

Student reflection and learning through peer reviews

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This paper describes lessons learnt whilst using an online peer review system in an undergraduate unit for pre-service teachers. In this unit, students learn to use information technologies as part of their future teaching practice. The unit aims to foster graduates who become lifelong reflective educators by providing opportunities to explore and reflect on how they might use technology in authentic learning situations. Whilst peer review is an appropriate activity for supporting critical thinking and reflective practice in this kind of unit, it requires a number of decisions to be made in relation to student preparation and support, implementation strategy, and technological infrastructure to make it work in specific contexts. Much research has been conducted in recent years to inform educators in making these decisions. However, there are still gaps in the research, particularly in how to improve the quality and consistency of feedback that students give to each other in their feedback. This paper describes the experiences of implementing an online peer review system aiming to improve quality and consistency of feedback. This exploration has revealed that we can learn much about ways to improve our teaching practices by giving students an opportunity to review each other's work and give feedback.

Introduction

Many universities aim to produce graduates who are lifelong learners capable of assessing their own learning and monitoring their performance (Boud, Cohen & Sampson, 1999; Ross & Rolheiser, 2003). Peer assessment and review is an authentic, real-world approach to assessing student learning and achievement that contributes to development of these attributes by fostering students' capabilities for critical thinking and self evaluation (Ross & Rolheiser, 2003; Wood & Kurzel, 2008).

Peer assessment and peer review are processes whereby students grade each other's work for either summative or formative purposes (Bostock, 2006). The term 'peer assessment' is often used to describe the process of giving summative assessment, whereas 'peer review' is generally used for giving and receiving non-summative formative feedback (Wood & Kurzel, 2008). As noted by van den Berg, Admiraal and Pilot (2006), such reviews have benefits not only for the student receiving the feedback, but also for the student giving it. Students generally experience peer review as a non-threatening process that benefits their learning by providing suggestions from their peers about how to improve their work and by helping them understand the criteria that will be used for the summative assessment of their work (Wood & Kurzel, 2008). In this respect, there are well documented benefits from encouraging students to review each other's work (Wessa & De Rycker, 2010). The students whose work is reviewed may benefit from getting external perspectives on ways in which their work may be improved, thus stimulating their critical thinking (Sims, 1989). The students doing the review also benefit as a result of having to process and analyse the work of a peer (Wessa & De Rycker, 2010), and may get ideas for improving their own work (Sims, 1989). The peer review process may extend

over a period of time, and may involve students in developing the marking criteria as well as applying those criteria to their own, and others' work. Students are thus encouraged to develop higher level awareness of the task through this extended engagement with the teacher in the assessment process (Wood & Kurzel, 2008).

Implementation Issues

For a peer review process to deliver benefits to students and educators, it needs to be set up according to a number of principles (Wessa & De Rycker, 2010). The process should have a clear purpose, and, be:

- Sustainable, in managing workloads for students and educators;
- Predictable, in managing the quality of the reviews and keeping them relevant to the purpose of the assessment;
- Comparable, in ensuring that the marking is fair.

The challenge for sustainable delivery of peer reviews for online study is to find a technology that facilitates deployment of peer reviews without increasing workloads for students and educators (Knight & Steinback, 2011). The strategy used by Knight and Steinback (2011) involved 11 steps:

1. Creating a grading rubric;
2. Entering the grading rubric into a survey generator (they used *KwikSurveys*);
3. Sending out an email to each student with detailed instructions on how to fill in the survey, adding the document to be reviewed as an attachment;
4. Resolving problems where students are unable to fairly review someone's work because of personal relationships or conflict of interest;
5. Processing the data from the reviews to enable students to see reviews of their work;
6. Dealing with late submissions;
7. Producing a PDF file for each student containing their reviews;
8. Composing an email to each student to enable them to view their feedback - checking that all identifying information is removed;
9. Assessing each student's peer review;
10. Assigning tentative grades to each student;
11. Generating a final grade.

The 11-step process developed by Knight and Steinback (2011) is clearly more time-consuming to perform than in-class peer reviews and would arguably be untenable for classes much larger than the 60 students that they worked with in their study. However, it is possible that using a technological solution to automate some of these processes would ameliorate much of the routine work associated with such an approach.

Addressing the quality and fairness of the marking process involves consideration of the process for implementing the peer reviews. Using a formative (peer review) rather than summative (peer assessment) approach removes most of the unfairness that might arise from peers marking each other's work (Wood & Kurzel, 2008). Making the reviews

anonymous can help avoid students feeling conflicted about commenting on the work of friends (Bostock, 2006). Preparing students for their role is also important for maintaining quality of the feedback (Pearce, Mulder & Baik, 2009), especially training them to focus on the aspects of their peer's work that are important.

The context

This paper describes how a peer review process was implemented in 2012 using technology for a first-year unit in a Bachelor of Education course for prospective primary school teachers. The unit had over 300 enrolled students, with about one third being external (entirely online) students. The focus of the unit was on how technology can be used by teachers to facilitate student learning. The unit adopted an authentic learning approach that engages students in complex, real-world tasks that result in production of artifacts that represent their learning (Herrington, Reeves & Oliver, 2010). The unit started with a focus on students' social use of technology, then moved to technology use as learners (research skills) and finally and most importantly, as teachers (pedagogical skills). In the first assignment, students were asked to plan a social event, and think about how technology might be used to enable that event and then set up an online resource to facilitate it. Students were given the following initial directions for the assignment and the peer review process:

- Think of a social situation where social networking could assist in the organisation of an event (such as a party, a family reunion, a sporting carnival, a wedding, a dinner party, a play group, a concert, a social club, etc.).
- Examine and learn to use *one social networking site or web application* (such as *Twitter, Diigo, Taste.com, Shelfari.com, Skype, Heritage.com, iTunes*, etc.) that would assist in the organisation and/or management of the event. Investigate and describe what the networking site does, then write clear instructions on how to sign up and use the site/service, and describe how a peer or partner can contribute to the social site.
- Share your work with a peer (your tutor will assign partners for this activity) who will follow your instructions and provide advice and feedback through peer review (you will do the same for your partner).
- Comment regularly on your blog about the process. Provide reflections on how you went about learning or refining the program or site, creating instructions and the process of peer review.

This assignment has been somewhat problematic in the past because some students have misunderstood the task and tended to focus on technology as a goal in itself rather than as an enabler for the event. The peer review process was introduced to help students focus on the assessment criteria that asked students to review the context of the event and the suitability of the technology for the context. Students also reviewed each other's online reflective journals in which they reflected on their learning and how that learning contributed to the development of the resource.

The challenges

Despite the potential contribution that peer review processes can make in helping students to achieve their desired learning outcomes, there are numerous challenges that must first be overcome. The first challenge relates to the attributes of students. Students may lack the skills, motivation, and knowledge required to engage constructively in a peer review process (Sluijsmans, 2002). The required skills relate to being able to identify the strengths and weaknesses of another student's work and give constructive feedback on how to improve that work. Lack of motivation is also a major issue, because the whole process depends on students making the effort to carefully look at each other's work and evaluate it in sufficient depth to provide useful feedback.

The second challenge relates to strategies underlying the design of the peer reviews. Ideally, as noted by Lu and Bol (2007), peer assessments for summative purposes need to be completed anonymously so that students are not prejudiced in their marking by personal relationships with their fellow students. As with peer reviews, students are more prepared to make critical and constructive comments when they are anonymous (Howard, Barrett & Frick, 2010). However, there are advantages in peer reviewers being identified because students need to learn to give each other honest and constructive feedback when working as a team (Gulikers, Sluijsmans, Baartman & Bartolo, 2009).

The third challenge when designing peer reviews, is deciding on the number of peer reviews each student performs. The quality of feedback given by students to each other tends to be quite variable (Robinson, 1999), so ideally each student should receive feedback from multiple reviewers. Deciding the number of reviews involves balancing student and teacher workload issues against the benefits of multiple reviews. Furthermore, decisions need to be made on the degree of monitoring reviews to ensure they are not over-critical and provide useful feedback to students (Pearce et al., 2009).

The fourth challenge relates to the practical management of a peer review process (Mostert & Snowball, 2012). Students need to be given access to each other's work and a forum for exchanging assessments. While peer review systems are becoming increasingly sophisticated in providing the means to upload and download documents, at the very least they need to be customised to automate the complex management of files associated with multiple peer reviews that was identified by Knight and Steinback (2011). All assessments need to be monitored and possibly assessed by teachers, which can be a logistical challenge where large numbers of students are involved.

Designing the peer feedback system

In the peer review system described in this paper, two key decisions were made in developing a streamlined and workable system for the unit. The first decision was to assess students on the quality of feedback they provided to their peers. This decision was based on the importance of students engaging seriously with the peer review process to maintain the desired quality and consistency of feedback (Pearce et al., 2009). Ideally, each student would have assessed three or more students' products. However, because of

workload issues for the teachers assessing the work, each student was asked to review only one other student's work. The second decision was to identify each reviewer to the student whose work was reviewed. Whilst the general recommendation for peer reviews is to keep reviews anonymous (Howard et al., 2010), it was felt that identifying students would make them accountable to each other and reduce the likelihood of overly critical comments. It also had the practical advantage that students could liaise with each other for clarification if they experienced problems in viewing their work, and through these communications could foster a collaborative environment with a focus on helping each other — and indeed, this was the result for many pairs of students.

Since student work was online, we developed a web-based system for facilitating the peer reviews. Whilst there are a number of online tools available for facilitating peer reviews (Keppell, Au, Ma & Chan, 2006; Mostert & Snowball, 2012; Pearce et al., 2009), such tools appeared to lack specific features (especially simplicity and flexibility of use) that were necessary in dealing with large numbers of students, so we developed a web-based tool to meet our needs. Students logged into the system using their student ID numbers and were given the name and web address of the item they were to review, along with a web-based rubric specifying the criteria that they were to use. Students were advised that these same criteria would be used for summative marking of their own work later in the semester. When students submitted their review it automatically sent an email to the reviewed student advising them that a review had been performed, and gave them the link to the review. Students could conduct more than one review of that student's work if they wished. For example, if a student modified their work in response to a review they could ask for it to be re-reviewed. At the assignment submission due date, the teaching team used the same rubric to assess each student's work. The teaching team also reviewed the quality of the review each student had performed. Once marking was completed students could view both the peer review and the tutor review.

The technology used in this web-based system was kept basic to avoid technological problems such as incompatible browsers. The review page used simple HTML forms, with no cookies, *Flash* or Java applets being required to complete the reviews. To make it easy to set up a website to display the marking rubric and manage student peer reviews a Microsoft *Excel* workbook was created that used *Visual Basic* macros to generate the web pages required by the peer review system. Through the use of this *Excel*-based Peer Review System Generator the process for organising and conducting peer reviews involved 10 steps, some of which took only a few minutes:

1. Develop a marking rubric for the assignment.
2. Copy the rubric table into a *Peer Review System Generator* spreadsheet.
3. Copy student details from the University's student records system into another *Peer Review System Generator* spreadsheet.
4. Allocate students into review groups in the *Peer Review System Generator* system. This will also allocate tutors to mark students once the assignment is complete.
5. Run the *Excel* *Peer Review System Generator* excel macro to generate all of the web files required by the system.
6. Upload the web files to a web server.

7. Link the unit content management system (*Blackboard*) to the student login page so that students can log in once the link is made available to them.
8. When students log in they are invited to enter the URL for their website so that their peers can access it. Once logged in they can access their peers' websites and the review rubric that they fill in and submit. Their peer automatically gets access to the review as soon as it is completed.
9. Once students have conducted their reviews and had an opportunity to modify their own websites in response to the reviews the tutors then mark their websites and also give marks based on the quality of the reviews that students give to their peers.
10. Once all marking is completed the students are given access to the reviews by their tutors.

The *Excel Peer Review System Generator* is documented at:
<http://ed-tools.wikispaces.com/Peer+Review+Generator>

Implementing the peer review system

Each peer review involved assessing each other's submitted work on two criteria: description of the context of use of the resource, and quality of instructions for using the resource. The rubric used by students for reviewing their work was also used for assessment of the resource. This rubric is shown in Figure 1 below.

Social Resource

Context of use of resource or social networking tool (e.g., a party, sporting event, dinner party, reading group, etc.)				
No context provided of the social setting where the resource or social networking tool would be used	Brief description of context provided	Good description of context provided	Detailed description of context provided	Very detailed description of context provided. Plus evidence of experimentation or suggestions of a range of ways to use the resource
Quality of instructions (e.g. How effective are the instructions provided on accessing the resource or social networking tool?)				
No URL provided or very unclear instructions on how to access and contribute to the social site on the website	Brief instructions about how to access and contribute to the social site on the website	Clear instructions on how to access and contribute to the social site on the website. Plus images and links to illustrate (e.g., images/ screen captures)	Detailed instructions on how to access and contribute to the social site on the website. Plus images and evidence of experimentation with other technologies (e.g., screen captures included)	Very detailed instructions about how to access and contribute to the social site on the website. Plus images and evidence of experimentation with a range of technologies (e.g., printed instructions supported by other media: audio, screen captures, screen casts, etc).

Written feedback for your classmate to improve the work:

What did you think were the best features of this resource?

What features do you think could be improved and how?

Figure 1: Rubric used for conducting peer review

The peer review process was purely formative and the marks students awarded each other did not count towards their final grade. Students were given a few days to improve their work in response to the feedback they were given. The quality of reviews given was assessed by tutors (see Figure 2 for the rubric used for marking students' reviews). The focus in assessing students' reviews was that they should give constructive suggestions to their peers on how to improve their work.

Peer reviews: Marking criteria (5%)

Fail (< 2.5)	Pass (2.5)	Credit (3)	Distinction (3.5)	High Distinction (4-5)
Peer reviews not completed within review period (Friday or later)	Peer reviews completed within review period (Tues - Thurs)	N/A	N/A	N/A
Review 1 No review completed or many items not completed	Review 1 Brief review but no useful feedback about what worked well and what could be improved.	Review 1 Good review with limited feedback about what worked well and what could be improved	Review 1 Very good review with constructive feedback about what worked well and what could be improved	Review 1 Excellent review completed with very constructive feedback about what worked well and what could be improved.

Figure 2: Rubric used for marking student peer reviews

Since the purpose of implementing the peer review system was to address misunderstandings by students about the marking criteria and to clarify the purpose of the assignment, we devoted time in one lecture to demonstrating the marking guide and describing how it would be used in assessing student work. This involved discussing what we were looking for in each component of the marking guide and describing what different levels of performance might look like on each criterion.

Observations

Students kept a reflective journal that was part of their assessment for the unit, in the form of a blog. The observations recorded in this paper are based on an analysis of comments made by the students in their reflective journals.

Virtually all of the 300 enrolled students completed peer reviews as requested. Some experienced problems in conducting a peer review when the student whose work they were reviewing did not submit work in time for a review. The teaching team wanted students to be able to modify their work following the peer review, so the assignment submission deadline was one week after the peer reviews were conducted. Some students did not take advantage of this opportunity, and only submitted their work at the assignment deadline without having it reviewed. However, most students were able to conduct the review without difficulty.

Topping (2009) notes that peer feedback can be 'confirmatory, suggestive, or corrective' (p. 22), and these types were all evident in the feedback students provided to their peers. However, many students were anxious about giving feedback, and they expressed concern about offending a peer with critical (corrective) comments, but noted that giving honest

feedback (suggestive) could be of benefit to their peer. A number of students commented that having a marking rubric helped them concentrate on the important aspects to focus on when giving feedback. One student developed a strategy of sandwiching negative comments between positive ones (confirmatory). Another student consulted a teacher on how to give feedback. It seems that students did benefit from the experience, as one pointed out: “it taught me a lot about reviewing, judging, and marking”.

Students found that receiving feedback from their peers was a mixture of positive and negative experiences. One student summarised this with the comment

... I began to look through my work and compare it to the peer review, and I was able to see what the student was saying. I repeatedly told myself ... this isn't a personal attack, it is designed to help you get better marks, so stop being upset and improve your work.

In general, students found the review process highly beneficial, both in terms of helping them improve their submitted work, and also in terms of learning how to assess their own work. For example, one student commented “... next I want to review my own site and see how I would assess my work against the marking rubric ... this should be interesting!”. Another commented: “... by reflecting on the work of someone else it has forced me to reflect on my own work”.

Despite using the most basic HTML forms in the web page used for conducting the reviews, one or more students had some technical difficulties “... I got a little frustrated when I went to submit the review because I had it all disappear into cyberspace ...”. Fortunately, these events seemed to be rare.

We were pleased to note that by not making the reviews anonymous, and by giving reviewers and reviewees each other's email addresses, we facilitated communication and cooperation between students. One student wrote

... through a few emails I ended up helping her out with a few things ... and over the next few days were both discussing how we were ... (having technical problems) ... I think we supported each other very well.

Another observation was that students were generally positive towards each other in their reviews, complimenting their peers on the clarity of their instructions, the attractiveness of their sites, and the quality of their reflective blogs. Their critical feedback tended to focus on minor spelling errors or problems with links. The reviews consequently tended to focus on superficial features rather than critiquing each other's understandings of the role of technology, and their use of technology as an enabling resource. This highlighted a misconception that many novice teachers hold about the role of technology in education. Many students assumed that technology is something that *teachers* use to facilitate student learning, whereas the philosophy of this unit is that technology is something that *students* use to facilitate their own learning. As part of this philosophy, each student's use of

technology must be set into a learning context. To help students address this misconception, the marking rubric used to assess their work ranged from: 'No context provided of the social setting where the resource or social networking tool would be used' (fail) to 'Very detailed description of context provided, plus clear evidence of experimentation and suggestions of a range of ways to use the resource' (high distinction).

A number of students gave feedback in their review to their peer that there was no context for the resource that the peer had created. However, (and surprisingly), many of those same students also had no context for their own resource. This suggests that at least some students were recognising that there was a problem in their conceptualising of the role of technology in the assignment.

Because the reviews were not anonymous, students expressed some concern about knowing the people whose site they were reviewing. For example, one student wrote:

I was a little nervous in reviewing as I know what it is like to be an absolute amateur at web pages and blogs! I was hoping to receive some-one who I did not know but this was not the case.

However, students generally commented positively on the peer review process in their reflective journals during the course of the unit. They valued the opportunity to view each other's work and were especially appreciative of the comments and suggestions they received from the peers on how to improve their own work. One student wrote:

The pleasing thing for me was to receive an email from the student thanking me for so many good pointers and for being so encouraging. I have since taken another look at the site and was really impressed to see that she had made changes from my comments.

How similar were student reviews to tutor reviews?

Whilst the students seemed to see benefit in doing the reviews, we were also interested to know whether they were interpreting the marking guide in the same way that the tutors were. The web-based peer review system had a database for each student and tutor review, so it was possible to compare reviews. Figure 3 shows the distribution of differences in assessment between students and tutors for two items on the marking rubric ('Context of use', and 'Quality of instructions').

In Figure 3, negative values on the X axis indicate that students marked higher than tutors, whilst positive values indicate that tutors marked higher than students. As can be seen from Figure 3, approximately 30% of students gave the same mark as the tutor for the site they reviewed. The range of differences between the student and tutor was 3 out of 25. Students generally marked slightly higher than tutors by a factor of about 1 mark out of 25, especially for the 'context of use' criterion. This is in keeping with Bostock's (2006) conclusion that there is no consistent finding regarding under- or over-marking by

students on a range of studies he reviewed. He concluded, however, that overall accuracy is good and can be improved by using methods such as: providing clear criteria, moderation by a tutor, and providing some experience or training in assessment.

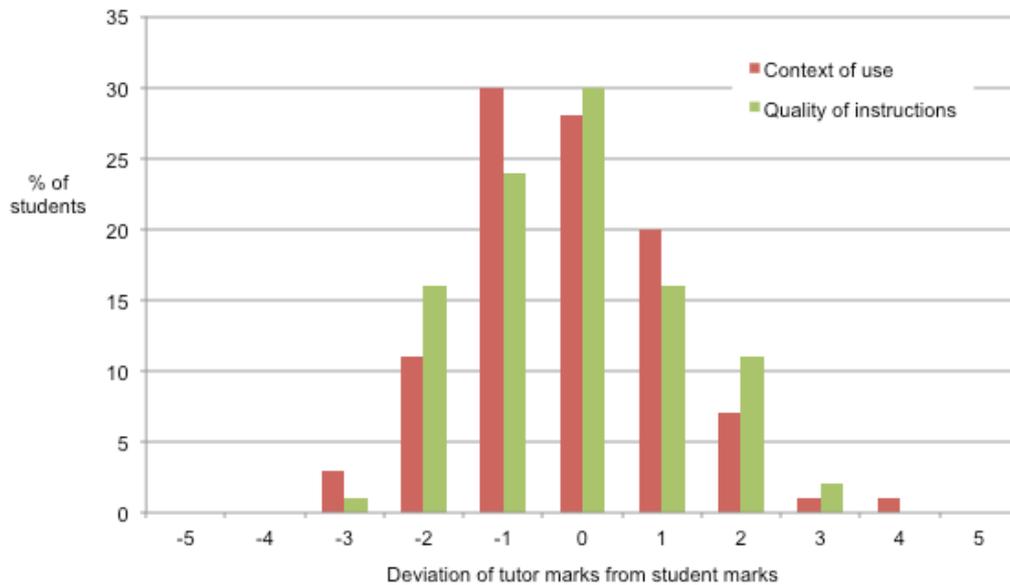


Figure 3: Deviations of tutor marks from student marks for two criteria on the rubric

Conclusion

The key lesson learnt from this investigation is that despite the use of the peer review process and devoting time to explaining the marking guide in detail, many students did not interpret the marking rubric they used for assessing each other's work in the same way as their tutor. This suggests that the peer review process and describing the marking guide in detail is not sufficient to improve understanding of the assessment requirements. It seems that students need to be given an opportunity to calibrate their interpretation of the marking rubric and the factors that characterise a quality resource (Topping, 2009). This calibration process should help students overcome their misconceptions about the topic. For example, many pre-service teachers appear to hold misconceptions about the role of technology in education that are consistent with research into pre-service teachers' assumptions about the role of technology in education (Znamenskaia, 2000). It seems that such assumptions are resistant to change and require teachers (and in this context, pre-service teachers) to make a conceptual shift in the ways they think about technology and their teaching practices.

One strategy suggested for bringing about this conceptual shift is for teachers to engage with their students in a dialogue in which the marking rubrics for the peer review and assessment are developed collaboratively (Sluijsmans, 2002). Such dialogue can deepen

student understandings about the content and goals of the unit and hence address conceptual misunderstandings. Topping (2009) refers to this as a developmental process that:

leads toward more sophisticated peer assessment, and the delivery of plentiful feedback that can help learners identify their strengths and weaknesses, target areas for remedial action, and develop metacognitive and other personal and professional skills (p. 26).

Such negotiations also give students a sense of empowerment and ownership of their learning, and may thus motivate them to participate more fully in the peer review process (Pearce et al., 2009). Using a dialogue to enhance motivation to engage with the process may reduce the need to motivate students by assessing the quality of their reviews, and thus free up the review process to allow students to conduct more reviews, and thus benefit from a greater diversity of feedback (Pearce et al., 2009).

The generally positive comments from students about the peer review process in their reflective blogs suggest that it is a worthwhile activity, and one from which their learning clearly benefited. This is especially the case for students studying the unit online who would otherwise tend to be isolated and lack opportunities to obtain feedback about their work to help them keep on track.

Finally, by giving students a voice, even if that voice is primarily directed to their fellow students, there is much that we can learn about what our students are understanding — and importantly, *not* understanding — that can help us to improve our own pedagogical practices.

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The articles in this Special issue, *Teaching and learning in higher education: Western Australia's TL Forum*, were invited from the peer-reviewed full papers accepted for the Forum, and were subjected to a further peer review process conducted by the Editorial Subcommittee for the Special issue. Authors accepted for the Special issue were given options to make minor or major revisions (minor additions in the case of Boase-Jelinek, Parker and Herrington). The reference for the Forum version of their article is:

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