

Promoting student participation and collaborative learning in a large INFO 101 class: Student perceptions of PeerWise Web 2.0 technology.

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Abstract

Gaining active student participation in large first year undergraduate classes is notoriously difficult. Tutorials may help to ensure engagement and participation, but the value of “lurking and learning” from peers in a non-threatening environment remains. This research reports on the experience of students from a large INFO 101 class with the new PeerWise technology. A student focus group using decision support software facilitated the identification of student perceptions of the technology and as a means of assessing its value as a pedagogic aid. It is clear from the focus group that students recognize the value of peer involvement and collaborative learning that results from using PeerWise. The anonymity of PeerWise contributions, and the ability of students to assess their own abilities and contributions builds confidence and competence. To improve student motivation towards using the tool having to submit questions on topics each week would enable more marks to be given to contributions, students would become more familiar with the system and see it as an integrated part of the course. By the final exam time, there would be a significant number of questions in the Peerwise system which students could use to study.

Keywords: Student participation; collaborative learning; large undergraduate classes; PeerWise; computer mediated learning; Web 2.0 technologies

Introduction

Encouraging student participation in large first year undergraduate classes is notoriously difficult. While tutorials may help to ensure engagement and participation, identifying topics of interest, or areas of weakness across the whole cohort remains elusive. “Lurking and learning” from peers remains a valuable means of self-discovery. Especially in a non-threatening environment it can be a great encouragement for students in their freshman years.

PeerWise is a free software application that harnesses Web 2.0 technologies to engage students in reflecting on their work, contributing multiple choice questions (MCQs) to a course database and then contributing and receiving peer reviews of other student MCQ contributions. In the process it enables students to identify the topics that they wish to focus on, while at the same time contributes a study resource that can be used to aid reflection and self-testing in a non-threatening way. It gives participants practice in the answering of MCQs prior to class tests. This approach is aligned with contemporary learning theory and has great potential for encouraging participative student learning, especially in large classes.

The PeerWise technology, developed in New Zealand, has been used elsewhere in New Zealand, Canada, Australia and the US, but not yet at the Victoria University of Wellington. This research

investigates the experience of students from a large INFO 101 class with the new PeerWise technology. A student focus group using decision support software facilitated the identification of student perceptions of the technology and as a means of assessing its value as a pedagogic aid.

Literature review.

Constructivist theorists argue that people construct their knowledge and therefore their learning needs based on their interpretation of their experiences in the world around them. (Taylor et al, 2000; Ben-Ari, 2001). Our experiences inform our interpretation and therefore we create our knowledge. That knowledge becomes the departure point for identifying the next thing we need to know or understand in order to enhance our ability to thrive in our immediate environment. Because each individual has different experiences on which to build their knowledge, sharing their knowledge and experiences enables them to achieve greater insights, shared meanings and more accurate understanding of the problem at hand. By talking to colleagues and peers we discover that our problems and understandings are not unique or idiosyncratic and we can increase our chances of discovering a new interpretation of our reality (Brookfield, 1995).

This social aspect of learning has deep behavioural roots. Mimicry has been shown to be a powerful component of our learning. We have all experienced the discovery process when we watch someone else demonstrate their knowledge or skill, which we then imitate. This process of watching, imitating and learning applies to most primate species but has particular relevance to the use of tools and machines including computers and information systems. Gallese (2008) identified certain premotor neurons which predispose us to imitate or mimic others. These mirror neuron systems exist within us even before birth. It is almost as if we are hard wired to watch and to imitate others as part of our self-discovery, learning and development processes. Accordingly, by establishing collaborative learning opportunities we create an environment in which students can become actively engaged in building their own discovery and learning, thereby putting into practice the major conclusions from modern cognitive learning theory (Barkley, Cross and Major, 2005). This is in accord with the student-centered environment advocated by Biggs (2003) for aligning activities with the desired learning outcomes, and the emphasis on the social component of learning as articulated by Mayes and Fowler (2006).

Chickering, & Ehrmann, (1996, p3.) identified principles of good practice that enhance learning. These include developing reciprocity and cooperation among students so that learning is collaborative and social rather than competitive and isolated. Active learning techniques and prompt feedback enable students to perform, to assess their existing knowledge and to receive feedback on that performance. Brown (2000) emphasizes the need for attending to both the cognitive and the social dimensions in order to encourage powerful learning.

According to Wickersham and McGee (2008) deeper learning is manifested when the learner does not just regurgitate information but reflects on and actively explores it, producing knowledge. Cross (2005) on the other hand explains that students “learning for deeper understanding” are “actively engaged in learning” and “likely to learn more than students not so engaged” (Cross, 2005, p1). Her emphasis on autonomy is reflected in Atherton’s (2005) perspective that “deep” and “surface” learning correlate fairly closely with motivation: “deep” with intrinsic motivation and “surface” with extrinsic. Both Cross and Atherton’s perspectives emphasize the abstract element of learning and the necessity of reflecting on reality in order to integrate new experience and discoveries with older learning and experiences.

In theory, therefore, the following components of the learning and teaching endeavour become important criteria for the evaluation of any pedagogic technology:-

- Builds on prior knowledge and experience
- Creates an environment for that to be shared, imitated and discussed
- Creates opportunities for active participation in the learning process
- Encourages collaborative learning that is student-centred and aligned with the learning outcomes of the discipline concerned.
- Encourages student reflection and autonomy
- Creates opportunities for peer review
- Promotes quick feedback on performance
- Allows opportunities for self-assessment and review.

PeerWise is a web-based software application that facilitates the development of multiple choice questions by students as part of their course work. The system provides for the generation of a database of MCQs that can be used to create a richer range of learning experiences through generating the questions, writing an explanation, evaluating the effectiveness of MCQ items and providing feedback on the quality of items as described in detail in an article by Denny, Luxton-Reilly and Hamer (2008a). The MCQs contributed by the students are required to demonstrate thinking about the topics of the course and the specified learning outcomes, the choice of distractors, written explanations, and answers (Lutteroth and Luxton-Reilly, 2008, p 79). Denny, Luxton-Reilly and Hamer (2008a) maintain that the system provides for deeper reflection on the nature and purposes of assessment activities and the learning process. It also ensures good peer assessment feedback as a critical aspect of learning. Students are encouraged to think critically and analytically about the MCQ items contributed by their peers. Through analysing those items critical assessment of their own contributions is encouraged. Engaging in such questions leads on to a deeper learning experience (Denny, Luxton-Reilly and Hamer, 2008a)

However, the situation is not quite as euphoric as one would wish. The literature identifies a number of questions that arise.

1. Quality of the questions - The quality of the questions contributed by the students will affect the usefulness and reliability of Peerwise as a tool for both instructors and students. Unless there is an evaluation process to monitor the quality of the questions contributed, students will be studying incorrect or confusing questions. Instructors need to be able to identify incorrect or poor questions and change them. While Hakulinen found that there was significant difference between student ratings of questions and the ratings of “experts” (Hakulinen, 2010), in another article it was noted that there was a high degree of consistency between grades assigned by students and those assigned by teachers (Denny, Luxton-Reilly, & Simon, 2009). As noted by Hakulinen (2010), when assessing “quality” of questions it is important to determine what a quality question looks like or entails. PeerWise has a feedback mechanism which enables students and administrators to add comments and feedback to questions. The feedback mechanism also results in positive reinforcement. As students comment on their peers good questions, the students will be compelled to write more quality questions. As a result the overall quality of the repository can be improved by enabling students to help each other but also helping students and administrators improve their questions (Luxton-Reilly and Denny, 2010).
2. Students final grade/Benefits to students - Based on information gained during the course and the final exam grades (multiple choice question exams), it was found that “Students who use PeerWise actively perform better in the final exam than those who

are inactive” (Denny, Hamer, Luxton-Reilly and Purchase, 2008, p 51). Designing questions, choosing distracters, writing explanations, answering questions and evaluating quality all contribute to a student’s learning. Before a student can write a question about a topic they must understand the topic and the misconceptions of that topic deepens the students understanding (Luxton-Reilly and Denny, 2010). The questions and the design of the questions helps students to understand the course objectives and important topics within the course. Explanations help students gain a deeper understanding of the topic themselves as well as developing their written communication skills (Lutteroth and Luxton-Reilly, 2008). It was noted by Lutteroth and Luxton-Reilly (2008) that there was no reason to expect that the use of PeerWise helped with written questions (rather than multiple choice) although the length of comments, day’s active and the combined measure do relate to the performance in written question answering. This may be related to practice questions creating a deeper understanding of the topic. There has however been supporting evidence that exam performance improves along with question creating and discussion threads (Denny, Luxton-Reilly and Hamer, 2008b).

- Usability of the system and motivating students to use the system - The usability of the system is uniform across all ability levels. Any student would be able to use the system regardless of performance and ability in other areas of the course (Denny, Hamer, Luxton-Reilly, and Purchase, 2009). However, there needs to be an incentive to get students to use the system. Most students don't contribute their own questions to PeerWise unless there is some kind of reward for doing so (i.e. course marks) (Luxton-Reilly and Denny, 2010). Providing an initial question on the database can encourage students and give them an idea of what a question on PeerWise should look like (Lutteroth and Luxton-Reilly, 2008). To encourage user participation, PeerWise has a scoring system which puts students on a “leader board” and allocates points depending on questions submitted and answered (Denny, 2010). Students who submit questions are able to see how many others have answered their question, any feedback given, their rating value and the answers other students have chosen. This can encourage students to carry on using the system but also helps to control the quality of questions (Denny, Hamer and Luxton-Reilly, 2009). Students don't like the fact that PeerWise can become clogged with a lot of questions that are boring and not much effort has been put into them. Students did however identify the fact that they could filter the questions by rating to eliminate these questions (Denny, Hamer and Luxton-Reilly, 2009).

Luxton-Reilly and Denny (2010) make the point that a large number of questions can be produced at a very low cost to academic staff. In large classes where MCQ tests and exams are frequently used because of the ease of marking, this can be a significant benefit. In a class of 600 to 800 students, requiring each student to submit a minimum of 2 or 3 questions can generate many questions in a short time. With the possibility of automatic recognition of faulty questions (Hakulinen, 2010) the value of PeerWise increases accordingly. Creating time and opportunity to discuss MCQs in class also enhances the social opportunities of the encouragement of learning in large classes where students are notoriously reluctant to contribute to discussions.

Methodology

In the second trimester of 2010, students in INFO 101 – the first year introductory course in Information Systems – were required to contribute two questions to the PeerWise database.

The incentive for this contribution was the award of 4% to their total course mark, broken down to 2% for contributing 2 questions and 2% for answering 10 questions.

Peerwise gives students a tool with which they can test themselves and each other on what they believe to be important topics for assessment. For courses like this one which have a MCQ component of the final exam, students can practice assessment questions written in the format in which they will be assessed. For the PeerWise assignment, INFO101 students were allocated a chapter of the text book depending on their small tutorial groups. These chapters represented topics which were all assessable in the final exam. Students were required to contribute two questions on their allocated topic by a certain date (2 weeks before the final exam). By the time those students contributed their questions Peerwise was filled with many questions covering all aspects of the course. This set the system up as a question bank that both students and academic staff could use.

The total number of students in the class was 575, of which 479 (83%) contributed MCQ questions. One student contributed 17 MCQs but the average number of MCQs contributed per student was 2.16. On average, students answered 28.21 MCQs each, indicating the use they made of the PeerWise system for revision and study purposes. One of the students answered 1108 MCQs. Similarly, the average number of comments contributed per student was 2.05, although one student contributed 101 comments on MCQs he had attempted.

Before the trimester ended and the students went off for their summer recess, a Focus Group using WebIQ Decision Support Software (DSS), was scheduled and facilitated by an academic colleague from a related School. The advantage of using WebIQ was that while the participants may be known to one another, their contributions remain unattributable and therefore anonymous. The DSS enables idea strings to be generated very quickly, and these stimulate the participants to contribute their ideas. Contributions can quickly be ranked and the software provides immediate analyses of participant votes and lists opinions or contributions.

On the day, only nine volunteers responded to the invitation to participate in the Focus Group, probably because of the timing being so close to the end of trimester and the approaching examinations. Of the nine volunteers, only seven students turned up. Nevertheless, it was considered worthwhile to continue, not so much for the quantitative elements so much as the qualitative data on student perceptions. In this case, some student feedback data is better than none at all.

Questions and responses.

Of primary interest was the students' perception of PeerWise for encouraging learning. The first question asked focus group participants to identify the "The most valuable feature of PeerWise for encouraging learning..." The responses obtained reflected some of the experiences recorded in the Literature review above. Two points were seen to be of primary importance:-

- *The most beneficial part of this whole experiment was that it was a student to student learning environment. You could discuss fundamental topics in an informal way, in your own time and in a language that was easy for you to understand.*

The anonymity element of PeerWise enabled students in a large class to assess their ability in comparison with the ability of their peers, and gain confidence in the process, without their own identity being revealed. This perspective was reinforced by a similar comment that showed the importance of peer participation:-

- *Student to student learning – answers and explanations were given for each question. Other students can comment on the questions you have submitted.*
- *Also helps that other students can comment on the questions you have submitted. Should be enforced more.*

The second most valuable feature of PeerWise, as articulated by the students in the Focus Group related to the way that they were forced to read the textbook and research the topic in order to create a new MCQ. Several responses dealt with this aspect:-

- *Making up questions encouraged students to research the topic*
- *The compulsory nature of MCQ creation forced students to research the questions before submitting them*
- *Makes you read the textbook more carefully*
- *Writing your own questions was good because it made you think about what you were learning. Putting things in your own words always helps.*

However, several responses identified the limitation of requiring only two questions of each student:-

- *I think it might have been a good idea if along with our tutorial submissions each week we had to submit one question on the topic studied in class*
- *Two questions was not enough*

Six other comments were recorded in support of these observations, but two students considered that it might result in too much work for those students who do not intend to major in the subject:-

- *That's a good idea but already has too many mandatory aspects for a compulsory 100 level paper that a lot of people will not take seriously or have as a major.*
- *I definitely agree*

Other points that emerged included the value of getting feedback on questions; the multi-choice format being similar to that of the exam; the value of PeerWise for encouraging students to summarize what they have learned; and the likelihood that, while on PeerWise, students are likely to try out other questions. One student wanted the tutors to be more involved.

The second question posed an opportunity for negative comment – “The least valuable feature of PeerWise for promoting learning was...” Similar to those of the first question the responses often reflected points identified in the literature review. However, many were positive and encouraging, supporting points made in response to the first question.

- *It required students to do thorough research in the textbook to make and answer questions*

- *I enjoyed that element of PeerWise otherwise I would not have paid any attention to INFO 101 and would not be doing as well as I have been*

The main criticism related to the quality of the questions posted and their accuracy:-

- *Sometimes it was hard to trust the answers to questions that other people had submitted.*
- *It didn't matter if you got the question wrong to make up the MCQs needed to pass. So you didn't really need to read the textbook to know what you were talking about*
- *But wrong questions does not mean that they were irrelevant, just ill-explained and ambiguous*
- *Sometime the answers may be incorrect so you may learn the wrong things*
- *Many questions were still too trivial*
- *Some PeerWise users did not explain their questions thoroughly or left the person answering the questions confused*
- *That's right. They don't explain well enough. I suspect some people don't even understand it themselves*
- *The fact that there was no requirement to get the answers right meant that you could answer wrongly and still pass – a bit like NCEA where you tick the boxes rather than actually learn the content.*
- *Yeah it didn't really make you want to read the textbook because you would pass no matter if you got it right or not.*

The solution to the problem was considered by several participants to be tutor monitoring, even though one of the purposes was to ensure student control of the PeerWise experience:-

- *Some questions are very badly worded so should be more harshly moderated.*
- *I agree. Moderation would solve the problem of people submitting wrong or trivial answers.*
- *I would have liked more monitoring from tutors to make sure all student Qs and As were correct.*
- *Agreed. Maybe the tutors should monitor it more strictly and check questions.*
- *I have the same concern*

A more positive suggestion related to these comments.

- *A lot of people went for the most basic and easy kind of question when making and answering them. There should be a requirement to make Qs of a certain difficulty to pass.*
- *Basic questions are helpful for learning basic information. Not everyone is at the same level.*

From these responses it would seem that requiring each student to contribute more questions and more frequently would enhance the learning experience and integrate PeerWise more into the pedagogy. If this is done through the tutorial system such that each student in each tutorial session has to contribute a question it will become more integrated and more accepted. Certainly, tutor monitoring of the questions and evaluations would be easier and could contribute to tutorial discussions or to lecturer attention in class. From the lecturer's viewpoint, a final encouraging comment in this section was the view that:-

- *PeerWise was not the most useful tool we had. Lecture notes were very helpful.*

The final focus group question asked the participants “How would you encourage students to use Peerwise more?” As intended the answers helped to integrate the points made in the two earlier questions. Particular attention was paid to requiring more questions to be submitted more regularly, raising the quality requirements and increasing the marks awarded for good contributions:-

- *Making it a weekly thing and getting marks every time.*
- *More marks would definitely do it for me. Maybe like needing to post a question with each tutorial session*
- *By requiring more questions to be written rather than just two.*
- *Improving the quality of questions is more important than quantity*
- *Give students some reward (marks)*
- *If PeerWise was more structured (more moderated or questions only posted by tutors) people would be more willing to use it. More marks would also be helpful.*
- *Maybe make the final exam 20 MCQs and during the trimester we have to come up with 20 of our own questions and get a mark for each of them.*

But there were reservations:-

- *I am concerned that it would be a major chore if students had to make it a weekly thing. If it was more structured and not as often as weekly (e.g. must submit and answer questions on a topic-by-topic basis and then allocating perhaps 2% per topic then this may encourage students to take it more seriously and see it as a study tool rather than a requirement)*
- *The Peerwise assignment could have just been made more serious - It could have been a requirement to add and answer more questions and the quality of the questions could also have been set at a certain level.*
- *Very Valid. I think that is what was needed*
- *Yea i think it didn't seem serious enough to many students.*

The reason that students did not all take it sufficiently seriously was not explored in any depth. At that stage it was not known that 17% of students had not contributed to the PeerWise initiative. The focus group did have some suggestions for improvement:-

- *Have some feature that shows that Qs and As have been approved by a tutor*
- *In the first couple of workshops teach students to use the system properly.*
- *Tutors should be more involved and give students confidence*
- *It would be really encouraging i think if we could have practice exams up there, that would show us if we were wrong or right after we had done them.*

Discussion of student feedback:

The fact that 96 students did not contribute questions to PeerWise (17% of the class) seems to indicate that the marks incentive may have been insufficient. Nevertheless the mandatory requirement for participation had some effect and resulted in most of the students taking the exercise seriously. However, the PeerWise activity was linked to the tutorial sessions rather than to the lectures themselves. By having Peerwise as a more regular and comprehensive part of the course students will

be able to explore in more depth and reinforce what they have learnt in both lectures and tutorials. PeerWise contributions could thus form a discussion platform that identifies popular topics for discussion, or as a diagnostic tool for topics that students found difficult. In tutorials, tutors can then monitor students submitted questions and discuss any important issues that emerge.

Students will always be encouraged to complete tasks which are allocated marks towards their final exam. The allocation of marks to assignments sends a signal about how important each assessment item is considered to be. While there is a limit to how many marks can be offered, even a small percentage per weekly contribution could be a good incentive for students.

Moderation of questions could enhance the value of PeerWise for the students, but may reduce the function of peer-group evaluation of posted questions. Too much higher level evaluation by tutors of submitted questions would reduce the involvement by students in each others learning and discovery. It would seem that the importance of students ownership of the evaluation process had not been adequately conveyed to the students in this experimental class. Academic or tutor evaluation and selection of PeerWise contributions can take place after the course is over and consideration can be given to their use for future MCQ exams. Some students had an idea that all questions should only be posted by tutors/academic staff, but this would destroy the value of PeerWise for student-to-student collaborative learning, and reduce student motivation. Students own quality ratings give a good insight into the true quality of the questions and their usefulness to students as a study tool. If selected questions are extracted and dealt with in tutorials, the process of monitoring, the correction of questions, the raising of standards and the identification of any problem areas can all be dealt with in a way that adds authority and credibility to the PeerWise database. This would also enable students to feel more confident the questions are correct.

Conclusions

It is clear from the focus group that students recognize the value of peer involvement and collaborative learning that results from using PeerWise. The anonymity of PeerWise contributions, and the ability of students to “lurk and learn” in the PeerWise environment, assessing their own abilities and contributions builds confidence and competence. This can all happen without active authoritarian involvement from tutors or lecturers. Positive reinforcement encourages students to continue to help each other and test themselves by contributing challenging questions with good explanations.

Two features of the use of PeerWise in this course seem to have contributed to it not being taken sufficiently seriously. Firstly it seems not to have been marketed optimally to students. By encouraging students to use PeerWise throughout the course rather than just at 2 points of the trimester, students would have had more ownership of the activity and a greater perception of the link between the course and their contributions to Peerwise. The fact that Peerwise was only a small part of the overall assessment in the course may have lead to students losing interest.

To exploit more fully the value of PeerWise and to improve student motivation towards using the tool more regular exposure and integration in the pedagogic process would be advised. For example having to submit questions on topics each week would enable more marks to be given to contributions, and ensure that, by the final exam time, there would be a significant number of questions in the Peerwise system which students could use to study. By using the system weekly, students would become more familiar with the system and see it as an

integrated part of the course. They would also be more aware of all the questions and feedback they can gain from using the system.

Acknowledgements

This research was funded by a grant from the Associate Dean: Teaching and Learning of the Faculty of Commerce and Administration, Victoria University of Wellington, for which grateful acknowledgement is made. Thanks must also go to Paul Denny of Auckland University for his helpfulness and willingness to answer any questions related to PeerWise and its use.

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