Using online peer feedback in formative assessment for medical sonography students teaching: the student view

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Abstract Purpose: This paper reports the results of a survey of external medical sonography university students which investigated their perceptions of anonymous online peer feedback formative assessments. Peer feedback is gaining popularity among academic teachers to both promote deeper learning and reduce heavy marking loads. Methods: In a cross sectional study design, 77 postgraduate students enrolled in an externally delivered sonography course in 2009 were invited to participate in a student evaluation survey. Results: Sixteen students (21%) responded to the survey. Students registered positive perceptions on a Likert scale for items asking about the value of the learning experiences, their level of comfort in participating in peer feedback, and their acceptance of using a web based medium. Anonymity rated highly as an important element of the assessments. Two-tailed Mann-Whitney U tests demonstrated no significant differences (P < 0.05) between student perceptions of assessment items with and without peer feedback, or between the feedback provided by their peers and the feedback provided by the teacher. Conclusion: Open questions provided insight in how the students perceived the assessment could be improved. Future derivations of the described assessment process should use a more user-friendly online platform, and the breadth of course content should be expanded so that all learning objectives and content are integrated into formative assessment. As well as being more acceptable to students this approach is more likely to motivate students to meet learning objectives, and encourage active learning. Further evaluation will be required as the assessments are modified.

Keywords: anonymous peer feedback, assessment, medical sonography, online learning, student feedback.

Introduction

Formative assessment integrated with teacher feedback is a fundamental part of university teaching. Well-designed formative assessment in combination with quality teacher feedback helps students to identify gaps between their current and desired knowledge, and guides them to take the necessary action to achieve learning outcomes.1-2 Extensive quality teacher feedback is particularly important in the delivery of external online courses to alleviate student isolation and help students meet learning expectations.3 Academic teachers are experiencing increasing pressures with heightened institutional and student expectations for the delivery of quality teaching in tandem with cuts in university budgets and increasing enrollments. In this environment, academic teachers are looking for innovative teaching and learning strategies to meet these challenges. Peer teaching and learning techniques are becoming popular among higher education teachers to improve formative feedback to students. This is an approach where students learn with and from each other without the immediate intervention of a teacher.4,5

Peer teaching and learning is attractive to teachers because it is reported to be logistically and economically efficient while retaining effective teaching and assessment.6 There are many ways of implementing peer teaching and learning, including “peer assessment”, “peer teaching”, “peer learning”, “peer tutoring” and “peer feedback”. These methods differ in how student involvement is integrated into student learning, but are similar in that students take an active part in learning, and they are used for formative rather than summative processes.7 There is also evidence that peer teaching and learning may provide added value by developing critical thinking, communication, lifelong learning, and collaborative skills.8-12 While many teachers feel that peer teaching and learning activities have great possibilities it is important to consider the student response to this practice. If students perceive that the activity is sufficiently worthwhile then it is more likely to be successful. Student evaluation is extremely important and has an important role to play in the quality assurance process of teaching.13

This paper reports on the student evaluation of an innovation in teaching external medical sonography students at the University of South Australia. The students participated in a peer teaching and learning activity called “peer feedback” which was incorporated into formative assessment activities. “Peer feedback” refers to an activity where students provide rich detailed comments to their fellow students’ work.7,14

Methods

In the first semester of 2009, online peer feedback was incorporated into formative assessment activities for external medical sonography students for the first time. A cross-sectional survey methodology was used to ascertain student perceptions of the formative assessment activities using student evaluation to inform future teaching practice. Specifically, this evaluation sought to answer the following set of questions:

1. Did the students perceive the formative assignments as a valuable learning experience?
2 Were the students comfortable participating in peer feedback?
3 Did the students accept the use of a web based medium?

The external teaching and learning setting
This case study was conducted on one externally delivered sonography course which is undertaken by medical sonography students at the University of South Australia as one of a set of eight compulsory courses in a post-graduate diploma program. The course is offered exclusively as an external course and structurally consists of eight learning modules in which students use self-directed learning to explore the underpinning knowledge required to perform a range of sonographic examinations. The content knowledge covered in the course includes the anatomy, physiology, embryology, pathology and sonographic techniques across a range of sonographic examinations. Sonography learning is supported by a printed study guide and a range of online resources including readings, quizzes, weblinks, power point presentations, online discussion and image viewing exercises.

The major assessment item for the course is a final written examination worth 70 per cent of the student’s final grade. The written examination is a combination of multiple choice and short answer questions including image evaluation which potentially could examine all course content. Two formative assignments, each worth 15 per cent of the total grade provide the students with feedback on their learning prior to the final examination.

Formative assessment tasks in previous student cohorts required the student to reflect on the knowledge and skills required to perform at least four different types of examinations. The lecturer provided individual feedback to each student through written feedback and a grade.

Introduction of online “Peer feedback” into formative assessment
After consultation with a university online advisor, a freely available wiki website (Wetpaint) was used to facilitate the introduction of online peer feedback into the formative assessment of the course. The course coordinator prepared a password protected, private website containing a collection of web pages, each presenting a different case scenario with a series of questions. The website could only be accessed if invited by the lecturer via email through the website. The lecturer invited all students in the course to subscribe to the website with a pseudonym user name and log-in identity to maintain anonymity. Each student revealed their user name to the course coordinator so that student activity could be tracked for assessment purposes. The course coordinator was the only subscriber to the website who could identify the authors of all student postings.

The first assignment required the student to author a piece of original work. Each student was instructed to access one allocated webpage on the website. Each web page contained a different case scenario, covering one topic within the course. The student was asked to answer a standardised set of questions (Figure 1). Each student in the course was therefore given a unique case scenario for the assignment. After the due date, each web page with its case scenario was populated with answers to questions by one student. All students could freely view all web pages and therefore the work of their peers. Brief lecturer feedback was provided to the student through the university’s electronic assignment return program prior to the due date for the submission of the second assignment.

The second assignment required the student to provide peer feedback to one of their co-students. Each student was instructed to access one allocated web page covering one case scenario on the website and to review and provide feedback on the student’s responses that had been made on that web page in the first assignment. The students were required to provide feedback by drawing on their own reading, experience or advice from their tutors. They were asked to comment if they were in agreement with the first student’s responses, and also to provide additional information to supplement the contribution made by the first student. Assessment was based on the student’s ability to provide accurate and respectful commentary which enriched the original contribution. Therefore, after the assignment due date, each web page in the website was populated with an original contribution by the first students, and peer feedback by a second student. The course coordinator then provided additional feedback on all the web pages, which confirmed or refuted student claims, clarified ambiguities and provided additional information where there were gaps. Students were encouraged to review all the web pages as a self-directed revision and learning exercise, in preparation for the final examination.

Participants
Postgraduate students enrolled in an externally delivered sonography course in the first semester of 2009 were invited to participate in a student evaluation survey to provide comment on the online peer feedback formative assessments. Seventy-seven students from across Australia were enrolled in the course as external students. A co-requisite of the course was that each student was engaged in sonographic clinical practice for at least two days a week. The majority of students were employed full time as radiographers or trainee sonographers in radiology practices while undertaking their studies part-time. There were no regular face-to-face lectures delivered in the course, excepting for an optional one
Table 1: Descriptive results for Theme 1 (value of the learning experience).

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency of Likert scale responses (%)</th>
<th>Sum</th>
<th>Mean</th>
<th>SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>0 (0) 1 (6.25) 12 (75) 3 (18.7)</td>
<td>66</td>
<td>4.13</td>
<td>0.5</td>
<td>0.245</td>
</tr>
<tr>
<td>Item 2</td>
<td>0 (0) 0 (0) 14 (87.5) 2 (12.5)</td>
<td>66</td>
<td>4.13</td>
<td>0.342</td>
<td>0.147</td>
</tr>
<tr>
<td>Item 3</td>
<td>0 (0) 0 (0) 3 (18.7) 11 (68.7) 2 (12.5)</td>
<td>63</td>
<td>3.94</td>
<td>0.573</td>
<td>0.279</td>
</tr>
<tr>
<td>Item 4</td>
<td>0 (0) 1 (6.25) 2 (12.5) 11 (68.7) 2 (12.5)</td>
<td>62</td>
<td>3.88</td>
<td>0.719</td>
<td>0.343</td>
</tr>
<tr>
<td>Item 8</td>
<td>0 (0) 1 (6.25) 2 (12.5) 12 (75) 1 (6.53)</td>
<td>61</td>
<td>3.81</td>
<td>0.655</td>
<td>0.343</td>
</tr>
<tr>
<td>Item 9</td>
<td>0 (0) 1 (6.25) 5 (31.2) 10 (62.5) 0 (0)</td>
<td>57</td>
<td>3.56</td>
<td>0.629</td>
<td>0.294</td>
</tr>
<tr>
<td>Item 10</td>
<td>0 (0) 0 (0) 13 (81.2) 3 (18.7)</td>
<td>67</td>
<td>4.19</td>
<td>0.403</td>
<td>0.196</td>
</tr>
</tbody>
</table>

Key: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree, 95% CI = 95 per cent confidence interval, SD = standard deviation, % = percentage.
day weekend workshop towards the end of the course.

The student evaluation survey was voluntary, anonymous, and students were advised that the results of the survey may be reported in a publication or conference presentation. Under the university guidelines for evaluation activities, institutional ethical approval for the survey was not required.

**End of course student evaluation survey**

An email was sent to all students two weeks before the end of the teaching period inviting students to rate their attitudes to online peer feedback in an online survey. The survey was accessible for a period of four weeks. Students were also given the opportunity to provide responses on hard copy surveys which were distributed at the end of course workshop. The survey consisted of 21 items (Figure 2). Seventeen of the items used a 5-point Likert-Scale to provide quantitative data, and four items were open questions to provide qualitative data. Three themes were explored in the survey; student perception of the value of the learning experience (items 1, 2, 3, 4, 8, 9 and 10); student comfort in participating in peer feedback (items 5, 6 and 11) and student acceptance of using a web based medium (items 13, 14, 15, 16, 17, 18 and 19). Demographic data about each participant such as age, gender and clinical work site were not collected to avoid the risk of revealing the identity of the student.

Responses to Likert scale items ranged from strongly agree, to agree, to neither agree nor disagree (neutral), to disagree, to strongly disagree. Responses were scored according to the polarity of the question. If a question was of positive polarity the responses were scored in descending order; strongly agree received a scale of five, agree received a score of four, neither agree nor disagree received a score of three, disagree received a score of two and strongly disagree received a score of one. If the question was of negative polarity the responses were scored in ascending order: strongly agree as one, agree as two, neither agree nor disagree (neutral), to disagree, to strongly disagree as five. The higher the score, the more positive the student responses were relative to the assessment tasks.

The Likert scale items were analysed using descriptive statistics. Responses to the open ended items were coded and categorised into the identified themes to support the quantitative data. Two-tailed Mann-Whitney U tests were performed to test for differences (level of significance < 0.05) between opposing Likert scale items.

**Results**

Of the 77 students enrolled in the course, 16 students (21%) returned the questionnaire (two online and 14 hard copies were returned). There were no missing data for Likert scale questions, excepting item 15, where one student did not respond.

There were 27 (of a possible 64) responses to the open questions. There were three responses for item 7, two responses for item 12, 11 responses for item 20 and 10 responses for item 21.

Mean responses to all questions were rated more positively than neutral (neither agree nor disagree), for all items excepting item 18 (range 2.86–2.71). Mean responses for each student rated more positively than neutral (neither agree nor disagree) excepting for two students (range 2.86–2.71).

**Theme 1: value of the learning experience**

**Quantitative findings**

Students were asked to indicate how valuable they thought different aspects of the formative assessments were as a learning experience in items 1, 2, 3, 4, 8, 9 and 10. Descriptive statistics for these items are presented in Table 1 and Figure 3. There were no significant differences between student perceptions of the two formative assessments (authoring assignment and peer review assignment). This was true when students answered in regard to the learning experience (items 1 and 2) and in regard to having the capacity to viewing of the work of their peers (items 3 and 4). There were no significant differences for student perceptions between the feedback provided by their peers and the feedback provided by the lecturer (items 8 and 9).

**Qualitative findings**

There were 14 responses to open end questions in the survey in which students commented on the value of the learning experience. Positive comments supported the positive Likert scores, particularly in regard to the perceived importance of peer and lecturer feedback, and the value of the assignments to facilitate revision, deeper learning and personal benchmarking. Negative
comments were made by one student who thought viewing other students work for revision was laborious, and three students who expressed a preference to be involved in assessment activities that covered a wider cross-section of course content than what was offered. The standard of feedback provided by students in the second assignment was wide ranging from superficial comments to evidence of deeper reflective thinking.

Theme 2: student comfort in participating in peer feedback

Quantitative findings
Students were asked to indicate how they felt about different aspects of participating in the peer feedback in items 5, 6 and 11. Descriptive statistics for these items are presented in Table 2 and Figure 4. The item asking about anonymity rated most positive. Students had slightly less positive responses when asked about their perceptions of all students in the course viewing their work, and one student providing peer feedback.

Qualitative findings
There were only two comments from students relating to student comfort in participating in peer feedback, one student having ambivalent feelings “...I wasn’t fussed being marked by others” and another student confirming that anonymity was a strength of the assessment activity.

Theme 3: student acceptance of using a web based medium

Quantitative findings
Students were asked to indicate their acceptance of different aspects of using the web based platform as a medium for the assessments in items 13, 14, 15, 16, 17, 18 and 19. Descriptive statistics for these items are presented in Table 3 and Figure 5. There were significantly more positive responses from students when asked of their preference to use a different web based medium other than that which was used for the assessments (items 18 and 17).

Table 3: Descriptive results for Theme 3 (student acceptance of using a web based medium).

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Sum</th>
<th>Mean</th>
<th>SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 13</td>
<td>0(0)</td>
<td>3 (18.75)</td>
<td>0(0)</td>
<td>11 (68.75)</td>
<td>2 (12.5)</td>
<td>60</td>
<td>3.75</td>
<td>0.931</td>
<td>0.456</td>
</tr>
<tr>
<td>Item 14</td>
<td>0(0)</td>
<td>4(25)</td>
<td>0(0)</td>
<td>10 (62.5)</td>
<td>2 (12.5)</td>
<td>58</td>
<td>3.63</td>
<td>1.025</td>
<td>0.5</td>
</tr>
<tr>
<td>Item 15</td>
<td>0(0)</td>
<td>3(20)</td>
<td>1(6.67)</td>
<td>11 (73.33)</td>
<td>1(6.67)</td>
<td>54</td>
<td>3.6</td>
<td>0.91</td>
<td>0.461</td>
</tr>
<tr>
<td>Item 16</td>
<td>0(0)</td>
<td>3 (18.75)</td>
<td>4(25)</td>
<td>9 (56.25)</td>
<td>0(0)</td>
<td>54</td>
<td>3.38</td>
<td>0.806</td>
<td>0.397</td>
</tr>
<tr>
<td>Item 17*</td>
<td>0(0)</td>
<td>1(6.25)</td>
<td>5 (31.25)</td>
<td>7 (43.75)</td>
<td>3 (18.75)</td>
<td>60</td>
<td>3.75</td>
<td>0.856</td>
<td>0.421</td>
</tr>
<tr>
<td>Item 18*</td>
<td>0(0)</td>
<td>4(25)</td>
<td>11 (68.75)</td>
<td>1(6.25)</td>
<td>0(0)</td>
<td>45</td>
<td>2.81</td>
<td>0.544</td>
<td>0.265</td>
</tr>
<tr>
<td>Item 19*</td>
<td>0(0)</td>
<td>2 (12.5)</td>
<td>4(25)</td>
<td>6 (37.5)</td>
<td>4(25)</td>
<td>60</td>
<td>3.75</td>
<td>1</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Key: 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree, 95% CI = 95 per cent confidence interval, SD = standard deviation, % = percentage, * = items with negative polarity

Figure 4: Results for Theme 2 (student comfort in participating in peer feedback).

Figure 5: Results for Theme 3 (student acceptance of using a web based medium).
**Qualitative findings**

Only three of 10 comments relating to the theme of student acceptance in using a web medium were positive in indicating that access and use of the web platform was easy. Seven negative comments were registered, consisting of complaints of difficult access, text formatting and image downloading on the web pages. These findings together with the Likert responses indicate that the high volume of negative comments for this theme arise from a negative perception of the particular platform used for the assignments rather than an overall poor acceptance of using web based activities for assessment in general.

**Discussion**

The teaching innovation described in this paper was undertaken because of its potential to improve the teaching and learning for external medical sonography students. The main modification to previous techniques was to introduce more student interaction into the formative assessment using peer feedback. Different methods of peer teaching and learning in university teaching have been widely discussed in the literature to support the perception by educators that a deeper learning experience emanates from students both receiving and providing peer feedback. It has been suggested that collaboration with peers provides the students with a vehicle to move students away from dependence on their teachers as the major information source to a situation where each student develops the capability to not only reflect on the work of their peers but also on their own work. Over time this can lead to increased learning. Peer feedback in an online learning environment may personalise the environment. Although the form of feedback utilised in the course was not dynamically interactive and was limited in building a sense of community, it did provide a medium for the students to view the work of their peers in an environment that was otherwise isolating. They could see how other students responded and therefore make a personal judgment on their own performance. Other pedagogical reasons for implementing the activities was to sharpen student engagement and to increase student’s satisfaction with the course and with the teacher, and because it resembles professional practice. Providing and receiving feedback from work colleagues is a common learning activity in many professional practices.

The use of peer feedback is also an effective strategy for university teachers to reduce marking load and therefore concentrate their resources on better quality learning outcomes. Although it was tempting when designing the peer feedback approach, to use peer feedback on its own to deliver feedback to students, a decision was made to retain teacher feedback for formative assessment so that students could be confident in the accuracy of the feedback they were receiving. This decision compromised potential reductions in workload for academic staff. Another method of maintaining accurate feedback is to use multiple peer assessors but this technique was thought to be cumbersome and too complex to manage. Small reductions in marking load were made, and future refinements may improve efficiencies.

Peer assessment (allocation of grades) was not utilised to avoid the risk of inaccurate grading which has previously been reported, and also the risk of student non-acceptance.

The student evaluation in this report allowed judgments to be made on the value of the assessment based on student perceptions rather than teacher perceptions alone. Student perceptions do not measure the effectiveness of learning but are useful in helping teachers define improved ways to meet student needs and are important because student perceptions may be more important than reality.

**Student perceptions of the learning experience**

Student perceptions of the learning experience were positive for both assessments. The first assessment mirrored conventional assessments that had been provided for students in previous student cohorts. The main difference from assessments offered to previous cohorts, was that breadth of knowledge tested was less, and students were able to view each others contributions online. The capacity of the student to view the work of other students exposed them to a greater breadth of content knowledge; although this knowledge was not assessed. The second assessment represented the main innovation, which was to provide peer feedback. In a similar style as the first assessment, the material covered in the assessment was limited to one topic, and students were able to view each other’s feedback online. From the Likert items there were no differences in the perceptions of the learning experience in performing the activity between the two assessments. Similarly, there were no differences in the perceptions of the value of having the ability to view other students work for either of the assessments. Student responses to open ended questions provided more insight, particularly around a subtheme of the narrow breadth of content knowledge covered in the assignments. Comment such as “would prefer maybe some quizzes or something as well to test bigger cross section of topics” and “only two topics out of course was investigated by students, must rely on others…” indicate a preference for students to take assessment activities that cover a wider breadth of content.

When designing the activities it was thought that reducing the assessable content would have a positive effect on student workload, and that the online environment would provide a good revisionary tool for the students, so they could review other topics in the course. The flaw in this thinking was an oversight of the established view that assessment drives learning. The motivation for unassessed revision is less compared to assessable revision activities and students, who often feel overloaded will only study the parts of the course that are assessed. While the online environment provided an ideal medium for students to share their work with their peers, and to benchmark themselves against each other, adjustments need to be made to better integrate the whole of course content and learning objectives into formative assessment.

The challenge for the teacher is to devise activities that not only address depth of learning, but also breadth of learning. This concept is embodied in a paradoxical comment from one student “it was good to do two subjects in depth. Looking at the other person’s work, made me look harder at the answers; to see if anything had been missed. I would prefer to answer questions on various pathologies...”

**Student comfort in participating in peer feedback**

Student comments were positive for their comfort with the peer review process, with highest ratings for the items which asked about the importance of anonymity in the peer review process. An anonymous peer feedback activity was chosen because it provokes more critical feedback, social pressures are relieved and students can express themselves freely without being concerned with interpersonal factors. A non-anonymous peer feedback activity may have been a factor in the general positive responses across the survey.

While anonymity allows students to engage more critically, there has also been some discussion in the literature around laziness that...
may occur in association with anonymous assessment. This phenomenon was not observed in the course, with students providing very detailed accounts. Laziness may have been prevented in this course because student contributions were not anonymous to the course coordinator. To make students more accountable in an anonymous assessment setting all learning objectives of the course should be assessed. This approach would be consistent with the previous argument in this discussion to increase the breadth of content and objectives in the formative assessment.

Student acceptance of a web based medium
A freely available wiki website was used as the web platform to administer the assessment instead of the university teaching and learning online platform because of its function to allow students to log on to the site with a pseudonym, and therefore maintain anonymity. While the wiki website offered this advantage, in other ways it was problematic. As indicated in open ended responses, students found it difficult at times to access for different reasons, they found it hard to format their work, and they found it difficult to upload and format diagrams and images. The course coordinator was required to assist with these processes when students were having difficulties, which became a burden. Despite these reported problems, responses on the Likert scales for using an online medium were positive. An indication of some dissatisfaction with the particular choice of web platform is evidenced by significant differences in the scores for the item 18 and item 19. This difference indicates that students would be happier using an online platform, but not the platform that they were offered. There are many online platforms available as options for this type of assessment and learning about potential pitfalls is useful for assessing options in the future.

Limitations
This student evaluation survey was primarily conducted to inform the teaching and learning practices of a course and was not intended as a formal research project. It would be difficult to generalise these findings to other courses which cover a different student population, different assessments and different learning outcomes. Caution should be applied when interpreting these results for a number of reasons that make it difficult to transfer the results to other settings. The survey suffered from a low response rate (21%) and low response number (16) and a power calculation was not performed to determine the minimum number of responses required to be a representative sample. The small number of responses also impacted on the ability to use statistical analysis to establish the tool as reliable and valid. Low response rates often result when evaluations are conducted online rather than in class. Most survey forms in this evaluation were returned when a paper copy was made available at an optional weekend workshop. This survey did not address the quality of the assessments in terms of learning outcomes, with only student perceptions investigated. There are difficulties with the measurement of learning; it is not easy to plan an educational study with a control and experimental group, and there are also ethical limitations to this approach.

Despite its limitations, this survey does provide information on the perceptions of students from the broader medical radiations arena towards online peer review.

Conclusion
While the results of this survey are preliminary, they provide encouraging findings about positive student perceptions and satisfaction levels of online peer feedback in formative assessments for medical sonography students. The literature supports the use of peer feedback as a tool to encourage deeper learning for external students. Feedback provided from this student evaluation survey indicate that future derivations of the described assessment process should use a more user friendly online platform, and the breadth of course content should be expanded so that all learning objectives and content are integrated into formative assessment. This approach is likely to be preferred by students and also provide motivation to meet learning objectives. Further evaluation of the assessments as they are modified are required to measure learning outcomes in addition to measuring students perceptions.

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