Perceptions of Peer Assessment in University Teamwork

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I. ABSTRACT

Self and peer assessment systems can provide a convenient solution to the very real problem of awarding fair marks for team members undertaking group assignments. The developing methodology has numerous benefits for enhanced student learning and transferable skill development. Peer Assessment is not, however, universally embraced: critics cite potential drawbacks including collusion, and unfair or vindictive marking and this paper provides a comprehensive review of the state of the art and then describes a web-based peer assessment tool from Loughborough University. The paper goes on to outline a research methodology that embraced interview, web survey and data analysis, through which staff and student experiences and perspectives were collected.

Whilst much of the data tends to confirm, update and strengthen previous literature on this subject, important new insights are gained into the thoughts of students who appear to recognise and value the fairness they believe peer mark moderation can offer. Statistical data verifies the lack of collusion associated with the web-based system and students comment positively on qualities of anonymity and the relatively accurate recognition of the different levels of achievement within teams. Individual and group marking behaviours also suggest that most peer review marking is "honest" but can be influenced by group size, selection method and the year of study.

II. INTRODUCTION

From cars to computers, aircraft engines to vacuum cleaners, products and projects worked on by engineers in industry today are created by skilled teams of people. Today's engineer must be well grounded in appropriate science but must also operate efficiently in the world of problem solving, decision making, and cooperative enquiry while functioning effectively as a member of a team. It has been said that an engineer is hired for his technical skills and fired for his people skills[1]. Notwithstanding the inherent benefits of practising working with others and learning to deal with human attitudes and frailties, it is well researched that collaborative forms of learning, such as, group tasks can help foster lifelong learning skills[2]. Little wonder, then, that universities are concentrating their efforts ever more on team projects and facilitated Problem Based Learning in the twenty-first century. Group or teamwork is commonly seen as an activity which stimulates students and therefore the use of group work within higher education courses is common, taking Loughborough University as an example, group work now takes place in over 500 modules representing every department at the institution [3].

Of all the problems associated with team-based education, the difficulties of precise and individual assessment are supreme. Academics who feel comfortable setting examinations and individual coursework assignments are often deterred from devising team assessments because the student-centred learning approach dictates that they have only a limited knowledge of the real contribution that each team member made to the team effort.

The most common system of assessment for group work has been marking the finished product of the project and awarding the group mark to everyone in that group. This has, however, been a cause for concern for many educators due to the lack of appreciation of the group members' different levels of efforts and quality of their contributions. The unfairness of group marks awarded to every group member has been recognised by many and a great deal of effort has been put into correcting this unjust system. Many educators have been trying different methods to resolve this and one of them is through using 'self and peer' assessment.

III. PEER ASSESSMENT

Context

In this context, the term '(self and) peer assessment' is used to describe the process undertaken by students to assess the performance/contribution of themselves and their peer group, in relation to a group task. This has been described by some as peer-moderated marking. Peer assessment is similar, yet different, from peer review which is typically where students assess a piece of work produced by a 'different' individual or group. Whilst the two are separate, there are some similarities in terms of the feedback and learning opportunities on offer because they share the common desirable element that students are actively engaged in the assessment process.

Falchikov [4] identifies two distinct types of peer assessment; the peer assessment of product and peer assessment of performance (also referred to as the peer assessment of process). Peer assessment of product is where students assess other students' work: either a finished product, in case of summative assessment, or a work in progress in the case of formative assessment. Hence peer assessment can be used summatively or formatively within a course. Peer assessment of performance could be where students assess. Peer review is almost always focussed on product while peer mark-moderation of group work could conceivably be of product and/or performance as defined by the criteria but is most commonly focussed on the contribution/performance of students working within the group. Clearly, the tutor may choose to assess once or more than once at the end of the work or at various stages along the road. There are a number of examples that show peer assessment can be used formatively or summatively, with the latter being the most reported in the literature and from our investigations. Some examples of summative peer assessment include case studies by Robinson[5] and Loddington et al[6], while Wheater et al.[7] compare two case studies; one summative and one formative, to show the success for both types of assessment.

The Benefits of Peer assessment

It is, of course, a simple strategy to treat teams of students like teams in the sporting arena where the whole team benefits or otherwise equally from the team's promotion of relegation in the league. Following this argument would suggest that, in the case of team assignments, individuals must be prepared to entrust their future to the collective outcome. This argument is not one that is easily accepted by either the students or by teaching quality assessors. The fairness of allocating equal marks to all team members was questioned by Willmot & Crawford[8] who concluded that this was not the correct approach and stated that the common belief is that "a lazy student might benefit from the efforts of team-mates or particularly diligent students may have their efforts diluted by weaker team members". Pond et al[9] found that "bunched group marks often show a low standard deviation and the use of peer review {assessment} can help to spread this when marks", which is generally a desirable feature in academia.

There is much concern, not least amongst the student body, over 'free riders' in group work. The term 'free rider' is frequently used to describe a student who relies on others to carry out a large proportion of the group work. Unfortunately tutors or project supervisors cannot be solely relied upon to identify and penalise free riders who may present very well in front of the teacher but shy away from any real contribution. Moreover, it can be very difficult or near impossible for a tutor to assess students' individual effort of a group task when the majority of work necessarily takes place during non-contact periods. One solution, in an attempt to make it fairer, is to involve students in the assessment process.

Peer assessment allows us to provide students with individual scores for group work activities. Some rightly regard assessment as an obligation bound by academic/tutors and that it is their job to assess students. Whilst this may be true, it has to be noted that it would be extremely difficult or near impossible for an academic to assess each member's contribution to a group output or task. Race[10] (2001. p.17) identifies that "when it comes to measuring an individual's relative contribution to group work, the only people who really know what the relative contributions are, are the students themselves". By involving students in the assessment, it allows teachers to gain an insight in the group dynamics and measure things that are not possible without student assistance. It has indeed been argued that tutor assessment of this type of work is not sufficiently valid and that students are better placed to assess their own or each other's work[10] (Race, 2001). The validity of peer assessment has mostly been evaluated by surveying participants and various studies find the assessment to be fair [9,11].

In addition to providing a convenient solution to the problem of unfair group marks, peer assessment has been recognised as contributing to student-centred learning. Self and peer assessment systems can and have numerous benefits for enhanced student learning and skills development. Russell et al [12] explore the potential benefits of group work and identify that peer assessment can improve a number of transferable skills including; "decision making, negotiation, communication, empathy and delegation", while Falchikov [4] described improved reflective skills and higher levels of thinking. In a wider sense, Boud et al [2] declared that "assessment is the single most powerful influence on learning in formal courses". Somervell[13] embraces the need for a shift in educational methods and argues that self, peer and collaborative assessment should be part of a process of change towards a student-centred approach. Such a strategic leap highlights the significance of designing assessments that stimulate the student learning process whilst achieving the aims and objectives of the course. In respect of assessment, it requires a change in emphasis from the norm-referenced to the criterion-referenced, from the purely summative to the formative and summative, from external to internal and from the assessment of product only to the assessment of process as well.

Potential drawbacks

Peer Assessment is not universally embraced as a solution: critics cite potential drawbacks including collusion, and unfair or vindictive marking. Nevertheless, there are some powerful administrative drivers that continue to attract academics to both team assignments and peer assessment; these were identified by Hughes[14]. One commonly cited drawback is the need to prepare students for peer assessment and to properly explain the assessment process. Discussions of the criteria beforehand might be helpful [15] and students need to understand how to apply the assessment criteria [16]. Of course, this assumes that the methods employed actually have explicit criteria and indeed, this is not always the case: it is not uncommon for team members to be simply asked to rate each other at the end of a project through some simple metric, even though this mechanism clearly offers little pedagogic validity. A reliable and valid assessment should measure against specific targets that are aligned to the intended learning outcomes and course content. Research into the reliability has more to do with peer assessment of product rather than of team-member performance but validity of peer assessment can be tested in both types. Langan & Wheater [17] report a strong correlation between tutor marks and student marks and others [16] argue that they have not found sufficient reliability of peer assessment.

The necessity of staff training is also frequently mentioned as a potential criticism in the literature, in particular reference to web-based peer assessment systems. Pond et al [9] discuss some possible drawbacks with peer assessment systems in general but confirm that there are ways to alleviate or remove these problems. They investigate the potential for group collusion and highlight that the extreme subjectivity a student could bring in marking their friends and the influence of personal dislike. Some have suggested that peer assessment can have a negative effect on students' personal relationship within a group but this problem appears to grow or diminish depending on the detailed methods employed. It is anecdotally reported that there is very little variation in marks allocated by team members where the method requires students to sit together and agree 'each others' contribution' because students can be afraid to speak up. Indeed some report that this just serves to increase the number of complaints of unfairness after the process and this characteristic was demonstrated by Willmot and Crawford in a national workshop for engineering lecturers in 2003 and later reported at ICEE 2004 [18].

Another obstacle suggested by Falchikov [4] is that peer assessment might be time-consuming for students and that they would object to this imposition. The time taken for the process is clearly dependent on the design of the system and is therefore largely in the hands of the course designer. Orsmond et al.[19] believe that, in comparison to traditional assessment methods peer assessment can be too demanding of students, too time consuming and criteria setting can be problematic. Whilst most authors who have reported on peer assessment note general student acceptance of the methodology some question whether students have an appropriate understanding of individual assessment criteria [20].

Literature Summary

It is clear that there are many potential benefits of self and peer assessment to both teachers and students. The main benefit for tutors is that it can save a huge amount of marking and reduce the ever growing ¹E-mail: P.Willmot@lboro.ac.uk

workload but without the complaints of unfair grading associated with simple team mark allocation. Students generally see well presented peer assessment as a fair way of assessing group work and feel more involved compared to other assessment methods. Peer assessment is not without its problems and it is clear that academics have a number of things to address before running such an assessment. Some of the most important are; setting the criteria to be used, forming the groups, making adequate provision for handling and reporting the peer assessment data and making the whole process transparent to students. Clearly any quality automated system should provide assistance to the user at both the setup and reporting stages.

IV. INTRODUCING WEB-PA

Web-PA is an online peer assessment system, or more specifically, a web-based peer-moderated marking system. It is designed for teams of students doing group-work, the outcome of which earns an overall group mark. Each student in a group grades their team-mates (and their own) performance, which is then used along with the supervisor's overall group mark to provide each student with an individual grade, reflecting their contribution to the team effort.

It is currently in use in over half the departments across Loughborough university campus and has been embedded into the university quality system as the recommended mechanism for group mark moderation. An open source variant has now been developed and adopted in a number of other UK universities including Hull and Manchester Metropolitan. In May 2008, the project was shortlisted for an IMS global learning impact award (Austin, Texas). The software incorporates a number of significant enhancements that help to integrate good practice being developed locally and nationally in order to benefit lifelong learning and builds upon existing evaluation of assessment practices across a range of subject disciplines. The system remains under constant development.

Web-PA was developed from an original paper based peer assessment system with a view to making data entry and analysis more convenient and providing flexibility for very many types of group assessments. Web-PA is flexible on team size and constitution and allows the tutor to define any number of assessment criteria or 'form elements' that can be aligned to the learning outcomes of the module or unit. It invites objective marking statements which guide students to what performance should be associated with a given mark. The tutor selects teams directly from the central university database and defines timeframe within which the students must enter their data. Students are just required to visit a terminal between the specified dates and complete a very simple form using clickable menus. Data entry is therefore confidential and only the entry points for their own team members appear on screen and they rate each member in turn, including themselves, against the stated criteria. The assessment may be applied at the end of a project or at any time during it; more than once if required.

Put simply, the system calculates a variation factor for each team member (Web-PA factor) based on the total scores received for an individual divided by the normalised average scores for the whole team. The tutor or supervisor marks the team submission in the usual way and this mark, or part of it at the supervisor's discretion, is multiplied by the factor for each individual. Where all team members score equally, the Web-PA factor is 1.0 so all members gain the unmodified team mark. After the deadline, the tutor can retrieve a complete set of data in a variety of customisable formats and still retains the option of intervening if foul play is suspected.

This rapidly maturing online tool has been developed over a period of years and more recently, design and development of the software has been supported by the Engineering Centre for Excellence in Teaching and Learning (engCETL) at Loughborough University and by JISC. The project site can be found at <u>www.webpaproject.com</u> where visitors can access a discussion forum and a demonstrator.

V. A MULTI-FACETED RESEARCH METHODOLOGY

The research benefited from the unique access to copious good quality, consistent data captured by the Web-PA system itself. This facility also gave email links to students so that the student survey could be sent out to a large number of students studying a diverse range of degree subjects. In 2005/6 an Higher Education Authority (HEA) "Small Grants make a difference" fund provided for a number of student focus groups [9]. This produced some high quality insights into the Peer Assessment (PA) process from Business School students and aided both the design of the wider student survey in 2007 and the focus on quantitative analysis

of the PA data. A further small 'Academic Practice' Grant in 2006 provided for further research into staff and student interactions with Web-PA and to advise modification and upgrades of the software platform. During 2007 the engCETL was awarded £200,000 by JISC over 3-years to further develop the system for sharing with the wider academic community.

<u>Staff interviews</u> were used to help form the student survey. It was found that usage of Web-PA was limited to a small number of Loughborough staff in Semester 1 of 2006/07 and so these interviews, themselves were limited since they only reflected the views of 'champions' and 'early adopters'. Repeating the interviews in 2007/8 would have provided a much wider population. The interviews were used to aid focus of the survey questions – much as in the earlier focus groups.



Fig. 1. Research Methodology

A <u>Student survey</u> was carried out at the end of Semester 2, 2006/07 using the commercial online tool 'SurveyMonkey'. Providing for a £40 book token 'prize-draw' inducement, the survey was sent out to 2209 students studying on 36 modules across 14 departments. There was ultimately an overall response rate of 13% with 284 usable responses. The survey used 27 Lickert scale questions as well as a number of static data questions such as department, year and gender. The Lickert scale questions were focused on the friendliness of the system, the benefits of Peer Assessment, the fairness of marking, the students own feelings and the extent of collusion at the point of data entry.

The final part of the research was to separately analyse the raw <u>Web-PA data</u> captured by the system during the second semester of 2006/7. Data was collected from 6 modules across 3 departments, and included group assignments taken by all undergraduate years: this data reflects 730 student interactions. The analysis focused on perceptions of fairness and honesty of marking and, again, on collusion within teams.

VI. COMPOSITION AND KEY FINDINGS OF THE STUDENT SURVEY

The majority of the student teams or groups were formed by tutor selection (77%) while a significant minority (19%) had been formed by the students themselves. It can be assumed that in these cases the students knew each other before the activity started. The residue (14%) used the method of team formation known as the 'seeding' method: formed by students around a seed member that is predetermined by the tutor concerned. Both undergraduate and postgraduate students took part in the survey with a reasonable spread across all year groups. Loughborough University has a particularly large engineering faculty and it was from here that the Peer Assessment facility originated so it is perhaps not surprising that there was a numerical bias towards males (62%) in the survey. A breakdown of year-group and gender of the respondents is given in figure 2.

Figure 3 demonstrates the breadth of the survey and names all departments that provided at least 5% (rounded) of the total response.



Fig. 2. Age and Gender profiles of the Survey

Male

62%



Fig. 3. Breakdown of respondents by Department

Standard statistical analysis tools have been used to analyse this significant survey. Techniques such as ANOVA, regression and bi-variate analysis have been applied but such a detailed treatment is beyond the scope of this paper (the authors hope to publish this elsewhere in due course). There follows a broad discussion of the key findings.

Using the linear regression model and a stepwise variables selection method it was found that the most significant variables (95% level) that helped to explain the overall positive acceptance of Web-PA were:

- Anonymity of marking
- The opportunity to reward higher achievers: 'Stars'
- The feeling that Web-PA provided fair marks
- The absence of instances of group collusion adding to the feeling that the Web-PA system provided honest marks.

Using a means comparison technique we sought levels of significance in excess of 95% in the responses given by students. This showed that in the sample:

- There were no significant differences between departments represented.
- Final year students and males, overall, were more discriminating and used the system to identify 'free-riders': they appear more protective of their final grade.
- Females preferred anonymity more than males but a majority overall preferred this feature as it aided honest marking.

Delving more deeply into the gender specific results indicates that men seem more characterised by a sense of camaraderie: they, in fact, reported to have it found more difficult to give to own friends in their group a low mark even when it was deserved. On the other hand, there is evidence that women students are more prone to value the importance of Web-PA for understanding their role within the team.

Through the survey we also delved into the area of feedback, i.e. attitudes to feeding back the assessment of the peer group to a student's work. Clearly this is a sensitive area that needs careful treatment but it is within this concept that there is basis for the frequently heard claim that Peer Review can develop key skills. While the analysis showed, in general, that not much difference exists in real terms between the various departments in the sample; the only significant difference that emerged was in regard to the possibility of offering other group members feedback on the mark that a student had given them (an optional routine for this exists within Web-PA). While postgraduate students of all departments appear keen to share there intergroup feedback and undergraduate students of some departments like Business School/Economics and Politics and International Relations would appreciate such feedback; students from English & Drama and Engineering would prefer not to disclose or receive peer marks or any indicator of the mark.

VII. QUANTITIVE (WEB-PA) DATA ANALYSIS

The live data for this section was extracted from the online web based peer assessment system. Six modules from the academic year 2006/2007 at Loughborough University were selected to encompass a variety of year groups and departments.

Α	В	С	D	Е	F	G	Н	Ι
Module	Method of group selection	Year	Number of students	Average Team size	Non submission %	Zero standard deviations %	'Self' lower than 'Peer' mark %	Teams with >95% available marks awarded
1	Tutor - Random	1	286	6.00	7.0%	6.4%	18.8%	2.1%
2	Tutor - alphabetical	3	87	3.90	1.2%	40.0%	15.1%	31.8%
3	Seeding	3	69	4.60	4.4%	40.9%	13.6%	26.7%
4	Seeding	1	109	5.70	4.6%	1.9%	27.9%	0.0%
5	Self selecting	2	63	3.20	12.7%	60.0%	18.2%	42.1%
6	Seeding	2	116	4.30	0.9%	2.6%	31.3%	3.7%

TABLE I. SUMMARY OF DATA ANALYSIS FOR SIX MODULES

Firstly we consider what 'honest' marking looks like from a data point of view. 'Honest' marking implies there is a willingness to discriminate between team members and we would expect there to be engagement with the process. So for 'honest' marking there will be a reasonable chance of a student marking him/herself lower than others in the team: 'self-mark < peer-mark'(column H, table 1). The opposite would be where a student seriously overestimates his/her own scores.

We would expect the groups not to give out 100% of available marks. There should be some variation in the marks awarded for different criteria and this is shown by a low percentage of zero standard deviations (column G, Table 1). A zero standard deviation occurs when individuals award all members of the group the same mark, probably applying little genuine thought to the process. We would also expect that if there is 'engagement with the process' then there would be few non-submissions (Column F, table 1).

The data collected shows that sometimes there is honesty as defined above and sometimes not. For all the groups there is a reasonable chance of a 'self less than peer' score, but there is variation in the other three measures. The interviews with staff and the survey of student users have suggested that method of group selection; year group and group size all have an effect on 'honesty'.

Comparing module 5 (self selecting) with module 6 (where the tutor predetermined the seed member) we see they are both second year groups and of a similar group size. However, for module 5 we see a high proportion of non-submissions (13%), 60% of zero standard deviations and over 40% of the groups have allocated over 95% of the available marks. This leads us to suspect there is less honesty – less willingness to discriminate and engage in the process in groups that are self selecting.

Considering modules 1 and 4, which are both from first year and of similar group size, the key difference is that in module 1 the tutor has allocated teams randomly and module 4 is seeded. Both of these modules appear to demonstrate 'honest' marking with the seeded module having a particularly low percentage of zero standard deviations. Now considering modules 2 and 3 (both third year and similar group size) again the key difference is that module 2 is random and module 3 is seeded. These modules also exhibit similar marking behaviour but would not fit the criteria as 'honest'. So we can conclude there is no apparent difference between marking behaviour for random and seeded groups, whether that behaviour is honest or not. Other factors are clearly having an influence here.

When comparing modules 1 and 2 which are similar in every respect except year of study the test suggests much less honesty in module 2 (year 3). Module 3 seems to confirm the suggestion of honesty loss in finalists. However marking behaviour could be influenced by the fact that by the third year the students are likely to know each other well however the teams were selected, so it is possible that the groups are behaving like a 'self selected' group. Further research would be needed to establish if this is the case.

Of particular interest are modules 4 and 6 which are both seeded, are of similar size from year 1 and 2 respectively and having the same Responsible Examiner. These groups both exhibit 'honest' marking behaviour with particularly low % zero standard deviations. Module 6 students had experienced the peer review process in their first year and appear to have confidence in and a commitment to the process, there being only 1 non-submission. Another explanation might be the style of introduction to the process that this lecturer uses.

In short, analysis of the PR data suggests that:

- Self-selecting groups are less discriminating and potentially less 'honest' in their marking.
- Early years students show more marking 'honesty' than finalists Finalists show a greater number of zero standard deviations in marks at group level.

VIII. CONCLUSIONS

There is considerable anecdotal evidence that students undertaking team projects where no rational measure is taken of the individual's contribution express concern about the way in which marks are awarded. As a consequence, the benefits of group work have sometimes been overshadowed by such concerns especially where students within a team are allocated the same mark.

This work has determined that there is much interest on a wide stage in peer assessment: the idea is not new, but the intensity of its uses and support for its pedagogic validity as a system is growing and very applicable to a world where recruiters are demanding graduates with enhanced interpersonal and transferable skills. The peer assessment method has been applied in a wide variety of formats with varying degrees of success.

The Web-PA self and peer online mark-moderation method, described here, has met with a very enthusiastic and rapidly growing following. Whilst much of the data it has generated supports previous literature on this subject, important new insights are gained into the thoughts of the student participants. After experiencing Web-PA, there is much support for the fairness they believe peer review can offer. More specifically they comment positively on qualities of anonymity, recognition of 'stars' and 'free-riders' and the point to a perhaps surprising lack of collusion associated with the web-based system. Individual and group marking behaviours also suggest that most peer review marking is 'honest' but can be influenced by group size, selection method and the year of study.

Overall, marking is found to be credible and while free riders are known to mark themselves up, the overall system appears to compensate for this generate an acceptable, lower than team average grade. Final year undergraduate students seem to be bounded by an individualistic approach to study which is heavily focussed on maximising their own grade rather than on developing team working skills or making maximum use of any developmental benefits. There are detectable differences in the peer review data according to how the teams were originally formed but, as yet, there is insufficient evidence to offer concrete conclusions except to note that self-selecting groups appear to generate a smaller variance in the marks they allocate.

Anonymous marking is strongly preferred by all except postgraduate while female students, in particular, express a desire for anonymity. Females are also more inclined to allocate a larger range of marks. In addition, the generally more mature postgraduate students show a stronger appreciation for peer assessment as an educational support tool for developing and refining their own team-working skills.

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