

## ***Peer review as learning tool in design units***

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## **Biographies**

**Dr Jo Jung** is the coordinator of Games & Interactivity at the School of Arts & Humanities at Edith Cowan University. Her research interest is in the field of human-computer interaction – in particular, user interface design approaches to improve the quality of user experience. Jo completed her PhD at Curtin University and the research topic was on socio-emotional UI design strategies, which adapted human behaviours and emotions to develop a set of design guidelines. Jo has presented research at international conferences including British HCI group annual conference in Scotland and Design & Emotion conference in Hong Kong. Jo also has consulted and worked on a number of industry and educational projects including WA Healthy Children Program (RefreshED) funded by the Western Australia Department of Health.

**Dr Mark McMahon** is Associate Dean Learning and Teaching in Edith Cowan University, in the School of Arts & Humanities. Mark's teaching has primarily been in the area of Digital Media and Game Design, with a particular focus on creativity and the design of transformational games. This is carried through in his research and consulting work. Mark was lead mentor on the Australian Flexible Learning Toolbox project – a decade long multimillion dollar initiative developing eLearning for the Vocational Education and Training sector.

## **Abstract**

Contemporary educational approaches focus on learning that is situated within a context (Brown, Collins, and Duguid, 1989), and addresses authentic complex problems that allow for the promotion of students' metacognition (Nelson and Narens, 1994). Feedback in design education has proven to be a valuable tool to achieve this, and Constructivist principles that eschew a single 'best' approach allow for such feedback to come from peers as well as experts (Butler and Winne, 1995). This peer interaction reflects the collaborative nature of many design activities and research has shown that engaging in practice within small networks can enhance the creativity of the work produced (Uzzi and Spiro, 2005). This paper provides findings from research undertaken at an Australian university where design students were required to critique each other's work as a design process before the submission of their final assignment. A formal online survey was conducted at the end of semester. The survey results indicated that students valued the peer assessment providing them with an opportunity to improve their work and understanding of subject matter through a cycle of giving and receiving feedback. Students also reported that the peer review was an opportunity for them to receive insights into their own work by reviewing other students' assignments and learning from comparison by seeing other students' work. This reciprocal process of evaluation encouraged the students to actively participate in their own learning and exposed them to a greater diversity of other individual learning experiences. This reflective learning process simulates the dynamics of collaborative design in industry and it is useful training for students to prepare for future practice.

**Keywords:** peer review, design critique session, reflective learning

## ***Peer review as learning tool in design units***

### **Introduction**

Feedback plays a significant role in students' learning processes and outcomes they achieve (Biggs and Tang, 2011; Falchikov, 2005). In a traditional learning context in higher education, feedback as part of formative assessment from teaching staff provides students with an understanding of their academic progress and enables them to address any shortcomings. However, this top-down process of receiving feedback from teaching staff is often seen as limited and lacks the in-depth information required to initiate self-directed learning (Mulder, Baik, Naylor, and Pearce, 2014).

The key to self-regulation is supporting students' capacity to monitor their own performance in a manner that scaffolds independence. In this sense, internal feedback rather than purely external remediation plays an important role (Butler and Winne, 1995). Nelson and Narens' seminal model of metacognition (Nelson and Narens, 1994) describes this phenomenon in terms of a reflective process of control and monitoring, between a meta- and object-level, where understanding is calibrated through the dynamic interaction between the two. At the object level, feedback promotes the monitoring required to adjust strategies to improve performance. This focus is strongly aligned to constructivist learning principles that argue that learning is about knowledge construction rather than reproduction, and that this is best facilitated by encouraging thoughtful reflection in a manner that involves multiple representations that reflect the complexity of the real world (Jonassen, 1994). In the discipline of design, where there is no single correct solution to a design problem, providing multiple perspectives embraces such complexity and prompts internal feedback by requiring students to reconcile competing ideas and values through their own critical cognitive lens rather than by receiving external means of remediation.

Peer review is a particularly powerful form of feedback in that students are exposed to alternative perspectives by assessing the work of peers and receiving that of others, which allows them to exercise reflective learning to improve their own work (Mulder, Baik, Naylor, and Pearce, 2014; Nicol and MacFarlane-Dick, 2006). The process of reviewing and giving feedback requires students to develop an understanding of assessment criteria, which in turn helps students to define goals in their own learning (Hounsell, McCune, Hounsell, & Litjens, 2008; Nicol and MacFarlane-Dick, 2006). In receiving peer review, students are exposed to "a greater

diversity of perspectives than just those of their tutor or lecturer” (Pearce, Mulder, and Baik, 2009, p. 3). In addition, the process of peer review nurtures more meaningful interactions between students, reducing dependence on staff as the experts (Brindley and Scofield, 1998). Since peers are less likely to be expert than their teachers, students are also required to be more critical in their evaluation of the validity of feedback. Finally, peers can provide feedback that is better targeted to students’ zone of proximal development. This constructivist concept can be defined as that sweet spot of cognitive development where students benefit from the feedback of others who are more able or experienced, but not operating at a level that is beyond their comprehension. This allows for differentiated learning based upon students’ individual styles and skills (Morgan, 2014).

## **Context**

Two units in a Bachelor of Design at an Australian university were chosen to trial student peer review as a learning tool. These units are technically oriented involving scripting languages, HTML, CSS, and ActionScript, as development tools for interactive media outcomes. They are introductory units, with a focus on the training of practical digital design skills that form the basis of subsequent (advanced) units. These were specifically selected because of their focus on the development of personal technical skill through individual projects, rather than group processes.

The majority of students in these units are millennial students in their first year majoring in the Bachelor of Design degree. Millennial students have distinctive values and intellectual characteristics that differ from previous generations, as they prefer collaborative experiences that exhibit clear goals (Brown, 2000; Frand, 2000; Oblinger, 2003). The mismatch between student characteristics and the context of the units has impacted on academic outcomes and proven to be less effective in terms of student engagement. As such, these units were ideal candidates for incorporating peer review.

The two units are first year units, with the majority of students enrolled in the Bachelor of Design, but with a small number of students from other discipline areas such as Education and Computer science, that undertook these units as electives.

The learning activities in these units are based on an adapted client-designer working process, simulating an industry experience. Assessments in both units consist of three linked assignments working towards one deliverable interactive media product (i.e. Web site and game).

Table 1: Overview of units that formed part of the study

Units	Descriptions	Assessments
Publishing on the World Wide Web	This is a first year unit that provides an introduction to web site development including HTML and CSS, standards for Web accessibility, and design and development strategies for interactive Web-based information systems.	<ol style="list-style-type: none"> <li>1. Project proposal</li> <li>2. Prototypes</li> <li>3. Web site</li> </ol>
Interactive Multimedia Authoring 1	This is a first year unit that introduces students to the concepts and principles of interactive media development through integrated authoring systems.	<ol style="list-style-type: none"> <li>1. Project proposal</li> <li>2. Prototypes</li> <li>3. 2D or 3D game</li> </ol>

### *Project proposal*

Working towards one project, students were required to write a project proposal containing information needed for the consecution of their final project. Students were required to conduct research into target audience and aspects of user experience design including usability and accessibility. A clearly articulated project overview including goals and requirements were also required as part of project proposal acting as a framework of their project.

### *Prototypes*

Based on their project proposal, students were required to develop prototypes to visually articulate their project and provide two functioning pages/screens. This was an important milestone for students when reporting on their progress, and allowed testing and review of their project.

### *Website or Game*

In their final assessment, students were required to address the problems identified in the previous assessment (i.e. prototypes) and submit a completed project. For the *Publishing on the World Wide Web* unit, students' final project must be a live website and be published on the Web. For *Interactive Multimedia Authoring 1* unit, students were required to produce a working game that can be delivered on the Web.

Prior to the trial of peer review in the two units, all three assignments were assessed by the unit lecturer or tutor. Therefore, formal assessments by the lecturer were the only means of feedback for students throughout the project development process.

The timeframe of assignment results was 10 working days. Assessment rubrics indicating levels of achievement for each assignment requirement with detailed feedback were provided to students.

### **Implementing student peer review**

Two student peer reviews were conducted in each unit and they were conducted on:

- the due date of the second assessment (i.e. prototypes)
- one week before the due date of the third assessment (i.e. final project delivery – web site and game)

This was to maximise the benefits of student peer review in promoting an iterative design process and encouraging continual refinement within their final projects. Students were required to attend the class to participate in both peer reviews, and their participation was assessed to encourage attendance.

There are two important issues to consider when planning to implement student peer review: the aim of the peer review; and the process of peer review (Pearce et al., 2009). As there were two cycles of peer review, the aims varied according to the learning outcomes and criteria associated with each assessment item. The aim of the first peer review, in which prototypes of students' proposed project ideas were reviewed, emphasised the broader user experience and project goals, but had minimal focus on specific technical characteristics. The aim of the second peer review was to improve and refine their project before final submission by focusing on solutions to issues, aesthetic choices, and the functionality of the product.

Both peer reviews were conducted during class time, using screen-based prototypes that demonstrated students' proposed projects as a work-in-progress. Each student displayed their prototype on a computer. A printed project proposal was placed near each computer to help student reviewers gain a better understanding of projects they were reviewing.

Prior to conducting the peer review, students were introduced to the goal and process of peer review. Each student was required to complete a review of every product other than their own work. The lecturer did not participate in this review process, as the prototypes were a formal assessable item submitted after the review. This allowed students to compare feedback received from their peers and the

lecturer. Reviews were conducted using a peer review form provided by the unit lecturer. The peer review forms were based on the actual assessment feedback form used by the lecturer to assess the assignments in the unit.

## Surveys

An online survey was conducted in final week of the semester for each unit. The survey was voluntary but everyone who attended the class on the day (26 students) completed the survey. Four likert-scale questions, which were used in a previous study, were used in the survey to examine the usefulness of peer review as learning tool (Pearce et al., 2009):

- As a learning tool, peer review was:  
(*Very useful, Somewhat useful, No opinion, Not very useful, Useless*)
- I learnt from:  
(*Writing reviews of other students' work, Receiving reviews of my own work, Writing & receiving reviews, Not sure*)
- I thought that my peers did a good job in providing me with critical feedback on my work:  
(*Strongly agree, Agree, Neutral, Disagree, Strongly disagree*)
- I think that I improved my work as a result of the reviews that I received or wrote:  
(*Strongly agree, Agree, Neutral, Disagree, Strongly disagree*)

In addition to the above questions, a screening question was asked to target students who participated in peer reviews and filtered out those who did not attend the peer reviews.

- Did you participate in a peer review in this unit?  
(*Yes, No*)

Responses to the screening question indicated that one student in *Interactive Multimedia Authoring 1* unit did not participate in student peer reviews. This student's responses were removed in the analysis of the survey result.

None of the students in both units had previously experienced a peer review process. This may be perhaps due to the majority of students in the units being first year students, and student peer review was not implemented in all design units in the Bachelor of Design.



### Survey results

The first question on the survey asked students about the usefulness of peer review as a learning tool. The majority of students responded positively indicating that their peer review experience was either *somewhat useful* or *very useful*.

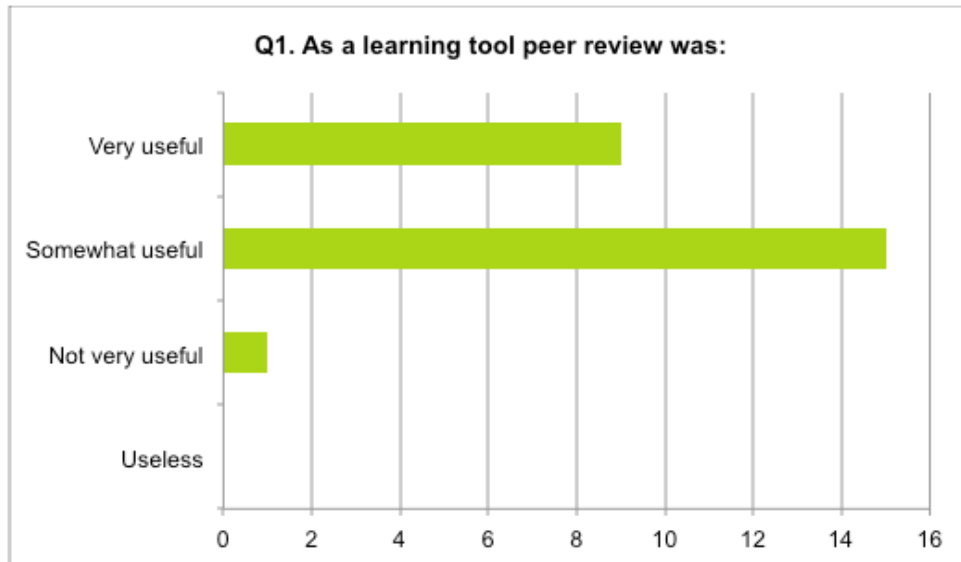


Figure 1. Survey data, Question 1

The second question was about the aspects of peer review that were useful to them. One student was unsure about the useful aspects of peer review. Two-thirds of students responded that they learned from *writing and receiving reviews*, and the rest indicated that they learned from either *receiving or writing reviews*.

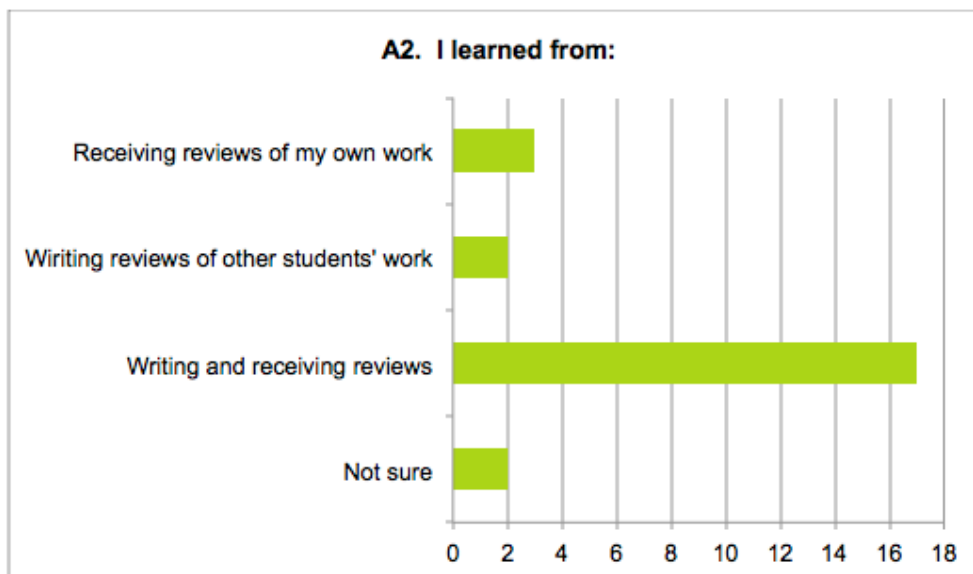


Figure 2. Survey data, Question 2

The third question asked about the performance of peers on providing feedback about their own work. The majority of students appreciated their peers' feedback, responding either *agree* or *strongly agree*. Four students responded either *disagree* or *neither disagree or agree*. Two students indicated that they did not think their peers' feedback was useful.

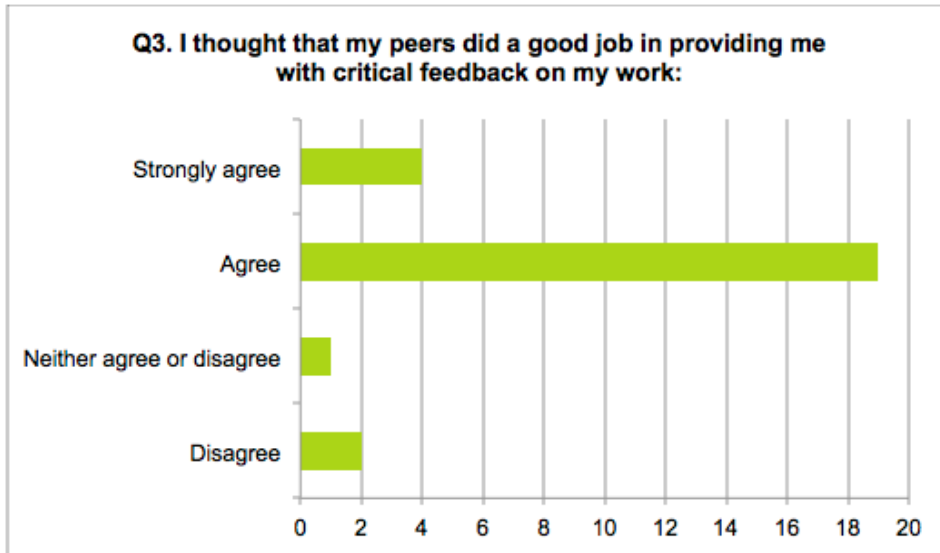


Figure 3. Survey data, Question 3

The last survey question asked students about the improvement of their work as a result of peer reviews. More than two-thirds of students either *agreed* or *strongly agreed* that the peer reviews they participated in helped to improve their work. The rest of the students responded either *disagree* or *neither disagree, or disagree*.

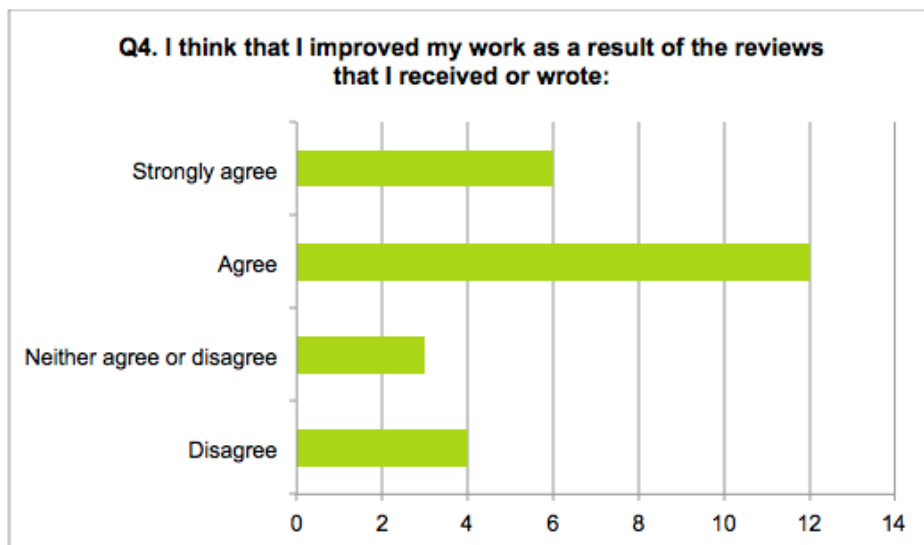


Figure 4. Survey data, Question 4

After the survey, students in one of the units (Publishing on the World Wide Web) that trialled peer review participated in an informal focus group led by the unit lecturer. The majority of students greatly appreciated peer review as part of their learning in the unit. Students noted that peer review should be part of all units as it gives them opportunities to truly benefit from:

- having a point of comparison with their own products;
- collaborative learning; and
- breaking-away from the silo mentality inherent in individual work.

Students greatly appreciated opportunities to share their work and knowledge with their peers. One of the reasons why this was so was timely feedback from multiple perspectives prior to receiving formal assessment feedback from the lecturer. Students also enjoyed the process of sharing and comparing their work-in-progress as this allowed them to see alternative ways to achieve project outcomes.

These findings were triangulated with the end-of-semester university teaching evaluations, called Unit and Teaching Evaluation Instrument (UTEI). UTEI is a centrally administered survey by the university. Written feedback gathered from UTEI indicated that students had positive learning experience as a result of participating in peer reviews. For example, one of the students participated in UTEI survey noted:

The most interesting part for me has been the critique session [peer review] whereby each classmates [sic] gets to see and provide feedback on each others work. The critique session [peer review] proved to be so helpful when it came to development/improvement of my website.

The overall outcome of peer review in the two units was positive and students appreciated the experience. Nevertheless, drawbacks were found in the quality of feedback students provided to their peers as some students:

- provided feedback based on their assumptions without fully understanding the projects they reviewed;
- focused on weaknesses of projects and did not complement strengths of projects; and
- provided less constructive feedback with subjective opinions or lack of explanation.

The above issues may be due to the students' lack of experience in peer review. For example, when reviewing prototypes (i.e. assignment two), some students did not read accompanied project proposals and reviewed prototypes based on the aesthetics of screen designs. This disregarded other important aspects of the projects (e.g. functionality, usability, accessibility), and resulted in the provision of unproductive feedback.

Another reason for the issues in quality of feedback could be students' ability to articulate feedback constructively. [expression a little unclear here ... Some of the feedback lacked reasoning allowing receiving students to understand the feedback to be useful and productive.

### **Discussion**

Although this study was conducted as a trial of peer review as learning tool with a small number of students, the outcomes clearly indicated that peer review is a useful learning instrument that advances academic outcomes. The survey results indicated a positive trend to all questions in terms of perceived usefulness of peer review and its value in improving their final product. The fact that there was also agreement to the value of both writing and receiving reviews indicated that the majority of students were able to engage in the internal reflection required to critique others' work as well as utilise the multiple perspectives inherent in external feedback to improve their products. While all students found the process useful, the fact that there was a small number of students who found value in either providing or receiving feedback rather than both suggests that these are quite different activities. Indeed, the critical skills in reviewing others can be seen as differentiated, not only in terms of the cognitive skills evident (critical vs. reflective), but also in the affective domain, where arguably students require a level of confidence to be able to express an opinion, but also a level of resilience to be able to take feedback on board constructively and use it as a tool for improvement. The informal focus group discussion reinforced these findings in that students articulated a clear sense of value for the process and understood the role of peer assessment in providing them with an opportunity to improve their understanding of subject matter through a cycle of giving and receiving feedback, and these processes commensurately enhanced the quality of their final product. Students also reported that the peer review provided them with an opportunity to receive insights into their own work by reviewing other students' assignments and learning from comparison.

## **Conclusion**

Peer review can be a powerful tool for providing a feedback-rich learning environment. Its role in supplementing traditional teacher feedback enables students to receive multiple perspectives about their work, which prompts a deeper level of reflection than would normally be afforded by a single expert review. The fact that peers are also more closely aligned in their existing level of skill has the potential to scaffold student learning in an adaptive way, within their zone of proximal development. It is evident that students both valued the experience and saw it as a means of improving their own work. The fact that not all students found the same value is an intriguing one that warrants further research. In particular, the differences between giving and receiving feedback, and the affective components of self-esteem and resilience as impacting factors needs to be explored. Despite this, the reciprocal process of evaluation encouraged the vast majority of students to actively participate in their own learning and facilitate the learning of others. Moreover, the reflective learning process inherent in peer review mirrors the dynamics of collaborative design in industry and provides an authentic context for students to prepare for future practice.

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