

An Evaluation of the Effectiveness of, and Students Attitudes towards, Technology Enhanced Learning (TEL) in a Clinical Skills Laboratory Environment

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ABSTRACT

The learning of students within the Department of Nursing and Midwifery at the University of Limerick is increasingly supported and mediated by computer based technology. New techniques, such as self-record and review of laboratory practice procedures and “clicker” response to quizzes in lectures, facilitate individual student engagement even with large classes. Further support is provided by the use of the Moodle learning management system. This paper illustrates how these techniques are integrated in the Clinical Skills Laboratory class and present the findings of a study aimed to discover how Irish nursing student view these technology supports.

Keywords: Blended Learning, Video Analysis, Self-Recording, Technology Enhanced Learning. Student Views

INTRODUCTION

This paper aims to present the perceptions of Irish Nursing students with regard to the use of technology in their learning environment. Within the University of Limerick, where this study was conducted, undergraduate student nurses have access to a plethora of technological instructional equipment. The laboratory-learning environment – called the Clinical Skills Laboratories – has a touch screen enabled video and audio recording facility called the DNA – Digital Nursing Archive[1]. This is available and accessible to any registered Nursing student in the University. Many instructors at both large and small educational institutions have begun to use classroom technology that allows students to respond and interact via small, hand-held, remote keypads called “Clickers”. It resembles the "Ask the Audience" portion of the game show "Who Wants to be A Millionaire," and enables instructors to instantaneously collect student responses to a posted question, generally multiple choice. The answers are immediately tallied and displayed on a classroom projection screen where both students and instructor can see and discuss them. This technology is known under many names and will be referred to as an audience response system (AR system or ARS). Audience Response Systems are an evolving in-class-student-polling technology designed to create an engaging and inviting learning environment that maximizes active learning. This is a relatively new technology and one that offers easy deployment of active learning and engagement within the classroom environment. The above listed technologies, in conjunction with a blended learning approach with the Moodle Content Management System, was used to educate these 2nd Year Nursing students. A

voluntary questionnaire at the end of the academic semester was administered to gather the students thoughts and views on how the technology aided or hindered their learning process.

BACKGROUND

The undergraduate Bachelors of Science in Nursing has a significant nursing skills component embedded into the modular structure and taught to students in conjunction with relevant theory. 2nd Year Students from the Module – NS3201 - Microbiology Immunology & Infection Control were selected for this piece of research. The focus of the research was on determining if technology aided students in learning practical skills via self-recording, critiquing and Clicker technology – in this case wound care management and suture removal. The theory was taught via an online module delivered with the Universities Content Management System – “Sulis”. Lectures were two hours per week, eight lectures in total in which the students focused on the theory applications of the module. There was also a two-hour laboratory session that was facilitated by the staff of the Nursing and Midwifery Department, in which the students practiced what they learned in the classroom. The “traditional” method for teaching labs involved demonstration of the skill by a facilitator to groups of 15–20 students, in the Clinical Skills Lab Environment, followed by an opportunity to practice under supervision. These large class sizes, which were determined by timetabling constraints and availability of teaching staff, posed several challenges. The requirement for large numbers of staff led to concerns about procedural consistency [2]. The lab facilitator believed a single demonstration was insufficient and that students would benefit from being able to see the skills repeatedly, if necessary. To this end, the students were allocated a task of recording a specific skill – Suture Removal. This required them to use a specific piece of equipment called the DNA – Digital Nursing Archive[1]. The students were charged with watching video resources online relating to the task at hand and familiarising themselves with the technique. The lab facilitator demonstrated the procedure first and then randomly chose two students from each group to repeat the process to their colleagues. The lab facilitator was at hand in case there were any questions on the procedure. Once this was completed, the students – in pairs of two – logged into the DNA system and recorded themselves removing Sutures. Upon successful completion of the task, the students saved the video clip for critiquing later on in the week. The lab facilitator provided the students with a checklist that was used when the recording was taking place.

LITERATURE REVIEW

Many methods are used to enhance student engagement in instructional nursing education courses [3, 4] and systems are introduced as new technologies become available [5-9]. Content Management Systems are popular nowadays and there are several main contenders in this market – with systems like Blackboard, WebCT, Moodle and Sakai to name but a few.

The usage of learning technologies can transform the concept of teaching and learning by redefining the role of the teacher and transforming the meaning and content of the learning procedure [10]. Learning moves from a Tayloristic or behavioristic linear model that treats learners as products on an assembly line, to a more constructivist approach fostered by web-based instruction where learning is a more authentic self directed personal experience [10-15].

Currently, students have a preference for digital literacy, experiential learning, interactivity, and immediacy [8, 16]. Greater use of technology has been introduced into classrooms to encourage student involvement [3, 17, 18] in the past several years. Research has shown that actively engaged students will absorb and retain more content [3, 19]. It has also been shown that using a variety of teaching/learning methodologies enhances learning for students with differing learning styles [5, 20]. A learner-centred teaching approach [9] and the creation of significant learning experiences [5, 20] are touted as means of creating interaction in the learning environment.

Self-video recording permits the students to take control and work at their own pace. Once a recording is completed, there are various methods available for reviewing and recalling the recorded clips. Any personal computer connected to the Universities network can be used for viewing a user's recordings, subject to the login privileges assigned to the user. Standard users have access only to their own recordings and to public recordings used for tutorials, etc. Lab facilitators and system supervisors may, subject to administration permissions, be able to access recordings of students in their group. Recordings are saved in high-quality MPEG-2 format, at a choice of quality settings, up to DVD quality. At the same time, a lower-resolution MPEG-4 copy is made automatically, which can be viewed across any allowed network or Intranet connection. Once a student is content with the recording, they submit it to their lab facilitator or Supervisor via a web-based portal. Upon successful use of this technology, we introduced the ARS approach.

The ARS enriches the students' engagement and activity levels in the learning environment. The operation of an ARS is a simple three-step process:

- 1) During class discussion or lecture, the instructor displays or verbalizes a question or problem – previously prepared or spontaneously generated “on the fly” by the instructor or a student,
- 2) All students key in their answers using wireless handheld keypads – aka “Clickers”
- 3) Responses are received, aggregated, and displayed on both the instructor's computer monitor and an overhead projector screen. The distribution of student responses may prompt the students or instructor to explore further with discussion or perhaps one or more follow-up questions.

This interactive cycle can continue until both the instructor and the students have resolved ambiguities or reached closure on the topic at hand [21].

RESEARCH AIMS

The aims of this research were to:

- Evaluate student experiences of the use of technology in supporting their learning of a practical skill.
- Examine the students' perceptions of a technology enhanced learning approach and whether it aided or hindered their learning.
- Contribute to the body of research in this area in order to enhance discipline specific curriculum resources.

RESEARCH METHODOLOGY

This study evaluated students' perceptions to the use of technology in the classroom to actively enhance and engage their learning cycle. This pilot group was a 2nd Year Nursing module in an Irish University. Nursing is divided into three distinct disciplines – Mental Health, Intellectual Disability and General Nursing. The students were assigned to their respective groups by the Student Service department within the University. These groups have a random allocation of students from the above three listed disciplines. The groups were allocated a given day and time that their laboratory session would take place. This session ran from week 1 to week 12 of the academic semester. The first four weeks of the semester, week 1 to week 4, the students focused on hand hygiene, standard precautions, infectious diseases and specimen collection. The middle four-week period, week 5 to week 8, the students were out on placement. This means that they were not physically on campus and therefore not available for lectures or laboratory sessions. The final four-week section of the semester, week 9 to week 12, focused on aseptic technique, wound care, wound management and suture removal.

The first four-week section was delivered via the standard means of delivery. The students attended the laboratory session and the facilitator taught them the material under review. Content was delivered via PowerPoint presentation on the overhead projector. The students had the opportunity to ask questions or engage in discussions with the facilitator. The students did have an opportunity to fill in an evaluation form at the end of each laboratory session voicing their thoughts and feeling with regards to the content they were studying and their understanding of said content. The only technology that was used was the overhead projector with the aim of displaying the content to the students.

Upon completion of placement and after returning to the University, the students were welcomed back to a different scenario. The content for the laboratory session was made available to them online via a content management system called Moodle. The students could access this system from on and off campus locations. Material in the form of PowerPoint slides, additional reading in PDF format and video clips in web based flash format was made available to the students on a week-by-week basis. The same material was taught in the laboratory sessions. An additional new technological strategy was the Clickers. The students were introduced to the concept of the Clicker technology and two groups – Group 1 and Group 2 – availed of this feature in the week 10 laboratory session. The other group – Group 3 – used the Clicker technology in week 11 – directly before an in class Moodle quiz. The question

of how time would affect the retention rate of the group was prominent here when introducing the different groups to the ARS. The overall results from the online Moodle quiz for these three groups are shown in Table 1.

Group	N	Average Score	Lowest	Highest
1	12	7.67/10	6	9
2	10	7.45/10	6.5	9
3	21	8.07/10	6.5	9.5

Table 1: Student Results from Online Moodle Quiz

The teaching in the last four weeks of the semester focused heavily upon the technology that was available in the department. Students had access to online resources via Moodle as well as discussion boards, assignments and other technology-enhanced features. Video clips were available in a YouTube style format where the students could play, pause and remind a clip as often as they deemed necessary. At the end of the academic semester, the students were asked to voluntarily fill in an anonymous questionnaire online that would provide feedback to the facilitator with regards to their thoughts on Technology Enhanced Learning via Moodle, the Clickers and the use of the DNA recording system.

RESULTS

The students were asked to record themselves performing the aseptic technique of Suture Removal. The students paired off and used one of the four beds in each laboratory setting. Student A logged in while Student B ran through a printed checklist of the procedure. Once Student A was logged in, s/he used the touch screen and started recording the procedure. Student B ran through the checklist as Student A was carrying out the recording. At the end of the session, the recording was saved and the students swapped roles and repeated the above steps. After the successful recording of the procedure, the students were able to review their own recording online. Based on this review, the students critiqued the recording and uploaded their findings onto the Moodle system for the facilitator to review. Figure 1 shows a student carrying out the required procedure.

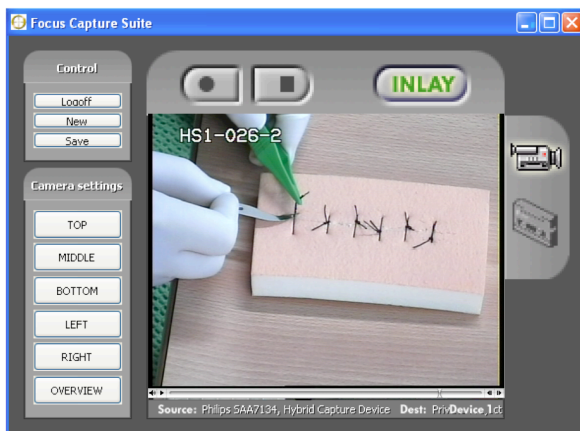


Figure 1: Students performing a Suture Removal on the DNA

Forty-eight students responded to the critique of the video recording. The students were asked several questions in relation to the recording and the procedure itself. 15% of the students

were from a Mental Health background, 35% from Intellectual Disability background and 50% were General Nursing.

Some of the comments received when asked if the video recording experience enhanced their learning included:

- “...found that this experience did enhance my learning. It provided us with the chance to revisit our skills demonstration and learn from our mistakes”
- “...really good way of looking back on a procedure as trying to remember details is not easy. This is more accurate”
- “...you could see the procedure you done on a video and to see your mistakes”
- “...could see for myself afterwards what I did wrong”
- “...doing it practically and being video recorded it enhanced our ability to do the procedure and by being video recorded we can critique ourselves.”
- “...I feel the DNA has enhanced my learning”
- “...I thought it was a good idea to record us taking out the stitches. This way we can access the recording anytime and refresh our memory on how to carry the procedure out.”
- “...This experience allowed me the opportunity to review and reflect on how I had performed during the aseptic procedure and suture removal. I was a bit nervous at first but if recordings are used more often I feel that people would be far more relaxed and view it as a chance to visually reflect on practice.”

	Average rank					
	Strongly Disagree	Disagree	N/A	Agree	Strongly Agree	
I found using the DNA (Video recording) system useful?				■		4.5
Recording the Suture Removal procedure helped me learn the skill better?				■		4.6
The DNA recording had a strong impact on my learning of the skill?				■		4.5
The experience of using the DNA enhanced my learning?				■		4.5

Figure 2: Students thoughts on using the DNA System

Figure 2 shows the students thoughts on the DNA system. The information was gathered via the questionnaire survey on Moodle.

Not every student was as positive with the use of the recording technology but the few who commented negatively were minor in their voicing. Comments like:

- “...i think the video part could be avoided...that the lecturer could just monitor and grade us.”
- “...I wasn't fully comfortable but I learned the correct procedure.”

It was not feasible to have the lecturer teach every student individually. The time required for such a task was beyond the two-hour laboratory limit.

	Strongly Disagree	Disagree	N/A	Agree	Strongly Agree
I found using the DNA (Video recording) system useful?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recording the Suture Removal procedure helped me learn the skill better?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The DNA recording had a strong impact on my learning of the skill?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The experience of using the DNA enhanced my learning?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3: Sample Question from Lab Overview Questionnaire

44 students filled in this anonymous questionnaire – a sample of which is shown in Figure 3. Students were asked several questions in relation to the use of technology in the teaching of the module. A 5-point Likert Scale was used in the questionnaire. The student could strongly disagree, disagree, N/A, agree or strongly agree to any question. Students strongly agreed (4.5/5) that the DNA system was useful to their way of learning in the laboratory setting. There was a strong agreement that recording the suture removal procedure helped the students learn the skill better (4.6/5). Students strongly agreed that the DNA recording had a strong impact on their learning with regard to the skill (4.5/5) as well as enhancing their learning (4.5/5).

Several important aspects of the DNA system with regard to the learning of the skill and the use of technology in the laboratory environment are listed below (taken from students submissions):

- “Being able to see the mistakes that I did make”
- “Good to use new technology”
- “It benefits as a fundamental learning opportunity to look back on what I have done and reflect on mistakes and learning opportunities.”
- “It is important to develop IT skills”
- “It was good for reflective practice”
- “Using this system we were able review what we had done during the lab and find any faults we may have made. This allowed us to improve our nursing skills”

When asked to comment on problematic or troublesome qualities of the DNA, the following responses were submitted (taken from students submissions):

- “Camera only covers a small area”
- “It can put you on the spot and make you nervous and uneasy”
- “Not being confident enough using the DNA system”
- “None” – several students reported that there was no drawback to using the system

- “We never used this system in first year and i think that a lot of people are nervous using the system. If we were allowed use it more often it would make people less apprehensive and enhance learning.”

Overall the students were positive with the record process associated with the procedure. They liked the aspect of being able to review the recording afterwards and critique it. This provided them with the possibility to re-record the procedure or submit the already recorded clip. The students made the decision on what clip to submit to the lab facilitator. This further empowered them in the session and provided them with further responsibilities in the laboratory, further treating them as adult learners. The students were asked to critique the recording online in the Moodle environment. Sample questions from the online critique are shown in Figure 4.

Do you feel confident to carry out an aseptic technique for suture removal?
<input type="radio"/> Yes <input type="radio"/> No
Did you successfully prepare a sterile field with appropriate equipment?
<input type="radio"/> Yes <input type="radio"/> No
Did you remove sutures by making one cut, when you determined where the loose end was visible? (Bearing in mind the part of the skin must not be pulled under the skin during removal)
<input type="radio"/> Yes <input type="radio"/> No
Did you successfully demonstrate the suture removal technique?
<input type="radio"/> Yes <input type="radio"/> No

Figure 4: Sample Critique Question from Video Recording

The semester was split into three four-week periods. The students had no access to Moodle in the first four-week period.

	Average rank					
	Strongly Disagree	Disagree	N/A	Agree	Strongly Agree	
I would like to have access to moodle for the full semester?				■		4.3
The supporting material on moodle enhanced my learning?				■		4.3
Accessing the moodle website was easy?				■		3.9
The video, powerpoint and pdf resources on moodle were beneficial to my studies?				■		4.5
Accessing moodle helped me obtain prior knowledge of my lab session?				■		4.3
Using moodle contributed positively to my student learning activities?				■		4.3
Using moodle contributed negatively to my student learning activities?		■				2.6
I would like to have received SMS notifications from moodle with regards to labs, notes, deadlines etc				■		3.9

Figure 5: Students thoughts on Using Moodle

When asked, via the questionnaire, if they would like to have access to Moodle for the full semester, 4.3/5 students agreed that they would. A similar 4.3/5 students noted that the supporting material on Moodle enhanced their learning.

3.9/5 students said that accessing Moodle was easy. There was some concern here with regard to why students agreed but did not strongly agree. Upon further verbal discussion with the students, it was found that the website address was inaccessible at certain times. Later, it was discovered that the IT department had to carry out maintenance and essential upgrades. Students agreed or strongly agreed to the following points:

- The online resource were beneficial to their study
- Accessing Moodle helped the students obtain prior knowledge to their lab sessions
- Using Moodle contributed positively to the student learning experience

When asked if Moodle contributed negatively to their learning experience, the results shows that students disagree to this statement.

Students were asked if they would like to avail of SMS (Short Messaging System) technology in the future with regard to notifications and updates in the module teaching. 3.9/5 students agreed to the introduction of this new technology into the lab. Full results are shown in Figure 5. Another form of innovative technology availed of during this pilot was the Clickers.

The Clicker technology was new to the department and University as a whole. The operation of an Audience Response System is a simple three-step process:

- 1) During class discussion or lecture, the instructor displays or verbalizes a question or problem – previously prepared or spontaneously generated “on the fly” by the instructor or a student,
- 2) All students key in their answers using wireless handheld keypads – “Clickers”
- 3) Responses are received, aggregated, and displayed on both the instructor’s computer monitor and an overhead projector screen. The distribution of student responses may prompt the students or instructor to explore further with discussion or perhaps one or more follow-up questions.

This interactive cycle can continue until both the instructor and the students have resolved ambiguities or reached closure on the topic at hand [21].

Students liked the idea of actively engaging with the lab facilitator on topics relating to their learning. The Clickers empowered the students to clarify their understanding on the related topics. The lab facilitator had the possibility to create impromptu slides if the need arose.

Comments with regard to the use of the Clickers in the laboratory included:

- “Provided a bit of variety in the classroom”
- “The whole experience was very good”

- “They were fun!”
- “Very useful”
- “Found the Clickers to be a very helpful learning aid.”
- “It was a good way of finding out if you had the right answer as everyone else, but kept private.”

The general consensus from the students was that the Clickers helped them validate their own learning (4.5/5), helped them stay focused and motivated towards learning (4.5/5), increased the students’ interaction (4.5/5) and involvement (4.4/5) in the laboratory environment. Students strongly agreed that using the new technology – the Clickers – enhanced their learning (4.5/5). Full details are shown in Figure 6.

	Average rank					
	Strongly Disagree	Disagree	N/A	Agree	Strongly Agree	
Using the clickers helped me to verify my understanding of wound care and management					■	4.4
Participating with the clickers enhanced my learning					■	4.5
Participation with the clickers increased my involvement in the classroom					■	4.4
Participation with the clickers increased my interaction with the lab facilitator					■	4.5
I would recommend using clickers in clinical skills labs					■	4.4
The clickers helped me stay focused and motivated me to learn					■	4.5
The use of the clickers helped in my preparation for the moodle assessment on wound care and management					■	4.5
The clickers helped me to validate my own learning					■	4.5
I enjoyed using the clickers					■	4.5

Figure 6: Students thoughts on using the ARS - Clickers

CONCLUSIONS

This paper has presented an analysis of the perceptions of Irish nursing students of various based technology supports designed to enhance their learning and skill acquisition in the laboratory and classroom. Some of these tools were introduced to assist with personalised learning in big classes, but had an added result of greater student engagement. For the majority of students this is a positive experience with the technology tools greatly assisting their learning. Although the sample group was small, it bodes well for future integration with lecture and laboratory material. A greater support system needs to be in place to support students with this new influx of technology in their learning environment, thus ensuring that they are not intimidated.

A further study is required with a larger group of students, possibly across several departments or Universities. The results from this pilot study show the benefits and advantages of using technology to educate and train our students. From this, an enhanced or improved method of teaching, resulting in higher knowledge retention rates, will emerge and benefit all – from the students to the end users- in this case – the general public.

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