in schools.
- b. The NCTE is an advisory body to the educational technology industry.
- c. The NCTE is the name given to the department of education and sciences broadband network currently being rolled out in schools.
- d. The NCTE stands for the Novel Communications Technology Evaluative Commission.
### Question 13
Only one of the following statements can be supported by the content of this course but which one?

- a. The NCTE was established to provide advice, support and information on the use of information and communications technology (ICT) in education.
- b. The NCTE is an advisory body to the educational technology industry.
- c. The NCTE is the name given to the department of education and sciences broadband network currently being rolled out in schools.
- d. The NCTE stands for the Novel Communications Technology Evaluative Commission.

### Question 14
Only one of the following statements can be supported by the content of this course but which one?

- a. Convergence refers to the merging of different technologies.
- b. Convergence refers to the trend of technology decreasing in size.
- c. Convergence refers to the widespread, almost unconscious use of technology in society.
- d. Convergence refers to the rapid developments in telecommunications since the development of the mobile phone.

### Question 15
Only one of the following statements can be supported by the content of this course but which one?

- a. Technological determinism is a belief that the development of technology itself follows a path largely beyond human influence.
- b. Technological determinism and social determinism are philosophies of technology in education.
- c. Technological determinism is a belief that technologies are strongly if not entirely shaped by society.
- d. Social determinism is the struggle for recognition of ICT as a legitimate area of study.

### Question 16
Only one of the following statements can be supported by the content of this course but which one?

- a. Social determinism is a belief that technologies are strongly if not entirely shaped by people.
- b. Technological determinism and social determinism are philosophies of technology in education.
- c. Social determinism is a belief that the development of technology itself follows a path largely beyond human influence.
- d. Technological determinism is the struggle for recognition of ICT as a legitimate area of study.

### Question 17
Only one of the following statements can be supported by the content of this course but which one?

- a. Ubiquitous computing integrates computation into the environment, rather than having computers which are distinct objects.
- b. Ubiquitous computing refers to the trend of physically decreasing the size of computers.
- c. Ubiquitous computing refers to the development of more environmentally friendly computers.
- d. Ubiquitous computing refers to analogue rather than digital computers.

### Question 18
Which of the following options best describes Drill-n-practice software?

- a. Drill-n-practice software allows learning to take place by discrete pieces of information being repeated until assessment proves that learning has been achieved.
- b. Drill-n-practice software allows learning to take place by discrete pieces of information being explained in context.
- c. Drill-n-practice software allows learning to take place by discrete pieces of information being built upon in a step-by-step manner.
- d. Drill-n-practice software allows learning to take place by imitating processes or sets of activities.
<table>
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<th>Question</th>
<th>Description</th>
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<tr>
<td>19. Which of the following options best describes Tutorial software?</td>
<td><em>(a)</em> Tutorial software allows learning to take place by discrete pieces of information being explained in context. <em>(b)</em> Tutorial software allows learning to take place by discrete pieces of information being repeated until assessment proves that learning has been achieved. <em>(c)</em> Tutorial software allows learning to take place by discrete pieces of information being built upon in a step-by-step manner. <em>(d)</em> Tutorial software allows learning to take place by imitating processes or sets of activities.</td>
</tr>
<tr>
<td>20. Which of the following options best describes Problem solving software?</td>
<td><em>(a)</em> Problem solving software allows learning to take place by discrete pieces of information being built upon in a step-by-step manner. <em>(b)</em> Problem solving software allows learning to take place by discrete pieces of information being repeated until assessment proves that learning has been achieved. <em>(c)</em> Problem solving software allows learning to take place by discrete pieces of information being explained in context. <em>(d)</em> Problem solving software allows learning to take place by imitating processes or sets of activities.</td>
</tr>
<tr>
<td>21. Which of the following options best describes Simulation software?</td>
<td><em>(a)</em> Simulation software allows learning to take place by imitating processes or sets of activities. <em>(b)</em> Simulation software allows learning to take place by discrete pieces of information being repeated until assessment proves that learning has been achieved. <em>(c)</em> Simulation software allows learning to take place by discrete pieces of information being explained in context. <em>(d)</em> Simulation software allows learning to take place by discrete pieces of information being built upon in a step-by-step manner.</td>
</tr>
<tr>
<td>22. Which of the following options best describes Special Educational Needs (SEN)?</td>
<td><em>(a)</em> Special Educational Needs (SEN) is best described as referring to students with disabilities, behavioural problems or exceptional ability. <em>(b)</em> Special Educational Needs (SEN) is best described as referring to students with learning disabilities. <em>(c)</em> Special Educational Needs (SEN) is best described as referring to students with learning and physical disabilities. <em>(d)</em> Special Educational Needs (SEN) is best described as referring to students with learning or physical disabilities.</td>
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Appendix 8
Post-study survey

Dear Student,

I hope you have enjoyed this online course as part of the EN4002 module. This has been the third attempt, within the module, to blend elearning with traditional tutorials and lectures and I would like to investigate your experiences. I would appreciate if you could complete this survey as your opinion will help in the evaluation of the course. If you have any questions in relation to my research please feel free to email me at greg.scanlon@ul.ie

Yours sincerely,
Greg Scanlon.

Please complete the questions below and submit the form by pressing the 'submit form' button at the bottom of the page.

Name:

The Moodle Portal:

Q1. Useability:
   (a) Structure and layout of the software
      very clear clear OK unclear very unclear
   (b) Clarity of the software functions
      very clear clear OK unclear very unclear
   (c) Website design
      very clear clear OK unclear very unclear
   (d) Ease of navigation
      very clear clear OK unclear very unclear

Q2. Fortnightly Topics completed
   All 4 3 2 1 None

Q2a. Where did you complete the four topics?
   Topic 1 In the timetabled computer lab Elsewhere on campus completed off campus (including residences)
   Topic 2 In the timetabled computer lab Elsewhere on campus completed off campus (including residences)
   Topic 3 In the timetabled computer lab Elsewhere on campus completed off campus (including residences)
   Topic 4 In the timetabled computer lab Elsewhere on campus completed off campus (including residences)

Q3. What did you find was the most positive aspect of using the software?
Q4. What did you find was the most negative aspect of using the software?

Q5. In what ways do you think the software might be improved?

As the course aimed to introduce how ICT can be used in education, I would like to get your views on the content of the course and what you feel you gained from the experience.

Q6a. Relevance of Subject matter
- Very relevant
- Relevant
- OK
- Little relevance
- Not relevant

Q6b. Relevance of Tasks
- Very relevant
- Relevant
- OK
- Little relevance
- Not relevant

Q7. Was the course beneficial in highlighting the issue of ICT in education? Please give details.

Q8. Have you changed your views on the benefits or disadvantages of ICT in education as a result of the course? Please give details.

Q9. Do you think ICT can be used in your subject area?
- Yes
- No

Q10. Should ICT be used in your subject area?
- Yes
- No

Q10a. If yes how would you consider using ICT in your subject area?
Q10b. What benefits would this have in your subject area?

Q11. Do you feel prepared to use ICT in your teaching?  
Yes  No

Q12. Would you like further training in the use of ICT in education?  
Yes  No

Q12a. If yes, what further training would you like?

Q13. Do you think the course was suitable for online presentation and assessment?

Q14. Did you enjoy this e-learning experience?  
very enjoyable  enjoyable  OK  not enjoyable  terrible

Q15. Any other comments?

Submit  Reset

Greg Scanlon. All information submitted is strictly confidential and will be used solely for research purposes. Revised: February 07, 2007.