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An Evaluation of a Technology Enhanced Learning Tool (Labtutor) From the Perspective of Undergraduate Student Nurses

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Abstract:

The efficiency of large group teaching (lectures) has long been called into question with much research highlighting low levels of student participation, and poor attention spans leading to a lack of engagement with learning which inhibits deep learning. Small group teaching and Enquiry Based Learning (EBL) are methods of teaching that can help promote deep learning. There is also a growing need and demand for Technology Enhanced Learning to suit changing lifestyles. The Labtutor® System, is one such piece of software that is designed to incorporate EBL and small group teaching quality into the large group setting.

This study provides a descriptive survey of adult nursing student's perceptions of the Labtutor system following its use in two Life Science modules within an undergraduate nursing programme. A convenience sample of first year adult nursing students (n=115) were identified to complete a 32 item questionnaire (appendix three).

Participants reported overall that they enjoyed using the system and found it beneficial to their learning specifically:

- (a) Increased engagement with material in online learning as a result of using the system.*
- (b) Increased participation and levels of interactivity in the lecture as a result of using the system.*
- (c) Increased enhancement of learning as a result of using the system and*
- (d) Usefulness of the formative assessment facilitated by using the system.*

The study concludes that Labtutor® system and other such methods of Technology Enhanced Learning packages if used correctly can enhance learning.

Keywords: Technology Enhanced Learning.

Introduction

Many teachers believe that life sciences cannot be taught using interactive techniques, while some believe that undergraduate students, due to their more limited basic knowledge, cannot participate in an interactive lecture (Haigh, 2004). However, there is also current opinion that conventional lectures should be replaced by 'structured interactive sessions' (Steiner and Snell, 1999; Race, 2006). Moreover, interactive techniques allow teachers to receive feedback on students' needs, on how information has been assimilated, and on future learning directions, while students receive feedback on their own knowledge or performance (Laurillard, 2002). Interactive lecturing is a way to benefit from the strengths of small group learning in large group format (Kumar, 2003; Bain, 2004). Although 'active learning' was not defined precisely in educational literature, some general characteristics are commonly associated with the use of strategies promoting active learning in the classroom. It was previously suggested that 'active learning'

involves students in doing things and in thinking about what they are doing (Keyser, 2000). In order to get the students involved, many learning/ teaching models and techniques may be used, including experiential learning, cooperative learning, problem-solving exercises, writing tasks, speaking activities, class discussions, case-study methods, simulations, role-playing, peer teaching, fieldwork, independent study, library assignments, computer-aided instruction and homework (Keyser, 2000; Legan, 2001; McLaughlin and Mandin, 2001; Micheal, 2001; Haigh 2004 and Johnson et al 2010).

Among many teaching models that have been suggested to make the lectures more interactive, is the expository model. The expository model encourages meaningful learning. The teachers present material in a carefully organized, sequenced and finished form. In this model, one of the major components in constructing the lecture is to provide the students a framework or a 'big picture' of the lecture to enable the students to receive the most usable material in the

most efficient way, organizing knowledge into hierarchical and integrated patterns, from the general to the specific and completing the lecture by the reinforcement of the cognitive schema (Chung and Huang, 1998; Ivie, 1998; Zarotiadou and Tsapralis, 2000). Aspects of technology enhanced learning is an example of an expository model.

Black and Watties –Daniels (2006) reviewed the literature relating to technology enhanced learning in teaching in general and found a large amount of literature supporting technology as an enhancement to the learning environment, but no literature specific to nurse or medical education. Simpson (2003) discussed how technology was transforming nurse education e.g. simulation patients, yet none were being used in the traditional lecture setting. Kennerly (2001) suggests using interaction in lecturing to facilitate student interaction. Walsh and Seldomridge (2006) encourages nurse tutors to move away from the model of delivering all the details in class to re-structuring content to allow students to discuss and be openly involved in the classroom to promote critical thinking e.g. problem solving tasks and case studies.

It is interesting to note that the literature also seems to suggest that while lectures are being poorly rated by most students, students of nursing and life science seem to like them especially in first year (Al-Modhefer and Roe, 2009). As a teaching strategy, the traditional lecture is one to which most students have adapted throughout the educational process to provide them with the necessary information for their classes (Race, 2006). Further, experience indicates that students have an increased comfort level with this traditional teaching methodology, partly because they can remain in a passive role as they are not expected to answer questions etc. Students report a preference for receiving didactic instruction that provides the information they believe they need to know. Many students indicate a decreased comfort level with non-traditional teaching methods such as use of case studies and EBL because of a need to be prepared, become an active participant, and change their role from passive to active learner (Delpier, 2006).

Al-Modhefer and Roe's (2010) study suggest that when nursing students come into university for the first time, they appear to favour lectures with a preference for clear and organised instruction. Although these results are from a single higher institution cannot be generalized, further evidence support's lectures as the favourable means for teaching and learning life sciences (Davies et al (2008) with 72% of students agreeing that lectures contributed to their learning and understanding of life science. A recent study found that students felt "overwhelmed" at the prospect of having to embark on on-line or self-directed learning, and wanted "old school" lectures to base learning on (Charbonneau 2012). Leamson (1999) noted that first year

students in particular want lectures and tutor contact to guide their learning and fear being "left alone". The same author writes of how all students and again in particular first year students report the importance of experience as part of their learning. "They need to experience concepts as their lone learning is not developed enough for connections to be made simply from reading" (Leamson, 1999).

The literature clearly indicates the components of good teaching and how to ensure deep learning in students. That didactic teaching should not be so heavily used as modern students can access information quickly and easily and trying to deliver too much content in large group lectures is of little benefit. Although small group teaching has many good qualities it can also have drawbacks unless these sessions are well facilitated and are not nearly a repeat of the lecture. Furthermore, with constraints on time and resources lectures will remain a part of third level education and the literature seems to suggest that one mustn't throw out the baby with the bath water. Well-structured lectures that engage students and involve active learning are not only as good as other methods of teaching they can inspire students and it would seem are actually wanted by students especially in the first year when they can feel overwhelmed at the prospect of self-learning (Beder 1997). It should also be noted that not all students are computer literate; therefore if lecturers are to facilitate learning including distance learning it must be directed. It would seem then that a "good" lecture should introduce the main themes and concepts, involve the students and then direct them on how to continue to learn in a structured and inspired way at their own pace. There must also be adequate feedback built into the module so students do not feel "adrift" when continuing to learn alone. Technology Enhanced Learning (TEL) is the term used to describe all those circumstances where technology plays a significant role in making learning more effective, efficient or enjoyable (Goodyear and Retalis, 2010). Many different types of technology can be used to support and enhance learning. "Technology" in its broadest sense includes hardware; such as interactive whiteboards, smart tables, handheld technologies, tangible objects, and software for example computer-supported collaborative learning systems, learning management systems, simulation modelling tools, online repositories of learning content and scientific data, educational games, web 2.0 social applications, 3D virtual reality, etc. Technology continues to change dramatically, with the majority of university students now owning a mobile phone or other hand held device which gives them access to the internet (Castells 2006). One such TEL programme available is Labtutor® Labtutor® is a computer based teaching programme which combines the use of software and hardware to aid in the teaching of human physiology principles. It is an HTML-based software package, designed specifically for laboratory teaching and

used in conjunction with AD Instruments PowerLab®. There are several experiments which demonstrate physiological changes such as respiration rate, changes in blood pressure etc. Students can conduct these very “safe” experiments on each other using an extensive range of hardware equipment such as exercise bike, PEAK flow meter etc. The student’s results are stored on their own “site” and questions are asked of them to interpret the results guiding them through learning. The software allows the Lecturer to pick and choose from the various experiments and insert one’s own resources and questions to make a tailor made resource for the student’s learning outcomes. The program is augmented with case studies, background reading and video clips to enhance learning. The lecturer can pick and choose whether to include or not. For the purposes of this study the Labtutor® system was used in the lecture setting and experiments conducted on live subjects to demonstrate some aspects of physiology such as the effect of exercise on blood pressure and respiration rate. Tutorials were then uploaded for the students to do at their own pace and the students used the results which they had seen being conducted to attempt to answer questions related to the experiments. The tutorials were “online” for students to access wherever and whenever they could or wanted. There were checkpoints to ensure students were progressing satisfactorily. Tutorials were structured so that one could not progress unless each section was successfully completed, thus giving the student a degree of formative assessment as they progressed.

The literature also reminds us that modern students are “technology friendly”. Bain (2013) suggests that students can read and access information faster than lectures can talk, and often their information is more up to date than year after year repeated lectures. Race (2012) stipulates that students have at their fingertips all the knowledge that the tutor has, however Kantanis (2002) reminds us that often students access information via poor “google” searches and do not process the skills of critically evaluating resources. A survey of some 3000 students revealed that students are demanding more technological resources such as videos, gaming, quizzes and learning management systems so they can control their own learning and complete work at their own pace (Undergraduate Technology Survey 2012). It must be remembered however, that not all students are “tech-savvy” especially mature students (Kevern and Webb, 2004) and that nursing in particular has a larger number of mature students compared to other disciplines. So it is imperative that any use of technology and/ or learning management systems must be used with guidance and caution.

Purpose of the study

The aim of this study is to investigate if students find the Labtutor® beneficial to their learning.

Objectives

- (a) To ascertain level of student engagement with material in online learning as a result of using the system.
- (b) To gauge participation and levels of interactivity in the lecture as a result of using the system.
- (c) To determine enhancement of learning as a result of using the system.
- (d) To determine the usefulness of formative assessment facilitated by using the system.

This study provides a descriptive survey of adult nursing student’s perceptions of the Labtutor system following its use in two Life Science modules within an undergraduate nursing programme. A convenience sample of first year adult nursing students (n= 115) were identified to complete a 32 item questionnaire comprising of a number of multiple choice questions using Likert Scales. The results of this questionnaire were analysed and are presented using a mixture of tables and graph.

The questionnaire was constructed using a five point Likert scale (ranging from “strongly agree” to “strongly disagree” and an “undecided” option, and a few yes /no answer questions. The questions were generated from specific themes and gaps in knowledge identified from the literature. In order to facilitate such a large group, to ensure confidentiality, ease of collation of data and to keep the time needed to complete to a minimum the Personal Response System (PRS) was used to facilitate the data collection.

The PRS provides each student with a credit card sized handset with several buttons on it, which transmits radio signals to a receiver in the lecturer’s computer according to which button is pressed. The receiver tabulates the responses and can present them on screen in various formats (e.g. as a pie chart, graph or bar chart) in less than a second from the last response, or when the lecturer clicks the mouse for all to see.

Students were invited to respond to a series of questions posed regarding the use of Labtutor® by pressing their PRS handset. Each response had a corresponding button on the handset. The system enables the facilitator to see when all participants had responded. Participants could change their responses at any time up to the point when the next question was posed, however if required they could also request at a later point to change a response, or have a response or all responses from them deleted, however no participant availed of this option.

Validity and Reliability

The questionnaire was reviewed and examined by several experienced teachers including fellow Life Science Lecturers, Information Technology experts and an Education Technologist who had all been briefed on the study.

A pilot study was conducted on a small group of 14 students from a different cohort who had also used the system. As a result of the pilot study and suggestions from experts several small changes were made to the questionnaire including the number of negative questions, the time allowed for some questions, the number of questions allotted to each concept and the wording of some questions.

Sampling

The researcher conducted all the lectures and wrote the material for the tutorials and the group of 115 students for whom the researcher had teaching responsibility were also the convenient sample group for the study.

Ethical application was made to the School Research Ethics Committee, and granted. Students were informed at the start of the module by way of verbal instruction that they would be using the Labtutor® system and extensive instruction on how to do so was given. It was emphasised on both occasions that participation was entirely voluntarily and there would be no repercussions if they chose not to, nor personal benefit gained if they did. Consent therefore was gained by attendance.

Data Analysis

A major benefit of using the system to collect the data from the questionnaire is its ability to collate the data via its “creating reports” function. Data is analysed using statistical tests similar to SPSS programme calculating confidence intervals and statistical inference. Question responses can be compared against each other, a breakdown of male/female respondents and responses’ by age can also be compared. This results in a plethora of statistical outcomes available which must be carefully considered. Descriptive statistics such as frequencies were therefore used to represent the data. Student responses are presented using a mix of pie charts and graphs that represent both numbers responding and percentage of the study population. Quantitative data is presented using the initial aims of the study to provide clarity.

The data was analysed using the statistical package incorporated into the P.R.S system, and the results are presented under the study objectives.

Of 115 possible participants who met the inclusion criteria, 92% (n=106) chose to complete the questionnaire a response rate of 92%, 91% (n=97) were female and 9% (n=10) were male. These figures are in keeping with the predominantly female gender of nurses and are supported by the Nursing and Midwifery Council (NMC) (2008) who state that 89% of registered nurses are female. The spread of ages was also representative of those nursing students in general, and provided useful information on the difference of opinion according to age. The 18-25 categories made up 75% of the group (n=80), 26-35 groups were 17% (n=18) the remainder 8% (n=8) in the 36-45 categories.

Key findings

The findings from this study clearly indicate that students found the use of Labtutor® in their undergraduate course to be a positive experience with 92% (n=97) finding its use enjoyable and 84% (n=87) finding it beneficial to their learning. When asked if they would like the system used in future lectures 77% (n=81) reported they would. Furthermore 76% (n=79) said they would recommend the use of the system to other nursing students.

Engagement with material in online learning as a result of using the system.

Engagement happens along a continuum and is a matter of degrees of involvement (Avendano, 2003). Though the student has the responsibility to engage in academic activities, it is the lecturer’s role to create purposeful course designs that promote interaction, participation, and communication in the online learning environment (Weiss et al., 2000; Johnson, 2003). Educators and instructors have to consciously and consistently develop and sustain different opportunities that will encourage engagement in online education. HEI’s are in a position to support technological innovations that promote the development of skills (Conrad and Donaldson, 2004). Participants in this study believed that online material was more interesting (71% n=74) when it was based on experiments they had seen facilitated by using the Labtutor® system, so it would seem that the system helped students to engage with learning.

Furthermore, student engagement pertains to the time and physical energy that students expend on activities in their academic experience (Jacobi et al., 1987; Kuh, 2003). Engagement also relates to the efforts of the student to study a subject, practice, obtain feedback, analyse, and solve problems (Kuh, 2003). Participants (75% n=80) felt more motivated to complete online work using the system as it allowed further development of concepts and experiments introduced in lectures. It would seem them that the Labtutor® system has the capacity to enable lecturers to design learning materials that motivate and engage students

with regards to online learning and assist students to embrace the technology that already exists to support online learning.

There is no change in higher education more sweeping than the transformation brought about by the advent of the Internet and Web (Robinson et al., 2008). Maeroff (2003) maintained that developments in online learning are not “just a fad” but a “sea change” (p. 2). The amalgamation of knowledge and technology permits higher education to provide learning opportunities anytime, anyplace, and to anyone (Aggarwal and Bento, 2000; Maeroff 2003; Pittinsky, 2003). In this study 80% (n=84) of participants reported that they would find it helpful if they could access the system remotely supporting the concept that modern students are comfortable with and even desire remote study.

The Internet and related technologies make possible creative and cutting-edge pedagogy such as online learning modules, that permits innovation for the teaching–learning process (Lowy and Ticoll, 1998; Burgstahler, 2000) and have been used effectively to enhance such learning (Cole, 2000). The elimination of time and place constraints, and the availability of flexible and innovative channels for interaction online have increased the opportunities for learning (Chickering and Ehrmann, 1996; Burgstahler, 2000).

Responses to the questions relating to engagement with online material when the Labtutor® system was used were overwhelmingly positive. Respondents felt they could relate to online material better when it was based on experiments they had seen in lectures (78% n=82) suggesting that Labtutor® helps achieve better engagement.

However, while the prevalent concept of an online environment allows content to be delivered in many ways and eases the task of interaction (Palloff and Pratt, 2001), there must still be a degree of lecturer/ student interaction and the material ought to be a continuation of that introduced by the teacher (Benbunan-Fich et al., (2005). Tackling new concepts online on their own is not recommended (Bucy, 2003; Conrad and Donaldson, 2004). The design of materials should focus on increasing student interaction with materials to increase motivation (Johnson, 2003).

Student engagement pertains to the time and physical energy that students expend on activities in their academic experience (Jacobi et al., 1987; Kuh, 2003). Engagement pertains to the efforts of the student to study a subject, practice, obtain feedback, analyse, and solve problems (Kuh, 2003). Participants in this study felt more motivated to complete online work using the system (75% n=80) as it was a continuum from concepts and experiments introduced in

lectures and students were therefore more engaged with their online learning. It would seem them that the Labtutor® system can help lecturers design online materials that motivate and engage students with regards to online learning.

Enhancement of learning as a result of using the system.

Often lectures are crammed with key information with little time for full exploration whereas the Labtutor® system aims to foster a “deep” approach to learning by introducing key concepts in lectures by way of demonstration of live experiments and then directing students to relate this information to further study online. The overall aim of “deep” learning as opposed to surface or rote learning is so that students retain and truly understand the key concepts (Snelgrove 2004). The majority of participants in this study agreed (79% n=84), that the system both helped them to conceptualize key concepts, which according to Kuh (2003) is the first step in deep learning. Participants also reported understanding concepts when the system was used (88% n=92) further demonstrating a deep as opposed to surface approach (Lorenzo and Moore, 2002). Most importantly, participants (63% n=64) found it easier to retain their learning when Labtutor® had been used to teach the information.

Linnenbrink and Pintrich (2003) reminds us that if a student believes that a teaching tool is helping them to learn their positive attitude towards the tool will help students to engage in and take responsibility for their learning, therefore promoting “deep” learning as opposed to panicked “rote” learning. It is of great significance then that when asked if Labtutor® was not beneficial to them in terms of learning, the strongest response was yielded with 88% (n= 91) disagreeing and when asked if overall the use of the system was beneficial to their learning 84% (n=90) responded yes. Clearly the participants in this study valued Labtutor as a learning tool.

Participation and levels of interactivity in the lecture as a result of using the system.

Bligh (1998) suggests that in the long term large group teaching is not effective in terms of student learning, as students are passive recipients of information, without engagement in the learning process, and therefore their attention wanes quickly after 15–25 minutes. (Conoley et al., 2006), recommending introducing a learning activity or change in teaching technique, even just a small break every 20 minutes to significantly increase the learner’s attention. The results of this study appear to support this as 81% (n=84) felt they were more attentive in lectures when the

system was used as it introduced interest and a break from the norm of didactic teaching.

Furthermore traditional didactic lectures can potentially facilitate passive learning, without any active engagement by the students (Gulpinar and Yegen, 2005). Where learners are passive in the learning process they demonstrate limited attention spans and low retention rates of factual information from lectures (Fischer et al., 2004; Gulpinar and Yegen, 2005)

However as a teaching strategy, the traditional lecture is one to which most students are exposed to throughout the educational process to provide them with the necessary information for their classes (Race, 2006). Students have an increased comfort level with this traditional teaching methodology, partly because they can remain in a passive role as they are not expected to answer questions etc. Literature supports interactive teaching methodologies as promoting increased understanding and application of knowledge as well as retention of factual knowledge (Costa et al., 2007). A carefully structured lecture can be an effective way to combine and present information from multiple sources on complex topics (Richardson, 2008).

The literature also supports the use of lecture as an effective teaching methodology for clarification of difficult concepts, organisation of thinking, and promotion of problem solving (Naismith and Steinert, 2001). In this study 66% (n=69) of participants felt more involved in lectures when the system was used in lectures and suggests that if the lecturer can successfully reframe the delivery from being strictly one-way communication and engage learners, then it can be a successful tool in the learning process (Di Leonardi, 2007).

Relevant literature does not support the belief that lectures should be completely abolished and the current opinion is that conventional lectures should be replaced by 'structured interactive sessions' (Steinert and Snell, 1999; Race, 2006).

Black and Watties-Daniels (2006) reviewed the literature relating to technology and enhanced learning in teaching in general and found a large amount of literature supporting technology as an enhancement to the learning environment. Participants in this study 76% (n=80) found the lectures more interesting when the system was used, supporting these concepts and challenging how lectures should be delivered. Studies have indicated that students are more likely to attend lectures if they contain interaction over didactic teaching alone (Traphagan 2005; Martyn 2009). Only 49% (n=51) of participants in this study agreed that they would be more likely to attend lectures if the Labtutor® system was used, which although was still positive was one of the lowest positive response rate. However, when asked if they would be less likely to attend 83% (n=86) disagreed

implying that the system certainly did not put them off attending. It is worth noting that 21% of participants' were undecided when asked if they would be more likely to attend, perhaps this could be interpreted as the students believing they would attend lectures irrespective if they didn't enjoy them or find them beneficial. Nevertheless the results indicate that they would not be less likely to attend if a tool such as Labtutor was to be used.

Al-Modhefer and Roe's (2010) study suggests that when nursing students come into university for the first time they appear to favour lectures with a preference for clear and organised instruction. Furthermore, Davies et al (2000) found in their study that 72% of students agreed that lectures contributed to their learning and understanding of life science. A recent study found that students felt "overwhelmed" at the prospect of having to embark on on-line or self-directed learning, and wanted "old school" lectures to base learning on (Charbonneau 2012). Leamson (1999) noted that first year students in particular want lectures and tutor contact to guide their learning and fear being "left alone". The same author writes of how all students and again in particular first year students report the importance of the experience of attending lectures and being part of a group as part of their learning.

It was of interest then to establish if participants would like to use the system in future lectures, in other life science module and if they would recommend its use to other nursing students. Responses yet again were positive; with 76% (n=79) recommending its use to other nursing students. A significantly high proportion would like to use the system in other life science modules (81% n=84) and 77% (n=81) agreeing they would like it used in future lectures. Labtutor is a physiology and life science based module. Question 27 asked if participants would like to use this type of interactive learning in other modules that were not life science based which only yielded a positive response of 63% (n=65) significantly lower than the other questions relating to this theme. However it is difficult to ascertain if this question confused the participants as in retrospect it could have been clearer that it related to this type of interactive learning rather than solely Labtutor.

Usefulness of the formative assessment facilitated by using the system.

The Labtutor® system provides prompt feedback to students as it identifies where they are achieving and where not, individually and immediately. First years in particular desire feedback (Wilcox et al., 2005) and it has been argued that it is essential for their development as they are not skilled at identifying gaps in their knowledge (Rhodes and Nevill, 2004; Yorke and Longden, 2007). The participants in this study (88% n=89), certainly seem to agree that it helped to

identify what they understood, and that it helped to identify gaps in their knowledge (72% n=75). However participants were less sure if it helped them identify their learning needs (57% n=59) or if they would use this information to direct further study with only 50% (n=50) agreeing or strongly disagreeing with this statement. However, what is significant about the responses to these statements was that 30% (n=32) were undecided in both, which suggests that the participants did not feel strongly that they would not use the information to direct their study and could be interpreted that perhaps that they didn't know how to and this concurs with the literature that suggest that students especially first years struggle to utilise feedback to direct their learning (Beder, 1997; Yorke and Longden 2007). It is also interesting to note that this question produced a significant difference in responses through the age range whereby 50% of 18-25 year olds agreed or strongly agreed in contrast to 71% of the 36-45 group. Again this supports literature that suggests that mature students are better at applying feedback to direct further study than younger students (Richardson, 2006; Young, 2010). However, it must also be remembered that mature students can also struggle with online course work (Barakzai and Fraser, 2005) Perhaps there is a need to further explain to students especially in first year how to direct further study once furnished with this feedback, as this can be difficult especially with online material (Schwartz and White, 2000).

Online material and self-directed learning

The modern student both wants and demands interactive learning (Undergraduate Technology Survey, 2012), and have a wealth of knowledge and information at their fingertips (Race 2012). However, it is important to recognise that not all students are "Tech-savvy", especially mature students (Jones 2012) and that first year students in particular can feel abandoned if they are "set adrift" in the world of self-directed learning (Leamson, 1999). It was noted by the researcher during the teaching of the module that some students had reported gaining access to the material online as being difficult when using the system; therefore this question was included in the questionnaire. Interestingly 17% (n=17) agreed/strongly agreed, 20% (n=21) were undecided, however 63% (n=65) disagreed/strongly disagreed. It is difficult to ascertain if this is because the Labtutor® system in particular was difficult to get access to, or because the students were very new to the course as they were only in their first phase, but it is imperative that lecturers must ensure when embarking on teaching using such a system that it is accessible and that help and support is available for those having difficulties or some students may be "left behind" or unduly stressed.

The participants were however overwhelmingly positive to the question regarding working remotely, as 80% (n=84)

agreed/strongly agreed and 11 % (n= 12) were undecided with only 9% (n=9) disagreeing/strongly disagreeing when asked if they would like the capability to access the system 24/7 from phones, laptops etc. This may be a reflection on the fact that students now more than ever have demanding lifestyles requiring them to work as well as study, and increasing numbers have families (Gillet et al., 1997). If having remote access enabled students to achieve more study at convenient times, saving travelling etc. then this would be positive, however it must be pointed out that again as discussed earlier students especially first year need and want feedback. Therefore a limit must be set especially initially on the amount of remote learning set as it is important that students come together, and have regular contact with lecturing staff. Furthermore it is important that sound group dynamics are formed early on, as is crucial for the success of a problem based curriculum (Albanese and Mitchell 1993)

Lastly, the system also provides the capability for students to conduct the experiments on their own or in small groups rather than just observing them. In response to the question "I believe my learning would be further enhanced if I had the chance to conduct the experiments myself", 73% (n=78) agreed/ strongly agreed, 14% (n=15) undecided and 14% (n=14) disagreeing/strongly disagreeing. Self-participation would seem to be desired by the majority of participants however, facilitating this would be a huge commitment in terms of resources for rooms, equipment and staff and would need to be justified. Morison et al (2004) contend that teamwork and collaboration are increasingly regarded as important goals in healthcare, and working through experiments in small groups could help facilitate this. Furthermore, actually "doing" experiments may suit some students learning styles especially "pragmatists" and "activists" (Honey and Mumford 1986) therefore promoting "deep" learning.

Conclusions

The ultimate aim of nurse education is to produce practitioners fit for practice in possession of professional knowledge. Findings from this study raise a number of challenges for nurse educators not least how to deliver the new curriculum in such a way as to promote deep learning and understanding, and engage students enabling them to link theory to practice to meet the NMC progression points (NMC, 2010). To simply deliver information to large groups of students didactically fails to encourage engagement with learning and therefore it could be argued does not promote deep learning. Ideally small group sessions involving interactive activities such as with Labtutor® and teaching strategies such as enquiry based learning can achieve deep learning. However, with continuing demands on resources it is unlikely that whole programmes can be delivered in this

way, and large group teaching seems likely to continue for the foreseeable future.

Recent advances in educational technology can go some way to assist the lecturer in implementing new teaching strategies. Furthermore, changing lifestyles and more demanding schedules are forcing more students to reap the benefits of academic instruction remotely (Glen 2006). The demand for distance education is growing exponentially and has been for some time. However the increasing need for online resources as a learning strategy must be used with caution. It must be of good quality and have adequate instruction on how and when to complete tasks and how to access help when necessary. Educators must acknowledge these facts and strive to incorporate the positive aspects of small group teaching such as interaction making lectures as interesting as possible to engage students and promote learning. Labtutor® as a Technology Enhanced Learning Tool was used in this study to help achieve this.

The participants in this study were overwhelmingly positive regarding the use of the Labtutor® program as part of their Life Science Module. Participants agreed that lectures were more interesting when the system was used, that they were more attentive in lectures and that they would be more likely to attend if the system was used. Participants also felt more involved in lectures when the system was used, and that they would like it used not only in other life science modules but in other subjects. Furthermore participants overwhelming agreed that they would recommend the systems use to other students.

With regards to feedback, the participants in this study also reported the system to be useful in identifying the gaps in their knowledge and that they would use this information to direct further study. Participants believed the system helped them conceptualise more easily and helped them retain information better. It is perhaps then unsurprising that they also reported that it was therefore beneficial to their learning as it assisted in fostering deep as opposed to surface learning. Therefore it provides the lecturer with a tool to help engage students more in lectures and promote learning. It would be interesting to further investigate if the students retained more information due to this increased involvement. Participants also believed that if they were able to conduct the experiments themselves that this would further enhance their learning and it would be interesting to carry out a follow up study to investigate if there was a detectable difference in outcomes between groups if one had conducted experiments and the other group simply observed them.

The participants in this study were very new to tertiary level education and as discussed previously it is imperative that educators' do not overwhelm new students with problem

based remote learning as they can feel adrift. This study clearly demonstrates that a system such as Labtutor® can help link the information presented in lectures to online learning and structure online material so students can work at their own pace but still feel supported. Participants in this study also reported that they would welcome the capability to be able to work entirely remotely on tablets etc. which reinforces other research describing the modern students need and desire for remote learning.

Limitations

Although the results of this study are overwhelmingly positive it must be remembered that this was a single centred study based in one Higher Education Institution in the United Kingdom. The results also need to be taken cautiously as they examine in some instances perceived effect e.g. enhancement of learning, improved retention of information etc., it is difficult to see if they actually have positive effects. Further study would be needed to confirm these effects. Educators are intending to embark on using such an online system such as Labtutor® should be aware that the initial outlay is expensive and there are strict licensing implications. This may pose some difficulties especially for smaller institutions. As discussed earlier some student's especially mature students may not be "tec-savy" and need careful instruction on how to access and use the system or they could be "left behind".

Lastly caution must be exercised when using the prewritten experiments, case studies and the other multiple resources available. They should be used to augment teaching and not used to replace it. Furthermore, the resources must be adapted to match the curriculum and should not be used as an "off the shelf", bought curriculum as it is not designed to do so.

Main Recommendations

A number of recommendations arise from this study:

- HEIs should consider investing in Technology such as Labtutor® to enhance large group teaching and the quality of small group teaching into the large group setting and Technology such as the Labtutor® can certainly help achieve this. The material presented in lectures must be linked clearly to tutorials and online learning for it to be worthwhile and again systems like Labtutor® clearly help to achieve this.
- Educators must also strive to assist students to work remotely and at their own pace, but must ensure that students particularly those new to this level of education are carefully guided as to what to study and how to assess the material and feel

supported. Again systems such as Labtutor® seem to help facilitate this and give structure to a module.

- The Personal Response System should be utilised more as it provides the student with the opportunity to participate more fully, particularly in large lectures and provides the lecturer with feedback.
- This initiative could be supported by for example the development of an “App” to further promote interest and indeed support for remote learning.

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