Teaching Complex Theoretical Multi-Step Problems in ICT Networking through 3D Printing and Augmented Reality

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This paper presents a pilot study rationale and research methodology using a mixed media visualisation (3D printing and Augmented Reality simulation) learning intervention to help students in an ICT degree represent theoretical complex multi-step problems without a corresponding real world physical analog model. This is important because these concepts are difficult to visualise without a corresponding mental model. The proposed intervention uses an augmented reality application programmed with free commercially available tools, tested through an action research methodology, to evaluate the effectiveness of the mixed media visualisation techniques to teach ICT students networking. Specifically, 3D models of network equipment will be placed in a field and then the augmented reality app can be used to observe packet traversal and routing between the different devices as data travels from the source to the destination. Outcomes are expected to be an overall improvement in final skill level for all students.

Keywords: mixed media visualization, networking, augmented reality, 3D printing, ICT

Introduction

As educators, we are increasingly surrounded by a new breed of individual - those that have never known a world where computers weren't commonplace. These so-called ‘Digital Natives’ (often defined as those born after 1980) are described as being naturally fluent with a variety of digital technologies, with a distinctive set of characteristics that seems to be natural, including preference for speed, nonlinear processing, multitasking, and social learning thanks to their embedded life in digital technology during childhood and adolescence when neural plasticity is high (Prensky, 2001; Thompson, 2012). This new generation of students, later described as “Digitally Wise” by Prensky (2009), approach learning using multiple different types of available technology (Thompson, 2012), working with technology and their applications from a technology understanding rather than from a classical educational understanding. In particular, Jones, et al. (2009), points out that these students expect to be engaged by their environment, with participatory, interactive, sensory-rich, experimental activities (either physical or virtual) and opportunities for input. They are more oriented to visual media than previous generations and they prefer to learn visually by doing rather than by telling or reading.

Students studying Information Communication Technology (ICT) could reasonably be expected to be the epitome of the “Digital Native” described above. Yet despite this new breed of student with a preference for learning visually, the representation of theoretical concepts without a corresponding real world physical analog model and the simulation of complex multi-step processes in the classroom is still a developing issue. For instance, in ICT the pedagogical approach of teaching programming has been discussed at length over a number of years by a number of researchers (Krpan, Mladenović, & Rosić, 2015; Pears et al., 2007), with the literature acknowledging that it is hard to teach students the problem solving and complex multi-step tasks required in the ICT discipline. In the teaching and learning of computer networking (the context for this study), this has been investigated with the development of virtual environments for modeling the processes (Dobrilovic, Jevtic & Odadzic, 2013; Powell et al., 2007) and abstract video based visualizations (https://youtu.be/-sUokuM6oY). However, networking models are complex to set up with software and require extensive reworking of existing network facilities. Abstract visualizations also don’t capture the complexity of the logical models, specifically the complexity and multi-step nature of the traversal of packets along the layers of the fundamental OSI-TCP/IP packet networking model. There is also a potential issue with interpretation of these models by students from varied cultures, as per previous work by the author on international students (Cowling & Novak, 2012).

This paper therefore presents a pilot study rationale and research methodology to examine a mixed media visualization intervention using 3D printing and a mobile augmented reality application.
programmed through freely available commercial grade visualization tools. The aim of the paper is to present a method to assist students in theoretical model understanding and applied use. In particular, to address the problem that these models are not physical in our existence but rather logical models used to describe packet behaviour at the software and hardware level.

Pilot Study Rationale

The use of visualizations as positive learning support tools are well documented and accepted (Mayer, 2005, 2008). Numerous academic disciplines incorporate a variety of 2D and 3D visualizations and haptic manipulations including medical anatomy, architecture, geography, chemistry and media/game design (Freitas & Neumann, 2009). This work also builds on previous work by the authors in multimedia design (Birt & Hovorka, 2014) studying the effects on learners building 3D models with applied mixed media visualizations, and paramedic science (Cowling, Moore and Birt, 2015), which studied the application of emerging technologies and comparative mixed media visualization on trainee paramedic science students studying airways management.

The fundamental difference between this proposed study and the previous work of the authors is the availability of a direct physical real world model. In networking, and in particular in modelling packet flow network diagrams, this is not the case, with no corresponding physical model that represents the various layers of the networking model in a visual fashion for students. Tasker & Dalton (2008) argue that this creates a mental gap for students, providing a disconnect between their understanding of the concepts and their visual mental model. Further, they argue that visualisations can assist with this by providing students with an appropriate mental model that they can use to understand the “hidden” concepts, as outlined by Williamson et al (2012).

This project therefore takes the work done by Tasker et al. and the previous work by the authors and extends it, with an aim to demonstrate that kinesthetic tools can be used to better form mental models (Paas & Sweller, 2014) and deliver improved pedagogy to teach networking concepts to 21st century students from varied cultures. Specifically, a combination of augmented reality through a mobile device and 3D printed models will be used to visualise how data travels through various network components from source to destination, addressing the following research questions: i) How does 3D printing and augmented reality impact 21st century student learning in ICT networking courses?; ii) How does 3D printing and augmented reality affect learning for students from varied cultures?; and iii) How does 3D printing and augmented reality assist ICT networking students in visualising complex multi-step processes?

Experimental Design

Participants in this work are students enrolled in the undergraduate networking course at the lead author’s institution. To conduct the experiment, the 3D printing and augmented reality intervention will be implemented into three standard tutorial exercises for the class. For each exercise, the student cohort will be split, with some students being given access to the new tools and some students using the traditional approach to the exercise. The groups completing the exercises with the new tools will be rotated to ensure that each individual student has equal access to both the intervention and the traditional methods.
The specific intervention involves the use of 3D printed networking components that are scanned by a mobile device using the Qualcomm Vuforia plug-in (www.vuforia.com) and an app developed in Unity3d (www.unity3d.com). Whilst previously being limited to game development and high end engineering projects, these tools are now becoming available to education. Specifically, 3D printing has seen an explosion in the past five years due to low cost fused deposition modeling (FDM) systems by makers such as MakerBot™ (www.makerbot.com). 3D printing at its basic level uses an additive manufacturing process to build objects up in layers using plastic polymer. Although the process is slow, 3D printing creates direct links between a virtual 3D based model and the formation of an accurate, scaled, physical representation from that model (Loy, 2014). This direct linking of object making to computer modeling changes the relationship of the learner to the making of the object and subsequent use, that is, it creates and enables a haptic feedback loop for learners.

Using the 3D printed components as a tool, the app will then identify each component and use them to construct a custom network on the device based on the placement of the 3D printed items in the field by students. For instance, instead of using a traditional and static 2D model, 3D models of computers, switches and routers will instead be placed by students to construct a network that will then be imported into the mobile device (Figure 1). Once the network is in the mobile device, students will be able to simulate network traffic, visualising the complex multi-step process of the OSI and TCP/IP model (see Table 1). Students will also have the ability to rearrange 3D objects to understand how changes in the network infrastructure affect the performance of the network, providing them with a mental model for this complex process, in line with Tasker & Dalton (2008).

### Table 1: The Internet Protocol Suite (commonly TCP/IP model)

<table>
<thead>
<tr>
<th>TCP/IP Model</th>
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<tbody>
<tr>
<td>5. Application Layer</td>
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<tr>
<td>4. Transport Layer</td>
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<tr>
<td>3. Internet Layer</td>
</tr>
<tr>
<td>2. Data Link Layer</td>
</tr>
<tr>
<td>1. Physical Layer</td>
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### Research Method

The theoretical framework underpinning this work will be action research (Kemmis, 2006), with each ‘loop’ in the research being conducted within a single term and with a different cohort of students, and the in-classroom implementation of the 3D printing and augmented reality intervention supplemented by research conducted with students to assess their feeling about the technology and its use in the classroom. The action research paradigm is appropriate because the researchers will work as practitioners in the classroom, implementing the change whilst simultaneously performing research to determine its effectiveness. Action research as a framework also implements an interactive inquiry process well suited to answering the research questions on student learning, teaching practice and visualisation of complex multi-step processes.

To provide research data, a pre-test will first be conducted with students to assess their base knowledge, and then selected students will be asked to volunteer to complete an intervention. After the implementation of each exercise all students (both those completing the intervention and those completing the exercise in the traditional way) will be given a small post-exercise quiz to assess their knowledge of the concepts being covered. This will provide useful data on whether the implementation has made a difference to student results and address the research question “How does 3D printing and augmented reality impact 21st century student learning in ICT networking courses?”. It is anticipated that approximately 50 students (domestic and international) will be able to participate in the experiment in total, after ethics approval is given and consent is sought from the students.
In addition to this experiment, at the end of the term students will also be issued with a survey asking how they felt about the use of the new tools and how they felt that they enhanced their learning. Survey questions will be developed based on existing theory on the digital competency of students and will include demographic questions as well as Likert scale quantitative questions to assess student feeling on the new tools, allowing for correlation between student demographics (such as international and domestic student details, age, gender etc) and the attitude to the research, amongst other factors, and answering the research question “How does 3D printing and augmented reality affect learning for students from varied cultures?”.

Finally, as part of the end of term survey, an open-ended qualitative question will also be included for students to provide additional detail on their use of the new tools as desired, and it is here that answers may be found to the research question “How does 3D printing and augmented reality assist ICT networking students in visualising complex multi-step processes?”. However, due to the complexity of this question, and depending upon the survey results, an online focus group may also be conducted to collect further rich data on student experiences that relate to this research question. Ethics approval for this survey and the possible focus group will be obtained from the Human Ethics committee prior to administration.

A combination of both quantitative and qualitative data will be collected from the quiz results and the survey instruments. Quantitative data will be analysed using SPSS to identify significant levels of difference in student satisfaction and to analyse whether a significant difference in student outcomes was identified. Qualitative data will be analysed using NVivo and coded to identify significant themes present in student comments.

Conclusion

This paper has presented a proposed pilot study involving a learning intervention using mixed media visualisation (3D printing and Augmented Reality simulation) to help teach complex multi-step problems to students studying computer networking in an ICT degree. Through the use of an action research paradigm, several tests will be performed at various stages to assess this assertion and student performance at the simulated task. In addition, a survey will be conducted to assess student attitude towards the intervention methods. Future work will report on the results of this study and provide correlations of various factors related to student performance, showing whether the use of these interventions have improved learning and whether the tools were accepted by the student cohort. Through this work, a greater understanding of the use of innovate technology tools and games simulation in the education space will be obtained, providing a foundation for future research.

References


Note: All published papers are refereed, having undergone a double-blind peer-review process. 

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An investigation of blended learning experiences of first-year Chinese transnational program students at an Australian university

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The extensive uses of information and communication technologies (ICT) in higher education have reformed the traditional classroom-based study mode. Blended learning, the combination of online and offline learning methods, has become an essential teaching and learning strategy for both instructors and students. An increasing number of Chinese students choose to conduct their undergraduate study through China-Australia transnational programs. Due to the differences in teaching and learning styles between Chinese and Australian universities, the perceptions of transnational students on blended learning strategies may impact their study experience and the adaptation to a different environment. Although previous studies have investigated learning experiences and adaptation issues of Chinese students from various perspectives, limited studies have explored the perceptions of Chinese transnational program students on blended learning in their first-year Australian study. This study describes a series of preliminary qualitative findings of these students blended learning experiences, especially the online section, in an Australian university.

Keywords: Blended learning; Online Learning; Transnational education; Chinese students; Higher education

Introduction

Blended learning has been proposed as a solution to achieve the goal of improving students’ engagement, accessibility and flexibility in the process of ICT-embedded study (Bonk & Graham, 2012). The term, “blended”, implies several meanings on the basis of different perspectives. Researchers (e.g. Bonk & Graham, 2012) summarize that blended learning is a study mode that combines traditional face-to-face styles with online learning methods. In this study, blended learning refers to the combination of offline and Internet-based study approach. The students’ online study mainly focuses on investigating experiences through Internet-based learning platform, for example, Blackboard. With the rapid development of ICTs, many unknown questions in blended learning emerge and need to be addressed. Kim, Bonk, and Teng (2009) argue that the topic of blended learning in Asian countries (e.g., China, Korea and Taiwan) and the use of blended learning in a cross-cultural phase should be investigated in depth and systematically.

Transnational education has become an important part of modern higher education (Altbach, Reisberg, & Rumbley, 2009). A growing number of Chinese students choose to conduct their undergraduate study through transnational programs, for example, China-Australia mode, which allows students to experience different cultural environments and educational settings. In particular, transnational program students normally need to study in a Chinese university for at least one year. Due to the differences in culture and education between China and Australia, however, many Chinese students struggle with the transition from a domestic to an international environment. To understand students’ cross-cultural learning experiences, many educational researchers have explored relevant topics from their specific perspectives, such as blended learning in Chinese and Australian higher education (Bluc, Ellis, Goodyear, & Piggott, 2011; Tang, 2013), issues of using blended learning (Bonk & Graham, 2012), and adaptation of ICTs in different cultural environments (Chen, Bennett, & Maton, 2008).

Literature Review

A number of researchers have investigated relevant issues about Internet-based blended learning in Australian and Chinese higher education. For the Australian context, Bluc et al. (2011) explored the
use of blended learning in different curriculums, such as arts and engineering. Furthermore, students’ learning experiences and perception of blended learning strategies have also been identified through critical analysis (Bliuc et al., 2011). According to these research studies, researchers have concluded that students can experience both online and offline study approaches through blended learning depending on their study demands. The positive perceptions of Internet-based blended learning are mainly reflected in three phases: the flexibility of study mode, the abundant resources of the Internet, and offline interactions. Meanwhile, some negative aspects are identified as well, such as information overload, influences on learning and teaching productivity, and the balance between online and offline activities.

For the Chinese context, many Chinese researchers have investigated students’ experiences of blended learning (Tang, 2013; Zhang & Han, 2012). Some studies have resulted in many similar findings to those of Australian researchers. For example, in accordance with Graham, Allen, and Ure (2003), Tang (2013) also suggested that the Internet-based blended learning approaches can help students to gain knowledge without the restrictions of time and space. Zhao (2008) resonated with Ellis, Goodyear, Prosser, and O’Hara (2006) who claimed that the Internet can provide a great many educational materials to students. Particularly, based on an investigation of using blended learning strategies in an English course, Zhang and Han (2012) identified that Internet-based blended learning strategies may motivate Chinese students’ self-learning interests and develop autonomous studying skills. Many Chinese students are used to rote and passive learning styles and lack critical and creative thinking (Chan, 1999). In a blended learning environment, students may use Internet-based tools to learn independently rather than only relying on instructors and textbooks (Zhang & Han, 2012). The mixed learning and teaching methods not only provide various educational recourses, but also establish a flexible environment for both instructors and learners (Rovai & Jordan, 2004). Hence, studying in such a blended learning environments may provide learners with more opportunities for thinking and studying autonomously and so enhance their motivation and self-regulation (Tang, 2013).

Research Gaps and Questions

According to the literature above, it is apparent that few studies have been conducted with the intent of identifying the learning experiences of Chinese transnational programs students to the blended learning environment in Australian universities. Therefore, this study aims to explore Chinese transnational program students’ first-year study experiences in Australian blended learning environments. On the basis of previous studies and introduction above, this study proposes to explore the following research questions:
What are the learning experiences of first year China-Australia program students in Australian university through online environment?

Research Methodology

Six undergraduate students who studied in first-year China-Australia programs at an Australian university participated in this research project. Ethics approval for the project was obtained and the participants were each given a pseudonym to protect their privacy. They include four female (Yan, Hua, Min and Qian) and two male (Lun and Gang). Yan, Hua and Lun are from an accounting major. Min, Qian and Gang are from a design major.

To investigate the students’ online learning experiences two focus group interviews were conducted. There were three participants in each of the two groups. Accounting students were in group one with the design students in the other group. Each interview took approximately one hour. Questions focused on exploring students’ online learning experiences of different educational settings and identifying the potential problems that they may struggle with. Based on students’ answers, initial understandings of using blended learning strategies in the selected transnational programs were analyzed. A thematic analysis was used to understand collected qualitative data systematically. In order to obtain precise and in-depth answers, the researcher used Chinese to interview each group and then translated the responses into English.
Results

The experiences of learning online in Australian university

On one hand, some participants identified that the Internet is fundamental tool in their study. With regards to the ways of using Internet in study, three participants from the accounting group and one student (Qian) from the design group thought that blended modes are more useful in their study, especially in the Australian university. These students provided various views of the reason why blended learning methods were important to their study in the Australian university. They pinpointed that online learning platform, for example, the Blackboard system, was one of the most useful learning online tools. According to interviews, these students agreed that many learning recourses can be found on Blackboard. On the Blackboard system, they can have a comprehensive understanding of the aim, goal, teaching/learning activities and assignments for a subject. For instance, Lun, from the accounting group, stated:

There are a lot of online tools that I used during my study. Instructors also apply some online tools during teaching. In specific, I think the blackboard is the most useful online tool. It is a systematic online learning tool and it makes our study flexible and productive. For example, when I want to know the course content, such as reading list, videos and slides, I can easily find out them in the system and do not need to spend more time to search for relevant materials online by myself. Many instructors in my major usually upload the most important learning recourses in the system week by week. Therefore, students can clearly understand what they need to know before and after a class. However, when I study in my Chinese university, there are limited uses of such kind of systems during study. My Chinese university also did not have such useful system, which has all necessary functions for study.

Compared to participants who agree that the blended learning mode is more helpful, two students (Min and Gang) from the design group prefer to study in offline environments. For example, Min claimed:

Courses of design majors need to create art works through computer software, online tools and hand-drawing. When students need to ask questions about drawing something or request tutors’ feedback on specific drawing techniques, I think online learning strategies are difficult to help students to require feedback effectively because sometimes designing or drawing is hard to explain. So face-to-face learning is essential in my major. Although there is a great deal of online resources, for some courses in my major, I think that is difficult to learn some specific knowledge through online platforms directly because communication with instructors and peers is important to have inspirations when I want to create something new or different. Therefore, I think online learning is not very useful sometimes for design major. I prefer to study in a face-to-face environment.

Based on these statements above, it is apparent that Internet-based tools, for example, Blackboard, can provide various learning recourses to students. Furthermore, students who study in different majors have their own understandings and requirements on the use of Internet-based learning tools in traditional face-to-face environments.

On the other hand, some participants identify that their Chinese university does not provide useful online learning tools for supporting teaching and learning compared to the Australian university. According to the analysis of their feedback, main issues are highlighted by students: lack of useful online tools, unnecessary information overload, and limited uses of ICTs in teaching.

Yan and Hua, from the accounting group, noticed that although the Chinese university has an online learning system, students did not use it because instructors let students use textbooks during study rather than uploading learning contents through the online learning system. Specifically, Hua also mentioned:

The online learning system at my Chinese university is not very useful to study. For instance, the online library does not have enough resources and the interface and layout
design is not very good. That platform is different to Blackboard that is provided by the Australian university. The platform of the Chinese university seems an online forum, which has information that is irrelevant to study. I just use it to watch videos and do other types of online entertainment.

Qian and Gang, from the design group, highlighted that they did not have any particular blended learning experiences in the Chinese university period of the whole transnational program. In particular, Gang stated:

Compared to my Australian learning experience, I think I did not have impressive study activities that were taught through blended methods. In Australian university, instructors always use Blackboard and other online tools to assist in teaching. Some of them are good at using online tools to design specific interactive sections that encourage students to think of taught contents and question instructor and peers. However, in my previous Chinese classroom, it is difficult to have such kind of learning experiences. I just need to read textbooks and listen to the instructors. It seems to study in a high school rather than a university. The Chinese learning styles become obstacles to adapt to Australian university. For my transnational program, there are limited courses that aim to introduce Australian learning styles. Chinese university only arranges English course but this is not good for us to adapt to the real Australian classroom.

According to students’ feedback, it is obvious that there are many differences of using online learning tools, recourses and study methods between Chinese and Australian universities, for example, instructors’ use of ICTs and the online learning systems provided by universities. These differences may become obstacles when students start to learning in an Australian university.

Conclusion

This study investigated the online learning experiences of six first-year Chinese transnational program students in an Australian university. The results revealed students’ experiences on the use of Internet-based learning strategies, including preferences for teaching and learning approaches, online study platforms and the issues of using online strategies. Depending on the differences of course contents, learning styles and educational environments, educators and students may consider how to use Internet-based tools in teaching and learning activities (Ellis et al., 2006). These findings resonate with previous research studies conducted by Bliuc et al. (2011) who concluded that the effective integration of face-to-face and online learning is an important aspect during teaching and learning.

On the basis of these results, some results are similar to previous studies (Graham et al., 2003; Tang, 2013). For instance, students feel more flexible when studying in an online learning environment, which resonates with Graham et al. (2003) and Tang (2013), who identify that online learning can provide more flexible teaching and learning approaches in traditional study mode. Comparatively, this study also reveals potential research gaps. Due to the particular settings of transnational programs, students usually have learning experiences in both Chinese and Australian universities. When these students come to Australia, the blended learning environment provides a different study style to this particular group of learners. Therefore, understanding potential problems by both educators and students may be beneficial. For instance, the different ways of using blended learning in different majors of transnational programs. It may be beneficial for future studies to focus on exploring the blended learning experiences of Chinese transnational program students in Australian universities in depth.

References


Note: All published papers are refereed, having undergone a double-blind peer-review process.

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A comparison of undergraduate student experiences of assessed versus non-assessed participation in online asynchronous discussion groups: Lessons from a cross disciplinary study in health and sociology

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This paper discusses a pilot study investigating perceptions from undergraduate students enrolled in units in which asynchronous online discussion boards were utilised formatively or linked to summative assessment. Of the influences that determine level of student engagement in online discussions, one key factor is whether discussions are assessed. Whilst assessing student discussions does motivate participation, this approach is not always valued by students as they are critical of the value of asynchronous discussion boards to their learning. The type of postings can be an influencing factor in student engagement, with effective facilitation, clear purpose and group participation perceived to be important. Students also viewed discussion boards as a platform in which peer engagement and information sharing occurred. Students who were enrolled in a unit in which discussion postings were assessed demonstrated emerging critical thinking skills. Students strongly indicated discussion boards must be fit-for-purpose and integrated into the curriculum regardless of whether they are assessed or not.

Keywords: assessment, discussion boards, asynchronous, student, engagement, higher education

Introduction

Communication tools such as discussion boards form an integral part of online learning management systems and therefore are extensively used in higher education, particularly in an asynchronous context (Andreson 2009) as they provide a means for students to communicate and learn collaboratively. In many instances, these discussion boards are linked to assessment to facilitate engagement and promote development of critical thinking (Johnson and Johnson 1986). However, there is also a role for discussion boards as a formative learning tool. Student satisfaction about studying online has been well researched (Horzam, 2015; Lander 2014; Ladyshewsky 2013; Liaw 2008; Bouhnik and Marcus, 2006) with engagement often posed as difficult to achieve across the student cohort. As stated by Gregory (2015) discussion boards can be a collaborative learning tool, particularly for off campus students, and students usually participate when they are linked to assessment. Less evident in the literature is the student perspective of participation in asynchronous discussion groups that are non-assessed compared to perspectives on assessed discussion boards.

According to Du et al (2008) active engagement with others promotes meaningful learning and in an online environment, the topic of discussion is important in determining the impact. Disengagement with asynchronous discussion boards may be related to facilitation (Northover 2002), with instructor facilitation preferred to student facilitation (Hew 2015). Students respond well to feedback in any learning and teaching paradigm and so instructor facilitation drives learning quality and student satisfaction in an online course (Ladyshewsky 2013). Disengagement may be related to the
ambiguous nature of discussion postings and the limited ability of students to construct knowledge through online discussion (Lander 2014) but once students are engaged they should be able to perceive the value of online discussion boards. The greater the level of student engagement, the higher the perceived value of asynchronous discussions (Northover 2005, Pena-Shaff et al 2005).

Pena-Shaff et al (2005) reported student attitudes to online discussions ranged from enthusiastic to hostile and that some students perceived the asynchronous discussions as a chore lacking either substance or meaning. These authors also reported that some students rebelled against the assessment incentive, which they viewed as burdensome, with some students exhibiting resentment at forced participation. Clear purpose of a discussion board is essential for engagement (Gregory 2015) with identifiable student outcomes (Steen 2015). As a result, discussion boards are often linked to assessment. This paper reports on a pilot study investigating student perceptions of online discussion boards utilised as a key assessment item or formative learning tool.

Methodology

Undergraduate students studying in one of four units in sociology or health science were invited to participate by completing an anonymous online questionnaire. Two units utilised discussion boards as an assessment task in the unit, (10% of the overall assessment was determined by discussion board participation), with clear assessment criteria provided to the students. In the other two units, discussion boards were used as online communication tools for formative feedback purposes. Respondents were recruited by email with two reminders sent at two-week intervals. The survey questions were designed to elicit both quantitative and qualitative data. The first set of questions gathered information on the factors which motivated students to engage using online discussion boards and their overall experience as learners. The second group of questions were reflective and open-ended, designed to generate descriptive data on student experiences and asked about students' proficiency and how they used discussion boards for learning. Research ethics approval was obtained for this study (H0013544).

Results

The students surveyed in this pilot study were enrolled in an undergraduate unit in health sciences or sociology in which discussion boards were utilised as either an assessment item (assessed) or a formative learning tool (non-assessed). A total of 78 students completed the questionnaire representing a small sample of the total cohort. Gender, level of education, and preferred language were similar for each group. The mean age of the assessed group was slightly older (aged over 25 years, 60%) than the non-assessed group (over 25 years, 41%). In addition, the non-assessed group were more likely to be studying part-time (81%) than the assessed group (36%) although a mixture of part-time and full-time status existed across the four units.

Just over ninety percent (94%) of students in the assessed group were comfortable using the internet before starting their course, compared to 45% of the non-assessed students. However, differences identified between the nature of the two groups were not significant and were not related to discussion board access as 92% of the assessed group (and 72% of the non-assessed group) did not encounter any barriers to access. The assessed group were more comfortable in initiating (62%) and responding (66%) to discussion posts than the non-assessed group, in which only 37% were comfortable to respond to posts with 52% expressing some comfort in initiating posts in a discussion board. Seventy per cent of students who participated in assessed online discussion boards found the discussion valuable to their learning and 41% of these respondents stated that the online discussions did assist them with the completion of other assessment tasks in the unit. Respondents who were not assessed in their discussion postings did find the postings valuable (62%), however, not as valuable in relation to their assessment tasks (26%).

In the assessed group, assessment was a motivating factor for participation according to 65%, while 33% of respondents in the non-assessed units indicated that linking assessment to discussion postings may motivate them to engage. Similarly, 56% of respondents in the assessed group indicated that discussion boards were useful to develop group engagement; however only 25% of the non-assessed group identified that this would be useful in their unit. Referencing of discussion posts was perceived similarly between the two groups with 43% in the assessed group finding referencing
of posts useful compared to 42% of respondents in the other group.

Participants in the study provided answers to open-ended questions that explored the student perspective about: the purpose of discussion boards; most and least useful discussions; suggestions for improvement; and an opportunity to comment on any other aspect of the discussion boards. The non-assessed group were more homogeneous in their responses, stating that sharing information or interaction with other students was the purpose of discussion groups. One student stated: “To engage with the unit content as well as communicate with other members of the distance unit, while maintaining links with the unit coordinator” and “To share understandings and to discuss concepts being taught with peers”. Additionally, students in the assessed group also indicated the purpose was to gain marks and enable reflection by participating in online discussion. Some students in the assessed group were critical of the discussion tool, perceiving the purpose of the discussions for assessment as inconvenient, and therefore not directly related to their learning.

Non-assessed group respondents indicated they preferred discussions that were compulsory (even if marks were not assigned) or where replies were posted. They liked the opportunity to gain or share information or be exposed to perspectives not already considered. For example, one student stated “…there were many different views and ideas presented that helped with a better understanding of things that may have been hidden/unknown”. Students in the assessed discussion groups commented they preferred the discussion posts that had meaning for them, including informal threads that developed from the assessable posts. One student stated: “Discussion kept me on track, so I found the discussions broad (and) to be a benefit. All discussions were engaging once you started”. However, over-sharing of personal information in discussion postings was not favoured by either group as this information was considered irrelevant and non-engaging. Lack of critical thinking or reasoned argument by other students was also frustrating according to respondents who were assessed on discussions. One student stated: (the least engaging were) “…the ones which only answered the question and did not have an opinion. What’s the point?” Referencing discussion posts was not always favoured among respondents in the assessed or non-assessed groups but non-referenced posts were also mentioned as being less engaging by students who were assessed. A number of respondents mentioned they preferred to post to a discussion board when they did not need to reference.

Students in the non-assessed groups commented that they would like more engagement by others in the discussions. Comments included making the interaction compulsory or assessing the posts or participation. One student stated: “Assessing posts would encourage students to participate, then they would learn how valuable posting can be”. Conversely, some respondents in the assessed group sought to make the discussion groups non-assessable items. One student stated: “Do not make them assessments. It was a monumental fail… it was very difficult to participate and feel engaged in them, it became a hassle more than a learning tool” and “Don’t use them. Adult learners do not respond to them. I found the overall tone of the discussion to be fake/false designed to achieve a pass mark and nothing else”.

Both groups indicated they would like the facilitator to guide and moderate the discussions more, and the assessed group students commented that they would like more engagement and feedback from facilitators. One student in the non-assessed group stated: “I think discussions could benefit from the lecturer’s contributions; to steer the topics and prevent the students from discussing too many personal issues”. One student stated: “I would have participated more if the lecturer was involved to keep the content of the discussions on the right track”. Respondents from the assessed group indicated would like the discussion groups to be comprised of a smaller number of students. The assessed group respondents also mentioned that technical difficulties and length of time involved to participate could be improved. One respondent stated: “It is very time consuming trying to prepare worthwhile discussion posts compared to the amount of marks they are worth”. The students in the assessed group focussed more on the inhibitors of discussions, citing disliking interaction, too much other work and too many discussions. A range of alternatives such as weekly quizzes, short answer questions or alternative assessment tasks such as an essay were suggested by respondents. One student stated: “would much rather just have online quizzes or assignments for learning, online discussions are a burden”.

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Discussion

Linking assessment to online discussions motivates student engagement particularly when discussion topics are facilitated to provide effective learning experiences. This is supported by previous studies in which students do value asynchronous discussions as an integral component of their online learning and assessment (Vonderwell et al. 2008). Participating in online discussions can enhance learning but the inclusion of referencing in posts may be detrimental to intended outcomes as indicated by respondents in this study. Lander (2014) found that referencing stunted conversation and halted learning and that some students were reluctant to state a value position that may diminish their perspective and have a negative impact on their knowledge construction. Referencing of posts was somewhat favoured among students in our groups and some students in the assessed group commented they did like referencing the information in their posts. However, some students did provide unfavourable comments with respect to the need to reference as they felt it impacted negatively on the quality of their post. Referencing of posts does add academic rigour to the postings and discussion threads and so should be encouraged for effective learning and teaching practice.

Students in this pilot study, particularly in the assessed group, suggested improvements to online discussions could include facilitator guidance and feedback to students. This supports the literature in which effective facilitation has been shown to enhance the quality and satisfaction of the discussions for students (Ladyshewsky 2013). As indicated in previous studies the majority of respondents preferred a facilitator to direct the discussion, irrespective of whether the postings were assessed or not, (Hew 2015). Student perceptions indicated that discussion posts need to be engaging and fit for purpose, regardless of whether or not they are assessed. Effective facilitation, enables engagement by students. Facilitator feedback can be scaffolded within assessed discussion boards to ensure that students are constructively building their online communication skills and knowledge effectively. This supports recent literature that indicates facilitators need to clearly indicate purpose for discussion boards and design tasks which provide constructive learning (Gregory 2015; Steen 2015). The nature of the group dynamics and motivation for participation in the online discussions will also influence student engagement (Robinson 2011). Assessment is regarded to be a key motivating factor in an online learning and teaching paradigm.

The hostile responses from some students in the assessed group were similar to the findings of Penna-Shaff et al (2005) who reported that assessment hindered participation by some students who resented being forced to participate. These authors also found there was written apprehension anxiety, which was also a finding in both assessed and non-assessed groups in this study. Comfort levels of posting to discussions was more evident in the assessed group compared to the non-assessed group, which is most likely related to experience. In addition, students in the assessed group were more likely to voice their concern about the content of their posts than those in the non-assessed group. Du et al (2008) suggested that identifying patterns in which online discussions are conducted effectively could enable improvements in collaborative learning. The differences in the patterns of engagement, willingness to participate and behaviour between assessed and non-assessed students in discussion groups, provides opportunities for re-orientating online discussions to better suit the learning needs of students. Moreover, curriculum re-design could improve student perceptions and understanding of the value of this educational tool.

The findings of this study suggest there were contributing factors that altered the student experience depending on whether discussion boards were assessed or not. Limitations of this study include different study status and ages of students, as well as the small sample size. Research into influence of discussion boards on student learning, in assessed and non-assessed groups across a range of disciplines and different undergraduate years, with a larger sample size, warrants further investigation.

Conclusion

This study found students focus on different aspects of asynchronous discussion groups depending on whether they are assessed or non-assessed. Students using online discussions that were assessed were more critical of the process, facilitator feedback and whether online discussions are a useful learning tool or a burden. The non-assessed group of students indicated the purpose of asynchronous discussions as a means of sharing information or engaging with their peers, with critical thinking being of less importance to this cohort. Online discussions, whether assessed or not, need to
have clear purpose, be authentic for engagement and enable meaningful learning. Assessing discussion postings does value add to their purpose pedagogically however effective facilitation also needs to be implemented to authenticate learning. Future studies investigating student perceptions of assessed and non-assessed asynchronous discussion boards across a wider range of disciplines and contexts are required to validate and extend the findings of this study.

References


Note: All published papers are refereed, having undergone a double-blind peer-review process.

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