Group work and individual assessment

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***Abstract**: Increasingly tertiary institutions are using group work and group projects in response to industry demands that universities produce graduates who possess appropriate 'employability skills' such as communication, team work, problem-solving, initiative and enterprise, planning and organising and self-management (DEST, 2002). However, when the majority of assessment items are based upon group activities, it is a difficult and time consuming task to be certain that marks awarded to individual students accurately represent that student's effort, knowledge and abilities. This paper describes several years' experimentation with different approaches to the evaluation of teams of students working on unique industry projects. The final approach – a system of regular peer assessment, combined with innovative assessment of project activities and deliverables through a formal project review process – has enabled us to allocate individual marks for group work that accurately reflects student contribution and knowledge while at the same time reducing the burden upon course academics.*

Background

In response to demand from employers that universities produce graduates with appropriate 'employability skills' such as communication, team work, problem-solving, initiative and enterprise, planning and organising, and self-management (DEST, 2002), universities and other tertiary institutions are increasingly turning to group project courses and group work more generally to help students develop these important skills.

While this addresses one problem it introduces another: that of allocating grades which adequately reflect individual knowledge and effort. To tackle this problem we have introduced peer assessment of all activities and use this as a moderator of the team mark to determine an individual mark for each student in the course.

Methodology

We have been offering industry-based projects to groups of undergraduate software engineering students since 2000. In 2004 we restructured our project courses, combining third and fourth year into a single course, leading to all students undertaking a two-semester (26 week) real-world project with industry partners in both their third and fourth years. No two teams undertake the same project. Teams are comprised of one or two fourth year team managers and three or four third year team members. Students are placed in teams based upon their expressed interest in the project rather than academic ability, gender, cultural background or any other reason. In addition, all teams have an industry experienced mentor assigned to meet with them at least fortnightly throughout the year and to provide formative feedback on artefacts and process. Greater detail about the design of this course can be found in Johns-Boast & Flint's paper (2009).

Along with restructuring the courses, we have also refined our approach to assessment so that we achieve a fair and equitable allocation of marks that adequately reflects both individual knowledge and contribution. An additional complication we faced was that we required an assessment scheme that would apply equally to all students despite the fact that they were working on quite different projects. We also wanted to focus students' attention on the process and not just the final product.

In 2004 third year students had a different assessment scheme from the fourth year students and that assessment scheme had clearly identified deliverables and activities. This led to students becoming quite

strategic (Ramsden1987, Newble &Entwistle 2009) and focussing their efforts upon only those activities and artefacts identified in the assessment scheme. We, like many others, allocated group marks for group activities related to the project and relied on individual activities, such as examination and individual reflective reports, to differentiate between students.

This approach led to a telescoped range of marks for the group work component of the course and complaints from some students that some team members were benefitting unfairly from being part of their teams. It meant that students who might otherwise have failed passed the course, while those who might have done very well, may not have done so well.

Over the intervening five years we have worked hard to refine our approach to assessment and grading of individual students who are part of a student team. We have done this through a series of changes and associated evaluation of that change. While many of the components have remained, the weighting of each has varied.

First change – students report on work undertaken; third and fourth year students have different assessment schemes with clearly specified deliverables and activities; clients rank value of final product; individual reflective report; written three-hour exam

In 2005 we attempted to differentiate between students by requiring each student to submit a monthly report of activities undertaken that pointed academics to their work as evidenced by artefacts stored in the team's on-line code and artefact repository or their project web-site.

Course academics were then required to assess and grade the various artefacts and verify a student's claims by interrogation of the logs showing commits to the repository. This was a very time-consuming task and encouraged students to identify and focus upon tasks and artefacts in the assessment scheme that they believed would help maximise their marks, in some instances to the detriment of the successful outcome of the project. This approach was further hampered by having teams comprised of both third and fourth year students, with each group having their own assessment scheme. In some instances students focussed only upon activities and artefacts that they deemed appropriate to their assessment scheme rather than on completion of a successful project.

Although we were able to differentiate between individual students, group work marks remained clustered about the credit and distinction grades and students focused on artefacts specified in the assessment scheme rather than on delivering value to the client. In some instances, students still complained that other students were not doing sufficient work for the grades they were awarded.

Clients ranked the performance of the team, based upon their assessment of the team's performance in terms of how well their needs had been met and upon the final delivered product.

Second change – introduction of team peer assessment to sit along-side student reporting on work undertaken; third and fourth year students have different assessment schemes with an identified minimum set of activities and deliverables required; individual reflective report; written three-hour exam for third year students and a half-hour oral exam for fourth year students

In 2006, in an attempt to overcome student complaints related to unequal contribution, we introduced rudimentary peer assessment: students were required to state the percentage effort each member of the team had made towards the current assessment period, usually seven or eight weeks. This was combined with a change to the specification of artefacts and activities teams were required to undertake, although third and fourth year students still had different assessment schemes.

As we wished also to use peer assessment as an instrument to help with the development of reflection and self-awareness, teams were required to discuss team contributions and to develop a single, team related peer assessment for each team member. This meeting was facilitated by the team's mentor.

However, it did not lead to the changes we sought. In many instances, hard working team members were unwilling to confront team members who were not pulling their weight. They decided that as they had to work with these students for the remainder of the year, it was better to attempt to foster a sense of 'team' than to potentially get other students off-side. Unfortunately this did not work as the team members who did not speak up then had to deal with growing feelings of annoyance and sometimes

anger directed towards those students who were not pulling their weight, all of which tended to undermine the team's progress.

In the instances where hard working team members confronted those who were not pulling their weight, frequently the under-performing team members were unwilling to accept their peers' assessment of the value of their contribution, which made for a very uncomfortable meeting. At times, this led to a further withdrawal from the team of the team member thus confronted.

As peer assessment was only used by the course academics as a guide when determining individual marks, there was little value gained: it did not reduce time taken in assessing individuals, did not contribute significantly to reflective practice and the development of self-awareness, nor did it help to get students to focus on completion of the project and delivery of value to the client, rather than on activities and artefacts they determined would maximise their marks, while minimising their effort.

In previous years we had found it extremely difficult to deal with the significant variance in client assessment of the value gained from the final product so we decided to remove formal client input into assessment. We were concerned also about the potential for conflict of interest, as many clients decided to employ students from their project teams.

In 2006 we introduced a half-hour oral examination for fourth year students as we had found that using a written examination to assess their ability to successfully manage the identification, development, use and evaluation of appropriate processes and artefacts required to complete each activity and deliver value to their client was less than satisfactory. However, a written examination is not a suitable instrument through which to demonstrate a high level of professional judgement and application of software engineering best practice which is one of the stated learning outcomes for the course. We were, however, very happy with the outcome from the oral exam: we could clearly differentiate between students who possessed a deep understanding and those who did not, while students themselves felt it was a much fairer way of assessing their understanding and how they had contributed to the project's success.

Third change – refinement and individual submission of peer assessment instrument to sit along-side student reporting on work undertaken; third and fourth year students have different assessment schemes with an identified minimum set of activities and deliverables required; individual reflective report; written three-hour exam for third year students and a half-hour oral exam for fourth year students

In 2007, the major change to assessment was to ask students to submit peer assessment to academics on an individual basis, i.e. team members were unaware of how they had been assessed by other members of the team. Nothing else was changed.

While this helped avoid difficult meetings where contributions to team work were discussed, it brought about no significant change in student behaviour and did not ease the load on academics when attempting to differentiate between students. Students, however, continued to be reticent about 'marking down' a poorly performing peer.

Fourth change – introduction of complex peer assessment instrument, used to moderate team marks; third and fourth year students have the same assessment scheme but with a different focus for each; individual reflective report; written two-hour exam for third year students and a half-hour oral exam for fourth year students

In 2008, after further research into peer assessment and discussion with colleagues in other areas of our institution as well as at other institutions, we decided to introduce a complex peer assessment instrument based largely upon the work of Oakley et al (2004). Along-side this change to peer assessment, we amended the assessment scheme so that it was the same for both third and fourth year students, but with a different focus for each. The focus for fourth year students was on the quality of their decisions and how well they managed the team; while the focus for third year students was on how well they completed the actual activities required by their project.

Artefacts and activities were assessed for a team. Students were required to submit their peer assessment instruments directly to course academics.

Students were required to assess each team member, including themselves, against a list of characteristics that relate to good team work and work habits – respect, professionalism, quality and accuracy of work, enthusiasm, timeliness, engagement, collaboration and leadership. Examples of the sort of behaviour that constitutes each characteristic were provided. For each statement students indicate whether the team member displayed this characteristic never (1), rarely (2), sometimes (3), usually (4) or always (5). Students were also asked to provide a brief commentary on each team members' performance and to rate them against the following scale: excellent, very good, satisfactory, ordinary, marginal, deficient, unsatisfactory, superficial and no show.

The results of the individual peer assessment were aggregated, producing a single peer assessed score for each student. The team's average peer assessed score was also calculated, against which individuals' peer assessed scores were compared. The differential between the team average and the individual's score was then used to moderate the team mark to produce an individual mark. Students assessed highly by their peers could be awarded more than100% of the team mark though the total mark that could be awarded was capped at 100% of the available marks for that assessment item. Students were provided with their aggregate peer assessed score which was sometimes used by team leaders and mentors to counsel students on ways of improving performance.

This change to peer assessment and the assessment scheme began to bring about the changes in behaviour we had been seeking.

Generally, students were no longer focussing on marks, rather they were focussing on the completion of the project and the delivery of value to the client. Aggregating peer assessed scores into a single score evened out extremes that might have been introduced through an individual student either simply not liking another or because they were influenced by yet another student. Also because of the range of behaviour students were asked to assess, students seemed more willing to reflect and to provide more honest feedback on their peers than when they were asked to provide a single assessment of team members' contribution.

Using aggregated peer assessment as a moderator of a team mark enabled us to differentiate more strongly between individual students without causing conflict within teams and without giving rise to student complaint. For the first time, it was relatively easy to justify failing one student in a team, while another might receive a high distinction, just as would happen in courses where there was little if any group work.

While marking project activities and deliverables as a team, without regard to who had completed what, meant a reduction in time taken by the academics in assessing students, it was still a mammoth task and we still had concerns that assessment was focussed too heavily on deliverables rather than process.

Fifth change – introduction of project reviews with moderation of team marks by peer assessment instrument; third and fourth year students have the same assessment scheme; two reflective reports, one at the end of each semester and weekly blogs

In 2009 we decided that the introduction of three project reviews, spaced evenly throughout the project, would enable us to focus on process as well as deliverables and project outcome. The project reviews are the equivalent of industry major milestone reviews and all students as well as clients, the team mentor and course academics attend. Reviews are more than a simple presentation and a few questions. Rather they act as a form of examination and take between one and one and a half hours each.

Teams are required to have on-line or local access to all project artefacts including project management tools, project documentation, source code, repository and other logs, running software, web sites and specialised hardware. During the review, team members are expected to quickly locate and display requested information. Where appropriate, they must be able to demonstrate any running code.

The course examiners and team mentors use these project reviews to assess the state of each project and award a team mark that reflects project progress. A mark for each individual student is then determined by adjusting the team mark (up or down) depending on the student's contribution. This contribution is determined by considering student performance during the review, observations made by mentors during mentor meetings, and peer assessments. In practice we have found that we moderate the team mark by the peer assessed rating and then verify that mark rather than doing anything more complicated.

We believe that we now have a form of assessment that enables us to differentiate confidently between students and to award grades that adequately reflect an individual student's knowledge, effort and commitment. In addition, although each week of project reviews is an intense period for course academics, the overall total time and effort taken to assess projects has been significantly reduced: we no longer need to verify student claims relating to contribution nor do we grade project artefacts. However, the quality of the assessment and our confidence in it has been increased.

Benefits and Issues

Benefits

This model provides substantial benefits for all stakeholders – students, industry partners and course academics. The principal benefits that we have identified include:

- **Students**
  - By removing the emphasis from specified activities and artefacts for assessment students are able to focus more upon the project itself thereby increasing both their learning from and enjoyment in participation in the project.
  - Students gain experience with both self- and peer-evaluation; a skill which they will require once they graduate and move out into the work force.
  - More cohesive teams composed of members who have learnt to work harmoniously with others of differing abilities and commitment.
- **Industry partners**
  - By removing the focus on assessment, students are encouraged to focus on the project itself thereby delivering increased value to the client.
- **Course academics**
  - A significant reduction in the total amount of time allocated to project assessment.
  - Increased confidence that marks allocated to individuals accurately reflect their knowledge, effort and commitment.
  - Reduction in complaints from students about 'unfair' allocation of marks to lesser performing students, leading to greater enjoyment all round.

Issues

There are still a few issues with our implementation of peer assessment and the assessment scheme as it currently stands. A small number of students are still uncomfortable with being asked to provide an assessment of their peers that they know will impact upon their peers' marks. However, we have been addressing this concern through a series of lectures on reflection and the importance of developing this skill as well as encouraging students to take responsibility for their contribution and learning. We also point out to students, as do clients and guest lecturers, that in a very few years as team managers in the work force they will be required to both mentor and assess their subordinate's performance.

Perhaps the most significant issue we face with the introduction of the complex peer assessment instrument is the lack of an automated system that helps collect the data, aggregate it and apply it to team marks. Currently this is all managed through spreadsheets. Students are supplied with a workbook that has been populated with the names of each team member which they complete and submit. Course academics then manually aggregate these worksheets into a pre-formatted workbook which performs all necessary calculations. We are aware of various software tools that have been designed to carry out similar functions; however, there is financial cost in adopting these. We are investigating way of using our learning management system (LMS) to improve this situation.

Reflections/Recommendations

We believe that we now have a form of assessment that enables us to differentiate confidently between students and to award grades that adequately reflect an individual student's knowledge, effort and commitment. This assessment is applicable across teams, despite the vastly different projects our students undertake, both within and across years. It enables students to adopt a life cycle model that is appropriate for their project rather than one imposed upon them by the assessment scheme. Although the weeks in which project reviews are held are intense periods for course academics, the overall total time and effort taken to assess projects has been significantly reduced while the quality of the assessment has been increased.

In addition, the inclusion of a significant component in the assessment scheme (25%) for two reflective reports and the keeping of weekly reflective blogs, has led to increased learning by students who can now talk confidently about all stages of the software development lifecycle and have a clear picture of how their learning is helping them develop Engineers Australia stage one competencies.

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