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Scaffolding Fully Online First Year Computer Literacy Students for Success

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Abstract

This paper reports on the findings of a study of first year students studying a fully online computer literacy module on a Real Estate Agency and Property Economics degree programme at Dublin Institute of Technology, Ireland. In addition to the cohort of entrants to higher education without prior computer literacy skills, there will also be a cohort who are unfamiliar with learning in an online mode. Those students well versed with internet and social media network skills do not necessarily have good office/desktop software skills. "Digital natives" they may be but are they really computer literate? Fully online learning systems in themselves do not foster the type of supportive environments that would encourage students to succeed. In this study a scaffolding approach was adopted with the inclusion of a number of learning supports (ranging from regular e-mails through to face-to-face tutorials) to provide a more likely opportunity to succeed. The results indicate that those students who navigated the unfamiliar online terrain and availed of the supports succeeded in this module.

Keywords: Computer Literacy, Fully Online, First Year Students

Introduction

Ensuring that all first year students have a required minimum level of basic Information Technology (IT) skills is deemed essential in the pursuit of their studies and the application of these skills when they enter the workplace. The provision of IT in core, first year modules by most Higher Education Institutes (HEIs) in Ireland is testament to the fact that there exists a lack of IT skills amongst some cohorts of new entrants. This is recognition perhaps that they are not all digital natives (Prensky, 2001). This may well be the result of shortcomings in access to IT courses in second level schooling in Ireland. There is however a cohort containing students who will have been fortunate enough to have had some formal IT learning opportunities prior to college and such students will, at a minimum, possess some level of basic computer literacy skills.

Background

In the past ten years much has been written about the potential of eLearning to address some of the difficulties that Higher Education Institutes (HEIs) are faced with in relation to reduced academic staffing levels catering to an increasing and diverse student population, by providing flexible learning options (Hunt, 2011, p.35). The provision of fully online modules has been promoted as a possible solution to address these problems. The presentation of these modules needs to be considered carefully if students are to succeed. Commercially available learning management systems (LMSs) of themselves, generally do not appeal to all levels of learners. They require some degree of localisation and with additional learning supports they will have the potential to create a learning environment more conducive to success.

Definitions

A range of definitions exist as to what computer literacy means. For the purposes of this study computer literacy is taken as a set of basic skills and understanding of personal computer

operating systems, office style software (also referred to as "desktop applications" or "productivity software") such as word processing, spreadsheets, and presentation software (Mason & Mc Morrow, 2006). Next, a definition in respect of this study for a fully online course corresponds with that of a Sloan Corporation definition as that *" ... in which at least 80 per cent of the course content is delivered online*" (Allen & Seaman, 2010, p.5). A scaffolding approach was used to support the learners in line with Bruner's concept of bringing the learner to a certain point in a task and then letting them discover the next step to finally complete the task (Bruner, 1960, p.xiv).

Context

This study involved the creation of learning supports that enhanced a commercial online learning system, namely, the Microsoft® IT Academy Learning System, which contains pre-packaged content. The IT Academy is currently the Learning Management System (LMS) of choice for Microsoft applications in Dublin Institute of Technology (DIT) and was introduced in 2009. The IT module was delivered in semester one of the 2010/11 academic year. The study does not attempt to evaluate or compare one online system to another but looks rather at how best any such system can be packaged and delivered. Some commercially available systems do offer some level of customisation, however the system employed here falls into the "all or nothing" category: a student signs up for a course, is presented with the full list of courses and is required to complete a set number of lessons and topics. The structure of the system caters for more advanced students by allowing them to skip the fundamental topics and move onto more challenging topics if they so wish.

Academic Performance of Online First Year Students

Current student satisfaction and performance rates with online learning are mixed. Recent studies suggest that current first year cohorts are actually displaying less productivity software skills than their older counterparts (McLennan & Gibbs, 2008). In a study of 700 students, Holt & Palmer (2007) showed that only half were satisfied with their online experience. Conversely, comparative studies between traditional and fully online delivery have revealed no discernible difference in achievements (Johnson, Aragon, Shaik, & Palma-Rivas, 2000; Palmer & Holt, 2007; Ramage, 2002). Others have argued that "*online students ... did significantly better than lecture students*" (Dutton, Dutton, & Perry, 2001, p.132).

A number of sources and methods were used to collect data for this study including anonymous pre- and post-module questionnaires, a focus group and post-module one-to-one interviews. The IT Academy reporting utility was used to track student's use and engagement with the module. Regular e-mail contact informed the study of the students' understanding of the module, its online nature and the content within the module.

Computer Literacy and First Year Students – A Literature Review

The importance of basic computer literacy skills as a support to students' learning is recognised by most higher education institutions in Ireland through the inclusion of mandatory IT modules in most programmes (European Commission, 2005). This is echoed throughout the HE world by a number of commentators (Bhavnani, 2000; Dednam, 2009; Ezziane, 2007; Foster, DeNoia, & Dannelly, 2006; Liao & Pope, 2008). There is a danger that HEIs may assume that college entrants already possess some level of computer competency and therefore do not include IT modules as part of their programmes. While it is reasonably acceptable to assume that most first year students have some knowledge and experience of

using the internet and web social networking, the same cannot be said of their knowledge of fundamental applications such as word processing, spreadsheets and presentation applications (Kennedy, Judd, Churchward, Gray, & Krause, 2008; McLennan & Gibbs, 2008; Stiller & LeBlanc, 2006). It is essential that first year students gain sufficient skills enabling them to develop and submit assignments using word processing applications, enhance presentations using presentation software and produce statistical analysis using spreadsheets. Continuous development of these essential skills will, of course, assist their transition into working life.

Prior Knowledge of First Year Students

Most second level schools in Ireland provide some form of IT Syllabus. It is important to note that these subjects are optional. Most countries recognise the importance of IT in second level schooling and have developed strategies that ensure their inclusion in the curriculum (Le Métais, 2004). In a study of the interactions between high school IT and first year IT curricula in Palestine, Yahya (2010) found that even with the compulsory provision of IT in second level schooling the students will finish second level schooling with a varied range of computer skills. First year entrants will also have gained some IT skills informally through the use of computers at home for personal and out-of-school activities (Hoffman & Vance, 2008). Finally, the mature age cohort may have had more opportunities to gain computer literacy through work based training and usage.

Modes of Online Learning: Fully versus Blended

Online courses may not necessarily replace the traditional classroom mode of delivery; however, a blended or hybrid approach may prove successful if the online element is well designed (Bedi & Lange, 2007; Bradwell, 2009; Hoffman & Blake, 2003; Reeves, Baxter, & Jordan, 2002). There are, however, many instances of successful fully online courses (Bartley & Golek, 2004; Lau *et al*., 2009) and institutions operating on a fully online or distance mode,

such as: Universitas 21 Global, California Virtual Campus and The Open University. The practical difficulties associated with having to cater for an increasing population of students with fewer resources still remain - "*Universities ... [have to] do more for less*" (Bradwell, 2009). The responsibility of filling this gap has fallen upon staff whose subject expertise may not necessarily be IT. The provision of online modules in this area allows these remaining lecturers to concentrate their efforts in their own discipline.

Methodology and Theory

The teaching and learning of software applications is a Programmed Learning activity which is firmly rooted in the learning theory of Behaviourism. It is a "*learn by doing*" activity (Drekmann, 1968). The traditional face-to-face method usually involves a "step-by-step" approach whereby the teacher demonstrates the task, students observe and then practice. The student will reach a point of mastery after repetitive practice and perhaps a series of trial-and-error attempts. Online learning environments provide students with the perfect opportunity to practice at their own pace and repeat as often as is necessary for them to master the task. This opportunity is less restrictive than a classroom environment where time limits prevail. It also affords a safe learning space where there is no fear of being shown to fail.

Wood, Bruner & Ross (1976) used the scaffolding metaphor to explain the "nature of the tutorial process" involving the skill of a teacher that is required to get a learner to "discover on her own" and bring them to a point which is just out of their reach. And then, crucially, let them uncover the remaining parts of a task or lesson. Initially applied to teaching children, this concept can equally be applied to online learning systems for higher education students coupled with the supports provided by the online tutor such as: answering e-mails, providing frequent feedback on in-class tests, sending weekly lesson completion targets, the module website, and the provision of a Frequently Asked Questions (FAQ) section. The nature of the

FAQ was that of providing guidance to the learner to solve an issue (rather than simply answering the question). This "technical" scaffolding also gave the students a sense of responsibility for their own learning (Yelland & Masters, 2007). The online system guided learners through tasks and they completed these tasks on their own or with the assistance of an online tutor. The opportunity to uncover the more difficult aspects of the task which may be just out of reach are overcome through a series of trial and error or simply a repetitive process. Bruner built on Vygotsky's concept of the Zone of Proximal Development (ZPD) to arrive at his idea of scaffolding. The ZPD is the "distance" between the actual development level and level of potential development of a learner (Vygotsky, 1978, p.86). Therefore, a teacher will use scaffolding techniques and methods to help the learner reach their level of potential development. These techniques can be applied in online learning systems but essential to their success are the interactions of the online tutor in the form of communications with learners via e-mail and face-to-face meetings. Collaboration is a central element of ZPD and this collaboration can be achieved with interactions between learners of differing skill levels. Feedback from the focus group demonstrated that support was evident among peers whilst attending the optional class.

A participatory action research (PAR) approach to this study was employed due to the researcher's active involvement in the tutoring of the research participants. An essential aspect of PAR is the aspiration to improve the teaching and learning experience through the collaboration of the participants and tutor (McNiff, 1988, p.4). This collaborative effort was encouraged and fostered through feedback from students via e-mail and face-to-face meetings. The evolution of the website and other learning supports driven by interactions between tutor and students contributed towards a successful learning experience for all (Brydon-Miller & Maguire, 2009).

Data was collected for this study using mixed methods. At the commencement of the module an online questionnaire (n=64) was put to the students. This was purposely delivered online to prime the students for the nature of the module to follow. Data from a post-module questionnaire (n=41), with the aim of comparing students' attitudes and interactions with technology and learning both pre- and post-module, were also collected. Usage reports created by the learning system and e-mails from students provided additional qualitative and quantitative data. The quantitative data was triangulated both with a focus group, held during the module and face-to-face interviews, held with four of the students upon completion of the module.

Post-module interviews were conducted with four students, two male and two female. One of the interviewees was in the school leaving age grouping and the other three were in the 23+ grouping. The purpose of these interviews was to triangulate the quantitative results gained from the pre- and post-module questionnaires. The questions for these interviews were designed in such a manner as to elicit a deeper understanding of how the students interacted with technology, how they managed their learning both in general and in the online environment.

The Module

The IT Academy was used by a group of students studying Auctioneering, Valuations and Estate Agency in the school of Real Estate from September to December 2010. The overall programme was designed to prepare students for a career in any area of auctioneering, estate agency, property valuation & management, valuation surveying and quantity surveying. In addition to the IT Module, there are modules in Valuations, Quantity Surveying, Construction Studies, Cartography, Economics, Marketing and Financial Accounting. Students are

timetabled for 24 hours class time per week. Two of these hours are set aside for optional attendance in class. At the commencement of the module students are given the choice to attend a facilitated (but not taught) class or work on their own in-class. Learning outcomes are measured by in-class formative assessments.

This module is designed to ensure a consistent level of basic IT skills in desktop applications and IT awareness while recognition of the diverse range of skills of new entrants. Its aim is to equip students with the necessary skills to produce coursework, projects and create presentations. There is an emphasis on spreadsheets as an important aspect of any real estate activity. In 2009 this module was delivered online for the first time.

Microsoft® IT Academy Program

The IT Academy is a web based learning system which provides learning resources for Microsoft applications. It is hosted and maintained by Microsoft US. Like many commercially available systems it has some limitations. It affords the usual benefits of most LMSs - access anywhere, anytime and at any pace. Its alignment with the concept of scaffolding is evident in the provision of video demonstrations of tasks and the provision of hands-on exercises where tasks are broken down into chunks. There is an e-mail feature within the system and a discussion forum but these are not activated on the DIT licence agreement. Access is by way of a user id and password.

Gagne's "Events of Instruction" (Gagné, 2005) are evident in the design of the IT Academy. Modules are presented in a variety of modes appealing to different learning styles e.g. video simulations, interactive tutorial, text-based instructions, practical hands-on "lab" exercises, self-tests and games. Not all lessons in the IT academy are mandatory, although students do

have the option to complete any extra lessons if they so wish. Details of the lessons and topics are available on the module website (http://bit.ly/9EYSWg).

Module Website

The website evolved and expanded over time, supporting students' learning through an FAQ, glossary, links to other learning resources, information on topics to be covered and access codes. The site was designed in such a way so as to try to avoid overburdening the students by employing a simple and easy-to-navigate layout. The FAQ section grew as a result of recurring questions from students. The following is a typical e-mail from a student who had difficulty using the system:

Table 1 Sample Question from a Student

Question	Answer
Hi, I can get access to the site and have completed the 1st course. However when I logged on with the second access code I don't seem to be in on the courses. I am just being navigated around the site as I am not given any exercises to do	I'm logged in but I don't really understand the menus and what is being asked of me? WELL DONE! You have successfully logged in. You need to read all the screens especially the first one. Make sure you click on the "Navigation Overview" link when you get into a course – it is a video of how to use the system and runs for about 2 minutes it is well worth viewing this the first time you log in.

Induction Day

On the first day of this module students received an induction onto the module consisting of a detailed presentation and demonstration in the use of the IT Academy. Students were given the opportunity to log in and navigate through a sample course. It was explained that the module would be presented fully online and that it would require some degree of self-directed learning. This was a new challenge to most. Nikolova & Collis (1998) noted that "*a higher demand on the learner's self-initiative, self-motivation, and self-control*" is required to

succeed in these types of learning environments. To address this, weekly e-mails were used as an extrinsic motivating factor to engage the students (Biggs & Tang, 2007, p.47).

A Typical Week

Following the induction week, a typical week's interaction with the module for a student could be characterised as follows:

- choosing to attend the facilitated class or not
- notification of weekly tasks via e-mail i.e. specific modules and lessons
- logging on and completing the lessons including the hands-on practical exercises
- sending queries in relation to system usage or lesson content via e-mail
- reading responses from the tutor
- attending optional group "drop-in" tutorials
- every three to four weeks, attending face-to-face tutorials

The diverse nature and backgrounds of the participants on this programme mirrors a trend that is being experienced across the higher education sector in Ireland. The Second level school leaver's cohort no longer hold a monopoly. In this study: 56% were school leavers, 27% were in the 20-29 age group and the remainder, 17% were 30 years or older. The non-school leaver cohort varied in backgrounds from being recently unemployed to parents returning to education to foreign students to further education entrants. These diverse cohorts carry with them a wide variety of skills in computer literacy.

This module was designed to ensure a minimum level of skill in desktop applications across all students as they begin their journey through higher education life. It was an opportunity for the less skilled students to catch up with their more advanced counterparts who have had the

opportunity to gain IT skills at earlier stages of their learning or working career. No assumptions can be drawn from either the school leaver cohort or the mature student cohort that they possess sufficient IT skills to carry them through higher education. Firstly, the school leaver cannot be guaranteed that they have done an IT subject in second level as this subject is not mandatory for all schools.

Another problem is that some students may overestimate their own IT skill level and assume they do not need to engage in a fundamental IT module preferring instead to concentrate their efforts on core, discipline based subjects. The mature student cohort may have similarly overestimated their skills with the result that they decide not to engage in the IT module and simply attend the exams. Surprisingly, a number of mature students did remain engaged - this was a result of these students realising an opportunity to update and build upon their skills.

Results

The key question put forward by this study asks "does providing a scaffolding approach to online learning ensure success?" This success was measured by the students satisfying the learning outcomes of a module in basic computer literacy i.e. passing all three in-class exams - Word, PowerPoint & Excel. More than 95% of students passed the Word and PowerPoint exams first time around. Students who persevered with the module up to week nine and beyond scored well (Figure 1) in the Excel exam (41 students out of 63). Most of the remaining students *did* pass the Excel exam.

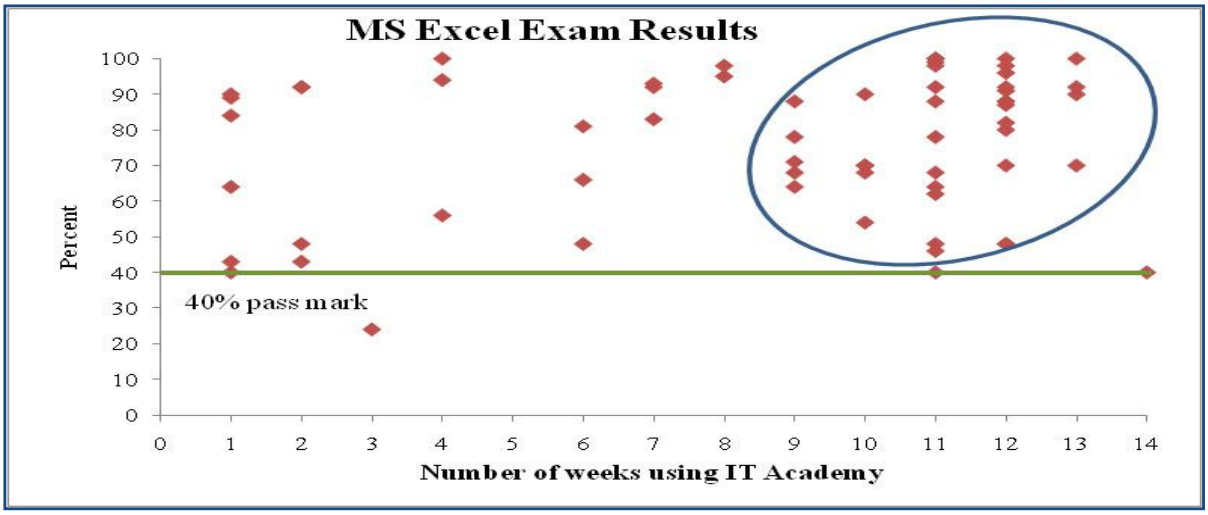

Figure 1 MS Excel Exam Results

Analysis of pre- and post-module Questionnaires

Gender & Age: Although there was an attrition rate of 25% (the previous year was approximately 20%), there was no significant change in the gender split or age distribution as a result of this. Out of a total registration of 103 students, 64 students logged on and used the IT Academy in the first week of the module; this number peaked at 81 during the module. The remaining students either dropped out of the programme altogether or choose another path of study for the IT module.

Time Spent Using Computers: There was an interesting shift in time spent using computers before and at the end of the module as represented by the following table. The percentage of students who reported that they used a computer for 10 or more hours a week dropped sharply from 22% to 12%.

Table 2 Hours per Week (before and after the module)

	School Leavers		Mature Students		Total	
Hours	Before	After	Before	After	Before	After
0-1	8%	22%	11%	6%	10%	14%
1-3	14%	30%	21%	22%	17%	27%
3-5	28%	13%	18%	27%	23%	20%
5-10	31%	26%	25%	28%	28%	27%
10+	19%	9%	25%	17%	22%	12%

When the data is interrogated at an age level there is a slightly different pattern for mature students - there are decreases in the 0-1 hours per week range and increases in the 3-5 hours per week ranges, these are contrary to the school leaver's results (Table 2).

Categories of Computer Use: Table 3 represents the six categories (split into two broad types - Academic and Recreational) measured in both the pre- and post-module questionnaires. Students were asked to rank these in order of importance (1 = most important, 6 = least important and "n/a" = "not used").

Table 3 Use of Computers by Category

Academic Use	Recreational Use
Working on Documents, Spreadsheets, Presentations & Databases	Playing computer games (offline and online)
Online research for study or other interests	Playing music or Watching Videos
Communicating with family/friends/College lecturers using E-mail	Watching streaming video (e.g. YouTube, Internet TV)

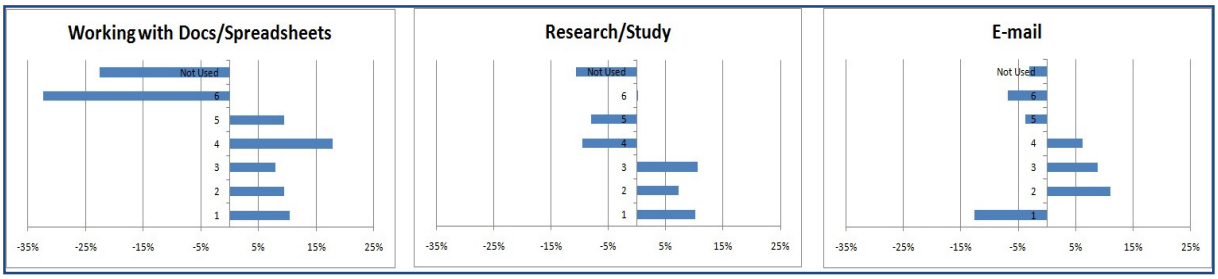

Figure 2 Shift in Ranking of Importance for Academic Use

Working with Documents and Spreadsheets: In the pre-module questionnaire this was ranked as #1, most important, by only 16% of students - this grew to 24% post-module, a shift of 8% represented in the first chart in Figure 2. It noticeably increased in all 1 to 5 rankings. It was ranked as least important by 38% of students before the module commenced and 7% at the end. The percentage of students who responded that they did not use computers to produce documents or spreadsheets at all, decreased from 28% to 5%. This would seem to indicate an

expected outcome that students are using these applications more often and have come to appreciate the importance of such applications and the relevance to their study.

Research and Study: The change in importance of this activity displayed a positive swing. This category's 1st, 2nd & 3rd rankings combined, increased from 35% to 61%. This demonstrates another indication of a shift towards study oriented use of computers. This is consistent with a number of recent findings showing that a large percentage of students are using Virtual Learning Environments (VLEs) and computers for study and research (Corrin, Bennett, & Lockyer, 2010; Jones, Ramanau, Cross, & Healing, 2010; Pedró, 2009)[1].

E-mail: Perhaps surprisingly, the importance of e-mail decreased in #1 ranking from 53% down to 42%; however, it gained importance in rank positions 2, 3 & 4 from 28% to 54% of students. It would be expected that students, having entered college are using e-mail for a mix of personal and academic use. The positive shift towards the use of computers for office style applications and study over the duration of this module is mirrored by the negative shift in use of computers for recreational use (Figure 3).

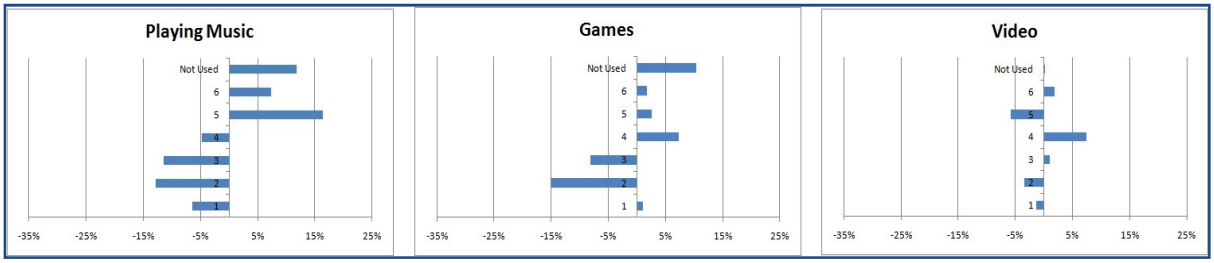

Figure 3 Shift in Ranking of Importance for Recreational Use

[1] All these studies show evidence of >80% student engagement with computers.

Use for Playing Music/Games and Video: There is a shift in ranking of importance **away** from overall recreational use (Figure 3). This would seem to suggest that students have moved away from using computers for play purposes and replaced these activities with more study-centric ones. In addition to measuring changes in use, the post-module questionnaire (n=41) also measured the student's satisfaction with the online learning system. A Likert scale of 1(worst) to 5(best) was used to rate various aspects as follows:

Table 4 Average Satisfaction Rankings of IT Academy

On a scale of 1(worst) to 5(best) rate the following:	Average (out of 5)
Videos/Screen Simulations	3.34
Logging in	3.19
Downloading Exercise files	3.11
Interactive Tutorials (those which you had to follow steps)	3.08
Printing off application step-by-step guides	3.06
Reading through instructions (on how to use the IT Academy)	3.03
Navigating through the system/ease of use	3.00
Technical Issues e.g. Speed of system/Crashing etc.	2.97
Lab exercises	2.94
Quizzes/Self Tests/Games	2.89
Terminology used in the IT Academy	2.77

Although students were generally happy with learning online, one common theme which was evident in the post-module interviews and reinforced by the post-module questionnaire was that there was a strong desire for more face-to-face tutorials. Furthermore, they all valued feedback on assessment. They enjoyed the fact that they could study from home instead of coming into class. One student mentioned that she enjoyed the opportunity to build upon existing knowledge by learning a new version of the software. The hands-on/interactive nature of the module was seen as beneficial to their learning. From a negative point of view, they found navigation of the system to be cumbersome. They expressed concern at the volume of information and instructions and this echoed the sentiments of the focus group held during the first semester. They would have liked to see more video/simulation style lessons

and exercises and have less detail in the instructions. This was also an outcome of the post-module questionnaire where this aspect measured highest on average rankings out of many aspects of the module.

An additional finding evidenced from the post-module interviews was that by engaging in the online module their overall IT skills improved. Navigating through an online course was shown to elicit a range of new skills, such as: filtering unnecessary lessons, a general familiarisation with a learning management system, awareness of being monitored through the tutor's use of the reporting function and fully realising the benefits of flexible learning - anytime, anywhere and at any pace.

Recommendations

As a result of the outcomes of this study, a number of approaches are recommended. A short pre-programme face-to-face bridging module as suggested by Calder (2000) would assist those with little or no relevant previous skills. A skills assessment test on day one of the module would assist in identifying the range of skills. For those students preferring face-to-face delivery the provision of more frequent, structured and regular tutorials to supplement the online lessons would enhance their learning experience. Other recommendations include; more regular tests with specific deadlines to promote better engagement, a more considered relationship with other modules on the programme, some element of localisation of the learning system itself to address ambiguity of instruction.

Conclusions

Undoubtedly, eLearning *has* the potential to alleviate some of the pressures that HEIs are faced with today. The use of commercially available LMSs will have minimal impact in

isolation if they are not packaged with well designed appropriate supports. There are two key finding of this study. Firstly, with learning supports in place, these online students were successful. These supports included regular e-mail contact, a module website which incorporated an FAQ, glossary and detailed module instructions and links to other reference material. Direct contact supports such as: regular group and individual e-mails, regular feedback on in-class tests, group and individual face-to-face tutorials were also used to support and scaffold the students' learning. Secondly, prior to the commencement of the IT module, students' reported on their lack of engagement in office software and use of computers for research and study. At the end of the module, there is clear evidence of a shift in the use of computers away from recreational use towards the use of office software and the use for study and research.

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