

Web-based active learning and frequent feedback: Engaging first-year university students

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KEYWORDS

Active learning, online quizzes, effective questioning, student engagement

Abstract Web-based technology is particularly well-suited to promoting active student involvement in the processes of learning. All students enrolled in a first-year educational psychology unit were required to complete ten weekly online quizzes, ten weekly student-generated questions and ten weekly student answers to those questions. Results of an online survey of participating students strongly support the viability and perceived benefits of such an instructional approach. Although students reported that the 30 assessments were useful and reasonable, the most common theme to emerge from the professional reflections of participating lecturers was that the marking of questions and answers was unmanageable.

Background

In 2009, 30% of first-year university students in Australia and New Zealand reported that they had considered leaving university prior to graduation (Australian Council for Educational Research, 2010). Among 32 Australian universities surveyed, actual attrition rates ranged from 5.3% to 30.3%, with first-year attrition rates consistently the highest with respect to undergraduate students (Olson, 2008). The Organisation for Economic Cooperation and Development (OECD, 2007) defines survival rates for university undergraduate students as the proportion of those who enter a program who go on to graduate from that program. Against an OECD average of 71%, the survival rate for Australian undergraduate university students was 67.3%. The lowest undergraduate survival rates were reported for the USA (53.7%) while the highest were reported for Japan (91.5%). Fisher, Cavanagh and Bowles (2011) concluded that “completion of the first year is ‘more than half the battle’ in progression to degree completion” (p. 226). Not surprisingly, given the importance of an educated and skilled population for economic and social prosperity, Australia, as well as most industrialised nations (Andrews & Drake, 2011; Thomas, 2011), are increasingly focused on improving undergraduate university student retention and graduate rates (Coates & Ransome, 2011; Noonan, 2010). Based on a comprehensive review of the literature, Ferguson (2011) concluded that “student engagement [is] at the heart of student retention and success” (p. 107).

Undergraduate student engagement: active learning and frequent feedback

Student engagement refers to psychological investment in learning (Carini, Kuh, & Klein, 2006). Students are engaged when they are actively involved in their university studies, persist despite challenges and failure, and take pride in their academic achievements (Pike & Kuh, 2005). The National Survey of Student Engagement, pioneered in the USA and adopted in Canada, modified for use in Australia, New Zealand and South Africa, and currently being piloted in China, rests upon a body of research unequivocally establishing the relationship between university student investment of time, effort and interest in a range of educational activities and favourable academic outcomes such as increased performance, persistence and satisfaction (Trowler & Trowler, 2010). Specific aspects of undergraduate student engagement, such as involvement in learning processes, amount of time spent on academic tasks and quality of effort, have repeatedly been linked to positive university outcomes (Hu, 2011; Kuh, Kinzie, Schuh, & Whitt, 2005; LaNasa, Cabrera, & Trangsrud, 2009; Pike, 2006). Perlman, McCann and Prust (2007) surveyed undergraduate students with respect to their perception of behaviours most beneficial to successful completion of the course. From a list of 59 student behaviours, attending class regularly, completing required assignments on time and paying attention during lectures were identified by students as most critical to successful course completion. Braxton, Jones, Hirschy and Hartley (2008) concluded “that faculty use of active learning practices plays a significant role in the retention of first-year college students” (p. 71). “Engendering a climate where students can actively participate in learning may ease the issues involved in transition to university” (Fisher et al., 2011, p. 225).

In their seminal work, Chickering and Gamson (1987) summarised the research evidence into the seven most effective practices in undergraduate education which included active student learning and frequent student feedback. *Active learning* is a general term used to refer to any instructional method that requires students do something in the classroom rather than simply listen to a lecture (Auster & Wylie, 2006). Allen and Tanner (2005) defined active learning as “seeking new information, organizing it in a way that is meaningful, and having the chance to explain it to others” (p. 262). Such an orientation to instruction “emphasizes interactions with peers and instructors and involves a cycle of activity and feedback where students are given consistent opportunities to apply their learning in the classroom” (Armbruster, Patel, Johnson, & Weiss, 2009, p. 203). In contrast to traditional lecture format, research has repeatedly established the benefits of undergraduate education that actively involves students in the processes of learning including improved student attitude (Prince, 2004) and increased academic achievement (Knight & Wood, 2005; Freeman et al., 2007). Cavendish (2010) reported that students rarely complete assigned readings prior to attending traditional lectures. Chevins (2005) observed that undergraduate students “were actively engaging with the text during preparation of the in-course assignment, but not with the lectures” (p. 2). Moses and Litzkow (2005) substituted a brief quiz followed by active-learning problem-solving activities in place of lectures in a nuclear reactor theory course. At the end of the

semester, students were surveyed. “Seventy-five per cent reported that the course required more self-discipline than most other courses, and 56% reported that it required more time than most other courses” (p. 29).

Lo and Prohaska (2011) reported on the redesign of an introductory sociology course in order to improve student success by adding active and collaborative learning activities that gave students greater responsibility for learning. The new hybrid course provided most learning materials online, required electronic submission of assignments and tests and reported assessment results and other feedback promptly. In its biggest break with tradition, the course’s contact hours were one-third of those mandated under the old syllabus. Resulting improvements included improved student final grades and increased numbers of students enrolled in the course. Esposto and Weaver (2011) described a case study of a strategy of continuous cooperative student assessment which was introduced into scheduled tutorial classes in an attempt to improve flagging attendance and low student motivation. The assessment tasks were designed to be undertaken in teams of two students, with ongoing feedback as an integral component. After a single semester of implementation, attendance at tutorials nearly doubled relative to previous years. Average assessment marks rose a full grade compared to the previous student cohort. Similarly, across two sections of an introductory business course, Michel, James and Varela (2009) compared the impact of an active teaching approach and a traditional or passive teaching style and concluded that “if students in a particular course are ‘forced’ to engage through active learning methods because their grades depend on how well they engage, student learning can improve with regard to their class material” (p. 64).

One approach to active student involvement in the learning processes is student-generated questions and answers (Yu, Liu, & Chan, 2005). “In traditional classrooms, teachers are frequently viewed as the main source and transmitters of knowledge, whereas students are expected to take on the role of receivers and recorders” (Yu, 2011, p. 484). From such an instructional perspective, student learning is assessed with teacher-generated questions. In comparing the effectiveness of teacher-generated versus student-generated questions, Bulgren, Marquis, Lenz, Deshler and Schmaker (2011) reported that, overall, differences representing large to very large effect sizes were found between the test scores of students in the two groups. “Specifically, students taught using the question-exploration routine earned higher total test scores than did students taught using the lecture-discussion method” (p. 578). Reported benefits associated with student-generated questions included increased levels of student reading comprehension, retention of information, use of cognitive strategies, motivation, satisfaction, communication, interaction and problem-solving (Abramovich & Cho, 2006; Barlow & Cates, 2006; Brown & Walter, 2005; Yu & Liu, 2005, 2009). Written response to student-generated questions has been associated with enhanced student achievement (Papadopoulos, Demetriadis, Stamelos, & Tsoukalas, 2010). Menary (2007) concluded that “creating and manipulating written sentences are not merely outputs from neural processes but, just as crucially, they shape the cycle of processing that constitutes a

mental act” (p. 622). The actual process of writing can be used effectively as a tool for supporting students in developing critical thinking and increasing their analysis, inference and evaluation skills (Quitadamo & Kurtz 2007). The benefits of reciprocal peer questioning and responding, a form of active student learning, are clearly established (Johnson, 2006a; King, 2002).

Related to active student involvement in the learning process, frequent feedback on the quality of student learning is an essential practice in effective undergraduate education (Chickering & Gamson, 1987). Feedback is “usually understood within education as information about how successfully a task has been or is being fulfilled” but can also be defined as “any information, process or activity which affords or accelerates learning, whether by enabling students to achieve higher-quality learning outcomes than they might have otherwise attained, or by enabling them to attain these outcomes sooner or more rapidly” (Tang & Harrison, 2011, p. 583). From such an orientation, the concept of feedback is expanded to refer to not only knowledge of assessment results, but also to assessment processes or activities. Glover (2004) concluded that “assessment has an overwhelming influence on what, how, and how much students study” and that “one of the most powerful influences on student achievement is feedback” (p. 6). “There is more leverage to improve teaching through changing aspects of assessment than there is in changing anything else” (Gibbs & Simpson, 2003, p. 22). The critical role of assessment in education has been underscored by advances in cognitive science that have contributed to increased understanding of the mechanisms by which learning is maximized; a variety of assessment strategies with prompt feedback to students is recommended (Goubeaud, 2009). Clarke, Heaney and Gatfield (2005) discussed the personal demands faced by contemporary university students, most of whom combine their studies with employment and sometimes with childcare responsibilities. In view of such commitments, many university students “seek those assessments that involve minimal group project work, are relevant, low risk and need relatively limited test revision time” (p. 51). Chevins (2005) described a study of the effects of partial replacement of lectures with a system of prescribed reading supported by weekly objective testing in a second-year animal physiology module. “Over a three year period, students’ reported study hours during the module increased significantly over their normal study time” (p. 1). However, since frequent quizzes are not necessarily compatible with all learning styles, Klappa (2010) suggested that university students be provided with a combination of activities to promote their active engagement in the processes of learning.

Active learning and frequent feedback with web-based technologies

Web-based technology is particularly well-suited to promoting active student involvement in the processes of learning (Deed & Edwards, 2011; Rhine & Baily, 2011). According to Yu (2011), the many advantages of network technology (e.g., time, place, device and platform-independence, immense storage space, high processing speeds, multimedia capabilities and instant data retrieval and management) facilitate the design and development of web-based student question-generation learning systems such as QAIS

(Barak & Rafaeli, 2004), Multiple Choice Item Development Assignment (Fellenz, 2004), ExamNet (Wilson, 2004) and Concerto II (Hirai & Hazeyama, 2007). Evaluation of the Question-Posing and Peer Assessment Learning System suggested that students' sources of motivation come from a hybrid of achievement, altruism, play and entertainment, security, challenge, satisfaction and confidence (Yu et al., 2005). In a web-based learning environment, the active process of writing questions and answers increased student domain knowledge and knowledge transfer (Papadopoulos et al., 2011). Johnson (2006a) reported a study in which first-year university students used WebCT Discussions to satisfy one of two study group conditions, reciprocal peer questioning or mnemonic devices. Students made postings according to their assigned study strategy in order to facilitate the learning of their group. While there were no differences between students in the two study conditions in terms of academic achievement, "students in the reciprocal peer questioning group reported higher levels of satisfaction with the virtual study experience" (p. 83).

In addition to promoting active student learning via question and answer instructional strategies, web-based technology facilitates frequent student feedback in the form of automatically-marked tests and quizzes. Grabe and Sigler (2002) provided university students with four web-based study tools: multiple choice practice test items, short answer practice test items, lecture notes, and textbook notes. Students who made use of the tools academically outperformed those who did not. Fritz (2003) reported a study in which university students in Spanish and French classes completed weekly web-based quizzes using Blackboard. Results indicated that online quizzes were viable in foreign language classes and that 10-15 minutes of class time each week became available for instruction rather than quizzes. "Instructor time was also greatly conserved since quizzes were self-correcting and self-tabulating" (p. 1). Itoh and Hannon (2002) concluded that "because of the convenience of online delivery, quizzes are well suited to the needs of today's liberal arts students who often participate in many extracurricular activities" (p. 551). Derouza and Fleming (2003) compared undergraduates who completed quizzes online with students who took traditional paper-and-pencil quizzes. Comparison of in-class examination marks revealed that students who took the quizzes online significantly outperformed student who took pencil-and-paper quizzes. Escudier, Newton, Cox, Reynolds and Odell (2011) "compared higher education dental undergraduate student performance in online assessments with performance in traditional paper-based tests and investigated students' perceptions of the fairness and acceptability of online tests, and showed performance to be comparable" (p. 440). Yate and Beaudrie (2009) concluded "that evaluating students through the exclusive use of online assessment is a reasonable approach that results in grades that do not differ from measuring student progress with exams that are given under proctored conditions (p. 69). Johnson (2006b) reported that first-year university student use of web-based quizzes was associated with increased academic achievement and that "short-answer and true-false online quiz items were differentially associated with measures of academic achievement suggesting that cognitive processing differed across item format" (p. 105).

Research Questions

Web-based technologies are amenable to active student engagement in the processes of learning including frequent student-generated questions and answers based on required readings and learning activities and frequent testing of student mastery of learning objectives. Are 30 web-based assessments during a 13 week study period viable for students and lecturers? How do students and lecturers evaluate their experience of frequent web-based assessments including student-generated questions and answers and automated online quizzes? Are there differences in evaluation of such frequent web-based assessments between male and female students, older and younger students and students in fully-online and blended learning classes?

Approach

All students enrolled in a first-year educational psychology unit were required to complete thirty web-based assessments during 13 weeks of study. The content of the unit included theory and research in child and adolescent development applied to professional practice in primary and secondary schools. Some students received instruction entirely online ($n = 23$) but most were in blended learning classes ($n = 154$) which included a three hour face-to-face seminar coupled with extensive online learning events. The blended learning classes included a maximum of 25 students. The fully-online learners had weekly *Illuminate Live* sessions during which material presented and discussed corresponded to that covered in the face-to-face seminars in the blended classes. Both fully-online and blended-learning students used Blackboard, the course management system used at their university. There were no assessments during the first two weeks and last week of the semester. Thus, the thirty assessments were distributed across ten weeks of instruction, specifically, three assessments each week.

The thirty assessment points included ten weekly online quizzes, ten weekly student-generated questions and ten weekly student answers to those questions. Specifically, each week students were required to complete a Blackboard multiple-choice test that assessed content covered during the previous week of instruction. Only one attempt was permitted for each quiz. Each quiz was available for one week following the weekly seminar or *Illuminate Live* session. Such limits forced students to consistently engage with required learning material. As specified on the unit outline for the blended classes, “it is critical that students independently read and study the required textbook chapters. The learning events that occur during the seminars are built upon the assumption that students have engaged with required learning resources as specified in the Unit Study Calendar. Quiz questions assess understanding, NOT recall of specific fact and, in this regard, it is unlikely that correct responses can be located in the textbook or lecture notes within the 20 minute time limit.” A similar statement appeared on the unit outline for the fully online learners with the focus on the *Illuminate Live* sessions rather than the face-to-face classes. Each quiz contributed 4% to the final unit grade for a total contribution of

40% for ten quizzes. Figure 1 provides the online quiz information and sample items provided to students in a Blackboard link.

During each of ten instructional weeks, as specified in the Unit Study Calendar, you are required to complete a timed (20 minutes) online quiz (i.e., 20 multiple-choice items). Quizzes are marked automatically and marks are entered in the Blackboard My Grades tool. Quiz questions assess understanding, NOT recall of specific fact and, in this regard, it is unlikely that correct responses can be located in the textbook or posted answers to questions within the 20 minute time limit. Quizzes are accessible for only one week, as specified in the Unit Study Calendar. Below are sample items taken from our Textbook Chapter 1. There is also a Practice Quiz (follow the link Online Quizzes) that you can take to build your confidence with the Blackboard Test tool.

Many well-known developmental theorists have focused on all children's progression through common stages. In other words, these theorists have emphasized:

- a. quantitative change and universality in development.
- b. quantitative change and diversity in development.
- c. qualitative change and universality in development.
- d. qualitative change and diversity in development.

Which of the following children is undergoing the best example of a non-developmental change?

- a. Thirteen-year-old Sally is undergoing a growth spurt.
- b. Six-year-old Ben clearly understands the difference between right and wrong after months of confusion.
- c. Nine-year-old Amy falls and breaks her arm.
- d. Five-year-old Tommy begins to role-play after months of talking only about himself.

Which one of the following examples illustrates the issue of nature versus nurture in development?

- a. Dr. Hepburn thinks that the course of children's development is largely predetermined at birth, whereas Dr. Tracy thinks that how children develop is influenced by children's home lives and educational experiences.
- b. Dr. Base thinks that children develop in a steady and continuous fashion, whereas Dr. Fitzgerald believes that children mostly develop in stages, in which development is rapid at times and slow at times.
- c. Dr. Bogart believes that 8-year-olds think in very different ways than 14-year-olds do, whereas Dr. Ball believes that the two age groups are quite similar.

Dr. Berg believes that some developmental changes occur in almost every child, whereas Dr. Wood believes that developmental changes are highly unique from one individual to the next.

Figure 1: Web-Based Quiz Information for Students

The thirty assessment points also included ten weekly student-generated questions and ten student answers to those questions. The questions and answers corresponded to the weekly material associated with each class (i.e., face-to-face seminars or *Illuminate Live* sessions). Blackboard Discussion groups were specific to each class of learners and, thus, no group included more than 25 students. As specified on the unit outline for the blended classes [or fully online learners], “prior to each of ten classes [or *Illuminate Live* sessions], having engaged with learning resources as specified in the Unit Study Calendar, each student will post a study question in Blackboard Discussions that will subsequently be answered by fellow students. Questions are evaluated by the lecturer for relevance to required learning content, clarity of expression and precision in thinking. Marks, ranging 0% to 2.0%, will be entered in Blackboard.” The ten posted questions contributed 20% to the final unit grade. The unit outline continued: “Within 48 hours following each class [or *Illuminate Live* session], each student is required to respond to one previously posted question. Responses are limited to a maximum of 1000 characters (approximately one

paragraph) and, in this regard, must be extremely concise. The lecturer will evaluate the response on the basis of demonstration of understanding, clarity of expression, precision in thinking and interpretation of required learning resources.” The ten posted answers contributed 40% to the final unit grade. Figures 2 and 3 provide marking criteria for student-generated questions and answers available in Blackboard and discussed with students in class or during the *Illuminate Live* sessions.

Score	Criterion	Sample
0.5	Question requires only recall of a specific fact.	What is meant by cognitive development?
1.0	Question requires demonstration of understanding beyond simple recall of facts.	Increased ability to remember instructions suggests which developmental domain?
1.5	Question requires synthesis of information.	How are cognitive developmental and social development related?
2.0	Question requires evaluation, the highest level of understanding.	Which theory of development is most useful for teachers?

Figure 2: Marking Criteria for Web-Based Student-Generated Questions

Score	Criterion	Sample
1	The answer is far too brief (30 words) and is poorly constructed in terms of vocabulary and sentence structure.	Cognitive development means changes in thinking and includes changes in the ability to learn remember, speak attention and solve problems. As children get older they get better at these things.
2	Although demonstration of understanding is apparent, the answer is too brief (76 words) and is poorly constructed in terms of vocabulary and sentence structure.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems. As children mature, changes in their brains make it easier for them to learn, remember, speak, focus attention and solve problems. But cognitive development is also influenced by experiences from the environment like parents talking to their kid and giving him lots of toys to play with. That would stimulate his cognitive development.
3	This answer clearly demonstrates understanding including synthesis of information and appropriate reference to our textbook. However, the answer is only 150 words in length and does not make reference to any sources outside of our textbook such as activities completed during our weekly workshops.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems. As children mature, changes in their central nervous system make it easier for them to learn, remember, speak, focus attention and solve problems. But cognitive development is also influenced by sensory stimulation. For example, in homes with many stimulating toys and activities, children’s cognitive development may be greater than that of children in unstimulating environments (textbook, p. 6), although this may be most apparent in extremely situation (textbook, p. 7). The most important cognitive developmental to ever live was Piaget (textbook pp. 13-14). Cognitive development influences and is influenced by all developmental domains like physical development and social-emotional development. Later in the term, we will examine both cognitive-developmental theories (textbook chapter 6)and cognitive processing theories (textbook chapter 70, both of which are important to understand cognitive develop

4	This answer is an excellent demonstration of understanding including synthesis of information and appropriate reference to our textbook, our workshop, and material outside required unit resources. The answer is the maximum length of 1000 characters.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems (Seminar 1). Central nervous system changes, due to maturation and environmental stimulation, make it easier for children and adolescents to learn, remember, use language, focus attention, thinking logically, engage in abstract thinking and logical reasoning and solve problems. For example, in homes with many stimulating toys and activities, children's cognitive development may be greater than that of children in unstimulating environments (textbook, p. 6), although this may be most apparent in extremely situation (textbook, p. 7) such as institutional children who fail to develop. For a tragic account of the effect of institutionalization on children's cognitive development, view this video clip on the Romanian orphans < http://www.youtube.com/watch?v=bvL_DGjGuhA >. Later in the term, we examine both cognitive-developmental theories (textbook chapter 6) and cognitive processing theories (textbook chapter 7), both of which are important to understand the biological and environmental focuses that give rise to cognitive develop.
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Figure 3: Marking Criteria for Web-Based Student-Generated Answers

Following marking of all assessments and posting of the final grades in Blackboard, all students who remained enrolled in the educational psychology unit ($n = 143$) were invited, via email, to complete a questionnaire using Qualtrics an anonymous online survey application. In addition to demographics such as student age and gender, eight survey items queried student satisfaction with the 30 web-based assessments. Students expressed their satisfaction by rating eight survey items on a 5-point scale ranging from, in the case of the first item, *very negative* (rating of 1) to *very positive* (rating of 5) and, in the case of the remaining seven items, *strongly agree* (rating of 1) to *strongly disagree* (rating of 5):

1. Describe your overall experience using technology in this unit.
2. I am disappointed with my learning experiences in this unit.
3. I found the workload in this unit to be excessive.
4. The requirements in this unit made me more anxious then in my other university units.
5. I would recommend this unit to other students.
6. The weekly online quizzes were useful.
7. Posting a question every week helped me learn the material.
8. Posting an answer every week helped me learn the material.

Fifty-eight students responded to the survey. Of these respondents, 48.3% were aged 18-19 years, 46.6% were 20-39 years of age and 5.2% were aged 40-59 years. Three respondents indicated part-time enrolment status while the remainder indicated full-time enrolment status. Almost 80% of respondents were female which is consistent with gender distribution trends in the participating university program. Forty-four (75.9%) of

responding students indicated that they were in blended learning classes; 14 (24.1%) indicated that they were in the fully-online class.

Two lecturers taught the first-year educational psychology unit which included managing the Blackboard site and marking the 30 web-based student assessments. One lecturer assumed most of the responsibility for Blackboard operations (for example, forming discussion groups for students to post questions and answers and releasing quizzes each week) while the other lecturer assumed more responsibility for marking student questions and answers. Each lecturer engaged in professional reflective journaling with respect to their experiences with students, the technology and the marking of assessments. The lecturers frequently discussed instructional issues among themselves and such conversations were often noted in their professional journals. During the 13 week semester and until all final marks were submitted, one lecturer made ten journal entries while the other made 17 entries. Entries varied from several words (for example, *marking is unmanageable and unsustainable*) to several sentences which included details of conversations with students and with the other lecturer. Professional reflective journal entries were organized and analysed in terms of themes. Some journal entries included multiple statements and sentiments and, thus, multiple themes.

Findings

Student evaluations of the unit, generally, and the application of instructional technology, particularly, were extremely positive. On a 5-point scale, where a rating of five was associated with the words *very positive*, the survey item *Describe your overall experience using technology in this unit*, on average, was rated by participating students as 4.31 (standard deviation 0.71). As illustrated in Figure 4, no students rated the use of technology as *very negative* and almost 90% rated the use of technology a *positive* or *very positive*. Analysis of variance revealed no significant differences in overall satisfaction with the instructional applications of technology for male and female students, older and younger students and students in fully-online and blended learning classes.

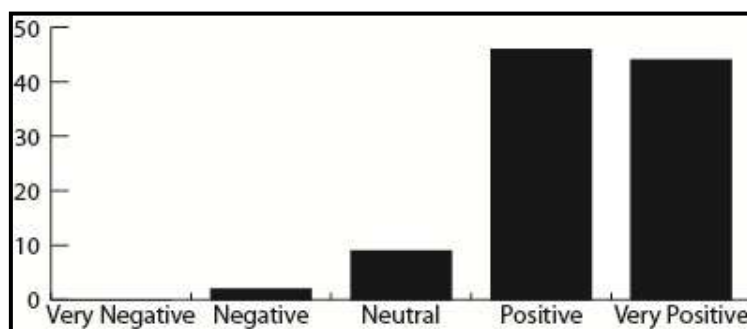


Figure 4: Percentage of Students Selecting Each Response-Option for the Survey Item *Describe your overall experience using technology in this unit*

More specifically, students expressed collective agreement that the weekly online quizzes were useful and that posting weekly questions and answers facilitated mastery of required learning content. As illustrated in Figure 5, on a scale ranging from *strongly agree* to *strongly*

disagree, on average, participating students rated the utility of the weekly quizzes as 2.28, posting weekly questions as 2.07 and posting weekly answers to those questions as 1.90. Thus, in general, students expressed the perception that the weekly web-based assessments were useful and helpful. Correspondingly and as presented in Figure 6, students were satisfied with their learning, found the workload manageable, were comfortable with the assessment and would recommend the unit to other students. Analysis of variance revealed no significant differences in satisfaction ratings for male and female students, older and younger students and students in fully-online and blended learning classes.

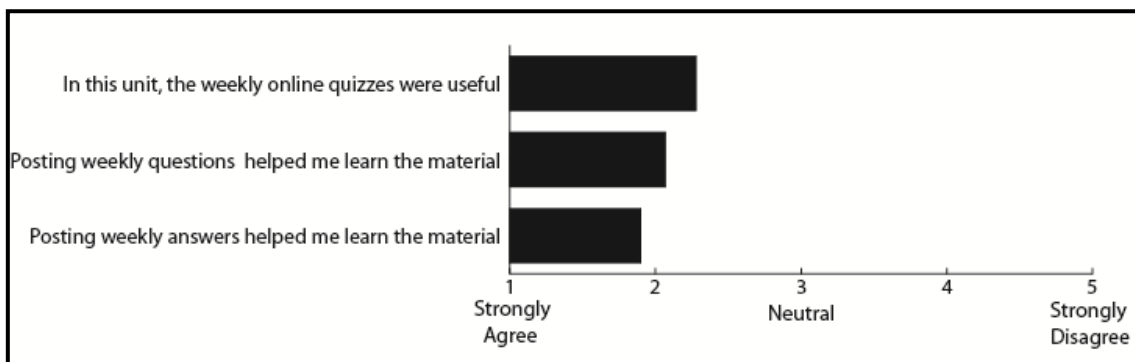


Figure 5: Average Student Ratings of Survey Items that Queried Satisfaction with Web-Based Assessments

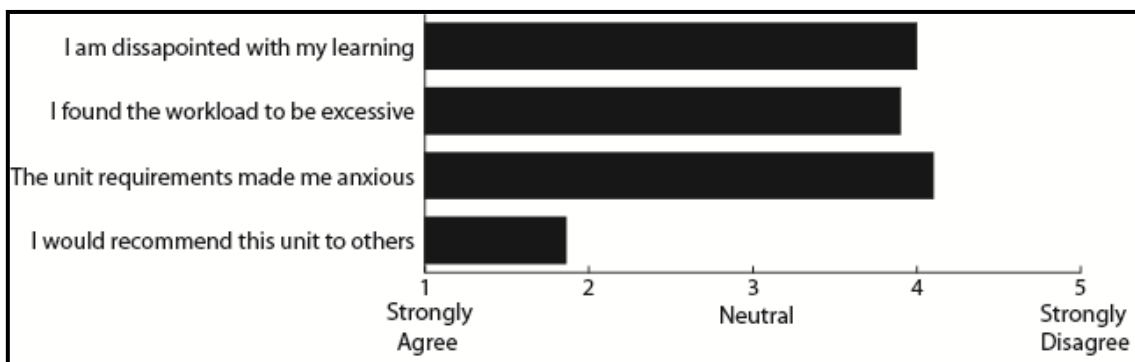


Figure 6: Average Student Ratings of Survey Items that Queried Satisfaction with Learning Events

Figure 7 provides graphic representation of the number and nature of the professional journal entries made by the two lecturers involved in the applied investigation. The most common comments reflected concern with marking and grading, specifically, the challenges of marking students' questions and answers each week, providing detailed feedback and maintaining consistency across lecturers, students and weeks. For example, one lecturer wrote, "I remember this. Like when I almost drown as a child. Every time I tried to come up for air, another wave smashed my head back down under the water." Another professional reflection included, "Not easy. So many marks allow students to compare their marks with each other and for different posts. They question why one answer scored 3 out of 4 and another, seemingly identical, scored 2.5/4. Yikes." Many lecturer reflections were extremely positive, particular with respect to student engagement. For example, "Attendance is excellent. The students are eager to cite their

lecture notes in their posts in order to score full marks.” Correspondingly, “The weekly quizzes force the students to engage regularly rather than cramming before exams.” Additionally, “Shocking! Many students have mentioned that they are reading the prescribed textbook chapters prior to class.” Nine professional journal entries reflected technical problems managing the weekly online quizzes. Most commonly, students lost internet connectivity which resulted in no mark entered in *My Grades* but the student was unable to retake the quiz. One lecturer frequently complained about the need to reset student quizzes. Four journal entries focused on students concerns including reasons for not completing weekly assessment and specific questions regarding unit content and assessment format. For example, one lecturer wrote, “This semester, I am receiving far more email from students seeking clarification of concepts. I suppose this is good?”

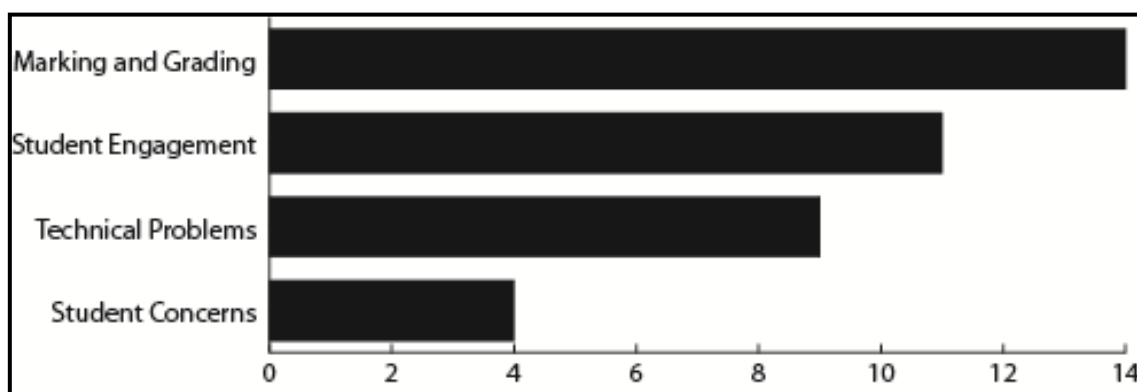


Figure 7: Number and Nature of Lecturer Reflective Professional Journal Entries

Conclusion

Results of the current applied investigation add to the growing body of research that confirms that web-based technologies facilitate active student engagement in the processes of learning including frequent student-generated questions and answers and frequent testing of student mastery of learning objectives. The 30 web-based assessments during a 13 week study period were appreciated by students but problematic for the lecturers. Overall, student evaluations of their technology-rich learning experiences were extremely well-received. Participating lecturers, however, while recognizing the clear benefits to students, expressed considerable concern regarding the demands of marking students' questions and answers each week. Indeed, although the weekly quizzes were marked automatically, many students required their quizzes to be reset due to reported loss of their internet connection during quiz completion or lack of understanding of online quiz requirements such as time limits and required completion once the quiz was started. Increased lecturer effort to ensure that students understand the online quiz conditions may reduce the need to reset quizzes. Additionally, it may be that student engagement in the processes of learning could be maintained with a rotating questions and answers. For example, during one week, half of the students might post questions while the other half of students answers those questions. The following week, student

roles might be reversed. In this way, lecturer marking would be significantly reduced while students remain engaged in weekly web-based postings.

Alternatively, peer assessment has been found to reduce teacher workload and improve the quality of student learning (Bouzidi & Jaillet, 2009; Yu, 2011). Peer assessment is reportedly as valid as the instructor's judgment (Cho, Schunn, & Wilson, 2006; Topping, 2008). Web-based learning environments facilitate peer assessment (Wen & Tsai, 2006) and the benefits of utilising online peer assessment have been established for both students and teachers (Hou, Chang, & Sung, 2007; Xiao & Lucking, 2008). Proper usage of online environments for peer assessment can supply a higher level of anonymity and provide more freedom of time and location for the students, thus stimulating feedback exchange among peers (Tsai & Liang, 2009). Teacher control is abandoned when students are entrusted to provide feedback to ensure work quality. The inclusion and use of peer assessment satisfies Web 2.0 technology principles such as *user as contributor*, *increased participation*, *decentralization* and *radical trust* (Abramovich & Brouwer, 2008). In the context of the current investigation, students may have provided feedback including grades for the posted questions and answers of their peers. Having liberated the lecturer from marking students' questions and answers, the test tool may have included written-response items in addition to multiple-choice items which could have been graded by lecturers thereby providing students with increased feedback on their demonstrations of learning and increased opportunities to write, an important feature of university studies.

Effective use of questioning is a fundamental feature of best practices in undergraduate education (Mastascusa, Snyder, & Hoyt, 2011). Although questions are used for many instructional reasons such as focusing attention, promoting recall, and encouraging reflection, using questions to stimulate critical, or higher-order thinking is one of the most important goals of education (Gibson 2009). Question types are dichotomised to include selected-response (e.g., multiple choice, true-false and matching items) and constructed-response (e.g., fill-in-the-blank, short answer and essay items). The current investigation included teacher-generated multiple-choice items in the ten weekly online quizzes and ten student-generated short answer questions. As suggested by previous research, different question types may contribute to different types of student learning (Fellenz, 2004; Johnson, 2006b; Wilson, 2004; Yu, 2011). As previously noted, reduced lecturer marking of student questions and answers may have facilitated use of the Blackboard Test Tool to deliver other types of questions including, most notably, constructed-response. Additionally, particularly given that participants were enrolled in a course of teacher preparation, students might have used a web-based question and answer (QA) system to post and answer a variety of questions including selected-response items. According to Zhang (2010), QA systems should be designed according to principles of human learning. Specifically, 1) different types of questions should be answered in different ways, 2) answers should not be given directly but instead learners should be encouraged to find the answers by themselves and 3) the function of the synchronous interaction should be added.

There were no significant differences between male and female students, older and younger students and students in fully-online and blended learning classes in evaluation of their web-based experiences and assessment in the introductory educational psychology unit. Since sample size was small, such lack of significance may be an outcome of the specific study. Nonetheless, while further investigation is required, it may be the case that first-year university students, irrespective of gender, age and learning environment, appreciate learning experiences that have many assessment points and make extensive use of web-based technologies. Indeed, recent research has established the erosion of gender-differences in attitudes and practices related to web-based technologies (Helsper, 2010; Horvat, Oreski, & Markic, 2011). Additionally, as the internet has been popular for more than 25 years, user age is increasingly unrelated to use of web-based technologies except in the case of elderly individuals (Australia Bureau of Statistics, 2008; Statistics Canada, 2011; U.S. Census Bureau, 2012). The current applied investigation was based on exemplary undergraduate instructional practice including active student involvement and frequent feedback on student mastery of required learning content (Chickering & Gamson, 1987; Mastascusa et al., 2011). It may be the case that sound instruction is equally appreciated across all learning conditions including fully-online and blended learning environments.

The technology solution utilised to implement the web-based learning activities may have implications for future application. Whilst an asynchronous discussion board provided a sound platform for the questions and answers, it proved to be challenging in terms of marking. Originally, the lecturers in this study trialled the “Hotseat” technology developed by Purdue University, however, due to a delay in rolling out the live environment, it was decided to retreat to Blackboard discussion boards as a solution. For future implementation, it could be beneficial to utilise a more fluent technology, such as Hotseat, that allows lecturers to move in and out of the questions and answers, and provide their feedback, in a more fluent manner.

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