

# Literature Review for the eSTEEeM project “The use of peer assessment/review in distance teaching via the Moodle VLE”

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## Introduction

Before discussing the role, structure and effects of collaborative learning in the area of assessment it is necessary to introduce the lexicon of the topic. Topping (2005, p631) has provided a useful definition of peer learning as follows:

*“Peer learning can be defined as the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions. It involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by so doing.”*

In an earlier paper (1998, p250) Topping also gave a definition of the narrower field of peer assessment as follows:

*“an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status”*

In fact peer learning and peer assessment are just two of a long list of terms used to describe this general activity, others being:

*“peer appraisal, peer assessment, peer correction, peer feedback, peer learning, peer marking, peer rating or peer review”. (Topping, 1998)*

The use of peer assessment in HE is growing (van der Pol et al., 2008) and has been used by many educational institutions as an assessment strategy for over fifty years (Luxton-Reilly, 2008), and has seen significant growth since the 1990s (Yu et al., 2011). Thompson (2009) has suggested that this growth is due to the fact that teacher marking of paper based assessments is becoming impossible with larger classes in HE. Another possibility is that the availability of online systems has made peer learning more viable.

*“The many distinct features and capabilities of networked technologies intended to maximize the learning effects of peer-assessment enable assessors to provide timely and constructive feedback about individual student’s work.” (Yu and Wu, 2011, p268)*

The general requirements of fairness in assessment still apply to peer assessment. This can be stated as (Robinson, 2002, p183):

*“Fair assessment is unbiased, transparent, accountable, and consistent, and accurately conforms to assessment criteria”.*

How to incorporate this idea of fairness into an assessment system is much harder to define. Robinson (2002) earlier suggested that the requirements are:

- Need clear standards, no ambiguity
- Understanding of how standards are to be applied
- Time to be spent should not be a factor

## Method

The initial search of journals was carried out using the broad terms of “education and/or e-systems”, “Learning and/or assessment” and “teaching and/or distance/open”. These produced a list of journals and also education, and more general, databases. A full list of the papers and databases that we found can be found at the wiki that we used to share the information (Chetwynd et al., 2011).

From these journals and databases papers were selected, care being taken to ensure that they were from peer reviewed journals; included a bias towards the last 10 years and also include pre-publication papers where available.

This initial search highlighted some key authors raised some important questions and the review was extended to look at peer assessment and the isolation of the distance learner.

This report summarises these findings and addresses the key areas that were identified in the eSTEE M project proposal as being where there was currently very little institutional knowledge ie the advantages and disadvantages of peer assessment/review; how it can be applied to distance learning; and automated systems for delivery.

## Online Tools specified in the literature review papers

Luxton-Reilly (2009) has recently performed an extensive review of online peer assessment tools, in a computer science context, so for the purpose of this literature review the main features of this paper have been summarised. Not included in the paper are peer review tools used in the school classroom, or in professional settings. Also excluded are tools designed for general purposes rather than being peer-review specific, for example word processing ‘track changes’ facility, email, forums and wikis.

Luxton-Reilly assigned the tools to three main categories, namely generic systems, domain-specific systems and context-specific systems and these are summarised in Tables 1, 2 and 3 below. With ‘flexible’ rubric designs the administrator can make modifications and with ‘fixed’ designs the rubric cannot be modified.

Rubric criteria noted in the tables are defined as:

- b- the tool supports Boolean criteria (e.g., check boxes)
- d- the tool supports discrete choices (such as a drop-down list or a forced choice between a finite number of specified criteria)
- n – the tool supports numeric scales (e.g., rating a solution on a 1–10 scale)
- t – the tool supports open ended textual comments (e.g., suggestions to improve the solution)

Generic systems can be seen to support peer review within a flexible range of contexts and across a wide range of disciplines and are summarised in Table 1.

<b>Name</b>	<b>Year</b>	<b>Rubric design</b>	<b>Rubric criteria</b>	<b>Discuss</b>	<b>Backward feedback</b>	<b>Flexible work flow</b>	<b>Evaluation</b>
<b>PeerGrader</b>	2000	Flexible	b,d,n,t	Shared page	Student	No	Student survey
<b>Web-SPA</b>	2001	Flexible	d,n,t	Public comments	None	Fixed	Validity, performance improvement
<b>OPAS</b>	2004	Flexible	b,d,n,t	Debrief	None	Script	Student survey
<b>CeLS</b>	2005	Flexible	b,d,n,t	Peers instructor	Unknown	Script	Validity
<b>PRAISE</b>	2005	Flexible	b,t	None	None	Fixed	Student survey, usage statistics
<b>Aropä</b>	2007	Flexible	b,d,n,t	None	Student	Limited	Student survey, staff interview

**Table 1 Generic systems, Luxton-Reilly (2009)**

Domain-specific systems support peer review activities for specific activities, for example essays reading and writing, or a review of programming code, as summarised in Table 2.

Name	Year	Domain	Rubric Design	Rubric criteria	Discuss	Backward feedback	Flexible work flow	Evaluation
CPR	1998	Essays	Flexible	b,n	None	Auto	None	Validity, student survey, writing performance
C.A.P.	2000	Essays	Fixed	n,d,t	Private author/ reviewer	Auto	None	Student surveys, higher-order skills, comment frequency, use of review features, compare
Prakotomat	2000	Programs	Fixed	d,t	None	Auto	None	Student survey, usage correlation
Sitthiworachart	2003	Programs	Fixed	d,n,t	Reviewers	Student	None	Student survey, validity
SWoRD	2007	Essays	Fixed	n,t	None	Student	Limited	Validity
PeerWise	2008	MCQ	Fixed	n,t	Public feedback	Student	None	Usage, effect on exam performance, quality of questions, validity
peerScholar	2008	Essays	Fixed	n,t	None	Student	None	Validity

**Table 2 Domain-specific systems, Luxton-Reilly (2009)**

Context-specific systems are for use on a specific module and have been developed solely for that purpose. They would need modification to be used in other contexts, as summarised in Table 3.

Name	Year	Context	Rubric design	Rubric criteria	Discuss	Backward feedback	Flexible work flow	Evaluation
Peers	1995	Computer Science	Flexible	n	None	None	None	Student survey, validity
NetPeas	1999	Computer Science, science teachers	Fixed	n,t	None	None	None	Student survey, rubric comparison, thinking styles
OASYS	2001	Computer Science	Fixed	d,t	None	None	None	Student survey, admin costs
Wolfe	2004	Computer Science, maths, marketing, psychology	Fixed	n,t	None	None	None	Usage
PEARS	2005	Computer Science	Fixed	n,t	None	None	None	Rubric comparison

**Table 3 Context-specific systems, Luxton-Reilly (2009)**

In summary, one of the key points Luxton-Reilly notes is that few online peer review systems allow unlimited number of reviews. Of the tools reviewed only two systems, PeerWise and Wolfe, have that capability. It is also suggested that there should be a process to determine which reviews are 'good', allocating appropriate grades. Aropa, SWoRD and C.A.P. have the most advanced techniques for accomplishing this. PRAISE is the only tool that dynamically allocates reviews.

Each of the tools listed in Luxton-Reilly have a specific reference that can be followed up, as listed below:

#### Generic systems

- PeerGrader (PG) system reported by Gehringer (2000)
- Web-SPA (Sung, Chang, Chiou, and Hou, 2005)
- Online Peer Assessment System (OPAS) (Trahasch, 2004)
- Collaborative e-Learning Structures (CeLS) (Ronen, Kohen-Vacs, and Raz-Fogel, 2006)
- PRAISE (de Raadt, Toleman, and Watson, 2005)
- Aropa (Hamer, Kell, and Spence, 2007)

#### Domain-specific systems

- Calibrated Peer Review (CPR) (Chapman and Fiore, 2000)
- The C.A.P. system (Davies, 2000)
- Praktomat system (Zeller, 2000)
- Sitthiworachart developed by Sitthiworachart and Joy (2004), based on the OASYS system.
- Scaffolded writing and rewriting in the discipline (SWoRD) (Cho and Schunn, 2007)
- PeerWise (Denny, Luxton-Reilly and Hamer, 2008)
- peerScholar (Pare and Joordens, 2008)

#### Context-specific systems

- Peers (Ngu and Shepherd, 1995) system
- NetPeas (Lin, Liu, and Yuan, 2001)
- OASYS (Bhalerao and Ward, 2001)
- Wolfe (2004)
- PEARS (Chalk and Adeboye, 2005)

Many online tools have been used in the papers reviewed for the eSTeEM project, several of which were general purpose rather than peer-review specific. For example there are instances where a wiki has been used (Tosic and Nejkovic, 2010, Xiao and Lucking, 2008, and Hou et al., 2007). Xiao and Lucking (2008) also review the use of online discussion forums. The advantage of the generally available tools is that they could be readily available for use as a peer assessment tool via a VLE.

Additionally, Yu and Wu (2011) note several peer assessment tools, each of which has a separate reference. These tools are QSIA (Question Sharing, Information and Assessment system) (Barak and Rafaeli, 2004), MCIDA (Multiple Choice Item Development Assignment) (Fellenz, 2004), QPPA (Question-Posing and Peer Assessment) (Yu et al., 2005), and Peerwise (Denny et al., 2008a and 2008b). Also one general use tool is noted, Hot potatoes (Half-Baked Software Inc., 2011). Yu and Wu's main research is based on the QuARKS (Question Authoring and Reasoning Knowledge System) context-specific tool, using multi-way interaction (Yu, 2011) and a flashing icon to indicate when a new comment was added.

Goldin and Ashley (2010) review a domain-specific tool, Comrade, with comparisons to two older domain-specific systems, namely SWoRD (Scaffolded writing and rewriting in the

discipline), Cho and Schunn (2007), and CPR (Calibrated Peer Review), Russell (2004). Lu and Law (2011) also conduct their research via a domain-specific tool, the Interactive Learning and Assessment Platform, iLAP. van der Pol et al. (2008) review Annotation (domain-specific) and Blackboard (general purpose). Thompson and McGregor (2009) review the domain-specific tool SPARK<sup>PLUS</sup> and Liu and Tsai (2005) utilise what they refer to as 'knowledge acquisition software'.

### How can PA/PR be assessed – good practice

In the extensive literature on peer assessment there is much discussion on what constitutes good practice in this field. The similarity of peer assessment to academic professional practice was noted (van der Pol et al., 2008). In Robinson (2002) the uniqueness of the education assessment and feedback system compared to other systems (for example juries, expert panels and medical bodies) was commented upon. In education the teacher 'writes the rules and then acts as judge and jury' (Robinson, 2002, p184). Could peer assessment alleviate this problem for students?

As a starting point for introducing peer assessment to a course Gielen et al. (2011) suggest that it is important to decide upon the goal or goals of the peer review, and this will then lead on to selecting appropriate quality criteria of the system. In the same paper the following possible goals of a peer assessment regime are suggested:

- a social control tool
- an assessment tool
- a learning tool (for and of learning)
- a learning-how-to-assess tool
- an active participation tool

There are many issues related to peer assessment e.g. effectiveness, fairness and reliability (Gielen et al., 2011). The quality of the feedback given by peers can be variable (van der Pol et al., 2008) and consequently the trust factor between students is key (Tosic and Nejkovic, 2010). Whether trust between reviewers exists or can be built depends on a number of factors according to Tosic and Nejkovic (2010) including 'previous knowledge, new knowledge, experience in assessment and unknown variables (outside factors)'. Engendering this trust may be made more difficult because, as Boud (1999) suggests students may find the idea of peer working difficult because they view assessment as an individual activity, and collaboration is not encouraged. Additionally students may perceive peer assessment as unreliable or not valid but tutor may not see these problems with it. (Robinson 2002, Cho 2006). Finally students can find it difficult to be critical in peer assessment (Lindblom et al., 2006).

Overall therefore the problem remains of how to judge the validity of peer assessment (Gielen et al., 2011). Should the peer outputs be compared with other peer assessments or with tutor comments? (Xiao and Lucking, 2008). Peer and tutor may be looking for different things. Also a peer and a tutor may have different knowledge about the assessee, through working together for example (Gielen et al., 2011). Different students react differently (Xiao and Lucking, 2008).

## System parameters

The majority of the reviewed work related to peer review systems that had been tried and implemented in campus based universities. Despite that, and the relative newness of VLEs at HE institutions, online systems were favoured with the benefits of speed and simplicity (van der Pol et al., 2008; Yu and Wu, 2011) and potential for anonymity (Lu and Law, 2011; Xiao and Lucking, 2008) mentioned. Additionally the benefit to the teacher, struggling to cope with ever larger HE classes and bigger marking loads, of an online peer review system was noted (Thompson and McGregor, 2009). However, Lu and Law (2011) note that technical skills are needed for successful use of an online system.

## Implementation; timing; student abilities

The choice of methods of implementation of a peer review or assessment system is wide, with numerous detailed examples of systems already discussed earlier in this literature review. However there remain many difficulties for the teacher to overcome and decisions to make. The most frequently mentioned issues in the literature are:

**Anonymity:** Yu and Wu (2011) suggest that there are three possible modes of review 'real-name, anonymity or nickname'. They found that the real-name mode was least popular and there was possibly less concern when anonymous feedback was given. Anonymous feedback may be more useful (Liu and Bol, 2007).

**Consistency:** The nature, reliability and validity of feedback given were found to be problematic. In one investigation peer reviewers gave a mark that was on average 10% higher than the teacher mark and the average spread between highest and lowest marker was 26% for any one paper (Robinson, 2002). This unevenness suggests that peer assessment would be better used to supplement teacher assessment. For example multiple assessments can be used to triangulate grades awarded (Gielen et al., 2011). More reviewers does not necessarily result in a better experience for the student however. More reviewers gives a greater perception of inconsistency in grading but increases chances of one useful/good review. In fact statistically with only two reviewers the inconsistency is the same but not so apparent to individual students (Robinson, 2002). Achieving reliability with peer reviewers also requires significant training to help student master the criteria and gain assessment skills (Xiao and Lucking, 2008).

**Fairness:** Students need to be prepared for the varying quality of reviews and varying opinions of their work (Robinson, 2002). In Robinson's (2002) investigation again it was noted that 1/3rd of peer reviewers provided inadequate feedback e.g. unjustified high praise and high marks or unjustified criticism. Matching participants at the same ability may overcome some of the difficulties (Topping, 2009).

Another choice the implementing teacher has to make is the nature of the peer feedback. Xiao and Lucking (2008) in a large trial used multiple rounds of feedback with some groups receiving both a grade and qualitative feedback and others only a grade. Another, possibly better method, is for the feedback to be qualitative only, with no grading (Richer, 1992). Topping (2009) offers the following choices:

- Feedback can be confirmatory, suggestive, or corrective
- Feedback can be open to negotiation
- Feedback can be formative or summative.

## Benefits to teacher

One of the major considerations mentioned in some of the reviewed papers is whether introducing peer assessment into a course saves the teacher time. In a pilot trial, Robinson (1999) showed that two peer reviewers plus a paid marker acting as an editor used marginally less staff time than conventional marking. Gielen et al. (2011) also note that time may be saved for the tutor, with the additional bonus that the educator can then focus elsewhere (Goldin, 2010). Peer review is also noted as better than computer marked assignments where free-form answers are used, as these cannot easily be interpreted by a computer (Goldin, 2010).

## The student experience: does peer assessment reduce isolation?

Lake (1999, p16) suggests that “Isolation can manifest itself as physical and psychological isolation”. He further subdivides physical isolation as being geographical isolation, either from the tutor or resources and temporal isolation which is caused when there is a delay in response either from the tutor or peers.

Isolation may lead to alienation and Rovai et al. (2005) suggest that alienation and low sense of community are identified in the professional literature as factors that explain low student persistence in distance education (e.g., Tinto, 1975, 1995, 1997 as cited in Rovai, 2005). Rovai (2002) defines classroom community in terms of four dimensions: spirit, trust, interaction and commonality of expectation and goals. He points out that learner interaction is important to develop a sense of community, but increased learner interaction is not necessarily a positive educational goal. Although taking a social constructivist approach (Vygotsky, 1978 as cited in Rovai, 2005) would suggest that learning has important social and cognitive dimensions and so it is most effective when there is a sense of community.

Shepherd et al. (2011, p142) report that many distance education programs are “beginning to adopt eportfolios to promote authentic assessment, reduce feelings of student isolation, and foster community”, and there is some evidence that eportfolios can lead to online students feeling more connected to their peers and instructors (Bollinger and Shepherd, 2010, as cited in Shepherd et al., 2011) and there is also some evidence that peer critiques lead to better end results (Barbera, 2008 as cited in Shepherd et al. 2011). The experience of Shepherd et al. (2011, p146) seems to have been mostly positive with students stating that they found the peer review very helpful in explaining what they had misunderstood and that they felt like they had a lot of support and the review process "showed participants what did and did not work, enabled them to measure their progress against others, and generated alternative view-points." They were however concerned about the possible ‘increased cognitive load’ that online tools may impose on the learners.

The theme of peer assessment increasing community and adding to the social cohesion of a group is also mentioned by Gielen et al. (2011), who suggest that undergoing assessment; assessing someone else and the interaction as a result of these two may reduce isolation.

The overall feeling from the reviewed papers is therefore that fostering a sense of community is a generally a positive idea both in terms of retention and student learning, and interaction through peer review can add to this sense of belonging.



## The student experience: peer assessment

From the student perspective, there are several benefits that could arise from interacting via peer assessment activities, for example students may think more critically about their work and the work of others (Lu and Law, 2011). Assessing the work of others helps evaluate their own work (van der Pol et al., 2008) and this can be especially valuable when the feedback is from multiple peers (Golding et al., 2010). Also it can help reduce the likelihood of some students not participating in group work (Gielen et al., 2011), although Luxton-Reilly (2009) suggests that online tools should provide a mechanism to deal with late or missing submissions.

Tosic and Nejkovic (2008) suggest that several elements come into play during the students' engagement with the peer assessment process. The level of students' assessment skills depends partly on the previous knowledge of the student as well as the new knowledge that students acquire during their current study within the module. Their experience in assessment is also a factor to consider. This could include the peer assessment guidance stage for the actual assessment task. Finally they suggest that unknown variables should be accounted for. These could include issues such as friendship bonds and interpersonal relationships (Xiao et al, 2008) or bargaining agreements where students mutually award each other a better mark than they deserve (Tosic and Nejkovic, 2008).

Xiao et al. (2008) propose that peer assessment can have two major effects on students' learning. As well as improving their motivation and self- efficacy, there can also be an improvement in their subject knowledge and development of their general skills. Xiao et al. also suggest that this can help students become more aware of the learning process itself, moving towards ownership of their learning. The skills acquired via peer assessment can be valuable, especially if they are transferable, such as the higher order thinking skills required for the task (Yu et al., 2011). The skills needed depend upon the types of feedback required, whether it is confirmative, suggestive or corrective (Topping, 2009). Students need to develop the required skills in order to develop confidence in their own ability to engage in the peer assessment process (Thompson and McGregor, 2009). Students also need sufficient time to develop the required skills for effective peer assessment and evidence from the literature review suggests that there might be little time allocated to this preparation stage. For example, Thompson and McGregor (2009) note that the guidance consists of watching 'instructional' videos, with Xiao and Lucking (2008) suggesting that students generally need more training than they receive, as the training required is often underestimated.

It should also be noted that there are several drawbacks to consider when reviewing the peer assessment process. Initially students may be unwilling to experiment with the technologies required for online peer assessment (Jones et al., 2010). Students need to develop the technical skills required and also should have confidence in the peer assessment system they use (Robinson, 2002). Students also need to develop their writing skills if the feedback is to be in free writing form rather than simple check-box style. It should be noted that few online tools support full discussion (Luxton-Reilly, 2009). In the context of peer assessment, the quality of feedback can be variable (van der Pol et al., 2008). Time spent by students on the feedback process may be advised when the task is designed but students who engage fully with the process could overrun this, resulting in detailed feedback but slow turnaround (Robinson, 2002). Robinson explores this further, noting that whereas some students put great effort into the peer review process they can be disappointed by receiving relatively few comments in return. Some students only add criticisms, which could be demoralising for the recipient if confronting their weaknesses (Yu et al., 2011). Students could be afraid to be too

critical, resulting in predominantly positive comments and subsequently not helping with the peer review process. If students merely apply the marking scheme, giving no constructive advice, it is difficult to justify the grade. Xiao and Luckin (2008) found that ratings plus feedback produced better scores and better performance. Additional concerns could be raised regarding their peers' poor quality writing. (Robinson, 2002).

There are two sides of the feedback process to consider. First is how to give feedback and secondly how to act upon the feedback (van der Pol et al., 2008). Uptake of feedback is variable and can depend on how the student views the importance of the feedback and then how the feedback is used for re-work. Topping (2009) suggests that feedback should be open to negotiation, that is some response mechanism is required, creating a dialogue between students. If the initial feedback has clear justification (Juwah, 2003) and concrete suggestions to work on (van der Pol et al., 2008) students can make best use of the comments. When the peer assessment process was perceived as good, Xiao and Luckin (2008) found that students rated peer assessment activities highly. Even if receiving critical reviews, as long as the comments were justified, giving clear direction for improvement, the students responded that peer assessment was useful to engage in, and beneficial to their learning experience.

### Summary

This literature review has found a wealth of information on the existing peer review systems, with references for more information if that is needed. It has also looked at the teacher's perspective and found discussions on what constitutes good practice and how effective it can be. Consideration of the timing of assessment, how to implement it and possible problems with student ability have also been reviewed. One of the benefits that has been noted for the teacher is that there is possible time saving.

From the student perspective one possible benefit of peer assessment is that it may increase a sense of community and so reduce isolation. Other benefits that have been found in the literature include the possibility that peer review encourages students to be more critical of their work; it improves motivation and it potentially gives the students a better understanding of the learning process. Drawbacks for the student have been suggested to be, the problem that they lack the skills needed to give effective feedback, and they may have a fear of giving negative feedback. There is also an issue with a lack of time for students and this may be exacerbated if they need to learn new systems.

This review has not looked at the history of peer assessment, although there is a spread of about ten years in the papers that have been reviewed. It has also not tapped the rich vein of information on the social implications of distance learning and doing so might help to inform the arguments on building a sense of community through peer assessment. It should also be pointed out that there has been no attempt to look in detail at the individual tools that have been listed.

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Note: All journal articles were accessed in August 2011.

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