Fostering teamwork skills across the School of Engineering using online self and peer assessment

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Teamwork skills have been a recognised key employability attribute in university graduates for at least the last two decades, as analysed by Curtis and McKenzie (2002) and continue to be a significant key selection criterion of many Australian employers (Graduate Outlook, 2014). This paper outlines the implementation process, learning and future directions associated with the use of an online self and peer assessment strategy, aimed to develop teamwork skills in engineering students, at Deakin University. Initially student feedback from a pilot study was used to inform and justify a three-year trial of the strategy. Then consideration was given to the professional development needs of academics to support and foster the teaching and assessment of teamwork skills in the school. Into the future, teamwork skill development depends upon the evaluation of course learning outcomes and development of minimum standard descriptors of teamwork skills across all year levels.

Keywords: Teamwork skills, Self and peer assessment, Project-oriented design-based learning

Introduction

At Deakin University, the School of Engineering is in the third year of implementing the Project-Oriented Design-Based Learning (PODBL) method. This student-centred learning approach is underpinned by students working together on projects. These projects are designed to engage students in real-world problems and enable students to collaborate, learn and develop their capacity as engineers within a team environment (Chandrasekaran, S., et. al., 2013). Students begin their PODBL experience in first year and build on their skill set throughout their degree. The learning design aims to replicate the experience that many engineers have in the workplace - that is, working together within a diverse team of people, who bring together a range of skills, knowledge and experience to complete a project. Deakin's graduate learning outcome for teamwork states:

> 'Teamwork is essential for life-long learning and problem solving, to develop shared understandings and bring together diverse talents and disciplines. Successful teams recognise and use complementary skills and knowledge and collaborate.' (Deakin, 2018).

The challenge at a tertiary level is not only are students required to develop the discipline specific skills required by the engineering profession, but they must also apply their skill set as proficient members of a multiskilled team. For many, working and learning collaboratively is a new experience. Therefore, learning design within the PODBL environment necessitates the inclusion of teamwork skill development and supported opportunities to apply these skills within a team environment. To support the implementation of the PODBL method, the School of Engineering engaged the faculties 'Learning Support Team', to design a systematic approach to the teaching and learning of teamwork skills (Gunning, T, & Krishnan, S., 2017).

This paper presents an overview of the challenges, opportunities and learning experienced thus far, associated with the development and fostering of teamwork skills within the School of Engineering's PODBL methodology.

The pilot study

In 2015, a pilot study was initiated using a second-year, civil engineering unit. The original unit was redesigned using the PODBL method. It was identified from previous iterations of this unit, that student engagement in the group project was problematic. Student feedback had highlighted the fact that many students did not engage in the projects but received the same group mark as everyone else in their team. This surfaced as frustration from high achieving students who were required to do the majority of work if they wanted a good mark. The

academic teaching team were also frustrated as the expected collaborative learning environment was difficult to monitor let alone assess, and therefore the individual student outcomes from the project perspective were hard to measure. Indeed, academics identified that they were not in the best position to assess teamwork skills, as the meetings and development stages of the projects often occurred external to the classroom and mostly online.

The approach

As a means to engage both on campus and online students in teamwork, an online 'self and peer assessment tool' was sourced that:
- Encouraged students to contribute equally to a project
- Assessed student's teamwork skills when they work in teams external to the classroom
- Collected evidence of teamwork skills in order to individualise a team mark

The tool of choice was SPARK^{PLUS} (https://sparkplus.com.au/how.php)(Willey and Freeman, 2006b). This tool was developed through the University of Technology Sydney, in response to tertiary student feedback. To support the implementation of SPARK^{PLUS}, into the pilot PODBL unit, the Learning Support Team provided one-on-one support at the academics point of need to ensure:

- unit learning outcomes included the assessment of teamwork skills
- the redesign of the project task to include self and peer assessment of teamwork skills
- training on how to use the tool
- setup and implementation of the tool
- in class support to introduce and justify the use of the tool to students
- analysis of results to individualise the project marks
- collection of student feedback about the tool and strategy

The assessment outcomes for teamwork skills in this unit were informed by the School of Engineering's Course Learning outcomes, which state:

> 'At the successful completion of this course students can:
> Undertake various team roles, work effectively within a team, and utilise effective teamwork skills in order to achieve learning goals.
>
> Apply interpersonal skills to interact and collaborate to enhance outcomes through shared individual and collective knowledge and creative capacity to optimise complex problem resolution.'

Students in this pilot unit were required to work in teams to learn and produce a project artifact for assessment. The academic team interpreted the course learning outcomes for this second-year unit and articulated it to students using the following Unit Learning Outcome (ULO):

> 'At the successful completion of this unit students can: Collaborate in a team to create a project brief, self-assess and peer assess team skills and reflect on their personal contribution to the team's project outcome.'

The results

With ethics approval, feedback was collected from students regarding their experience using the self and peer assessment strategy during the pilot unit (SCITECH Ethics Low Risk, STEC- 55-2015). Students responded to the survey questions using a Likert scale. 22% of students responded.

Summary of key points from the survey about the self and peer assessment strategy.
- 100% agreed that the tool was accessible and easy to use
- 93% agreed it was a safe way of providing feedback to team members
- 85% agreed it was an appropriate process to individualise contributions to the project
- 93% agreed the team task helped them to link the skills of Teamwork to their future career
- 85% agreed they would be comfortable using the tool again to self and peer assess against criteria
- 93% agreed that it would be valuable to receive feedback from their team during the project

In addition to the online survey, students were provided with the opportunity to raise questions and concerns with a member of staff not associated with the unit. A group of three engineering students challenged our team with the following question, 'Why are you wasting our time with teamwork skills when we are here to learn how to be engineers?' This highlighted a communication disconnect between the academic team and the students. The academic team had aimed to link the importance of working in a team with the professional environment of engineers. Additional clarity was required to help students make this link.

Feedback provided by the academic team confirmed the tool provided flexibility to create the criteria they determined important for their unit. They were also appreciative of the paper free analysis of ratings, which was faster than manually sorting through student responses associated with contribution to the project. The conclusion was that the strategy enabled academics (with support) to confidently individualise a team mark for students.

During our end of unit reflection, the teaching team identified that while the tool was initially implemented as a strategy to engage students in a team-based assessment task, and to inform assessment outcomes, it was clear that the tool had additional value as a learning tool, as previously observed by Willey & Gardner, 2009. By constructing criteria and requiring students to consider it at the beginning, midway and at the end of the project, we were exposing students to what the academic team valued about teamwork and what that would look like in action. The giving and receiving of formative feedback against those criteria also provided a platform for students to conduct self-reflection and experience how to construct constructive feedback to help their team members improve their skills.

The above responses provided the necessary support to proceed with a trial of self and peer assessment of teamwork using SPARK^{PLUS}, in the first stage of PODBL implementation. A three-year trial was designed to test the logistics, effectiveness and scalability of the self and peer assessment in PODBL units.

The trial

Preparation

To support the implementation of self and peer assessment in PODBL units, a student resource was created. Its purpose was to guide the students to use the tool, explain how the teaching team uses the results and addressed the key student concerns from the pilot. The resource was created as a power point to be delivered by a member of the teaching team. The content aimed to explicitly link teamwork skill development with the Deakins Graduate Learning Outcomes and the world of work. A quote from Engineers Australia stating the importance of teamwork in the engineering profession was added to ensure students were clear about why we were expecting them to place a high importance on the development of teamwork skills. An overview of how to give and receive constructive feedback was also included, to support students to provide appropriate comments to substantiate their ratings of each other. It also addressed how to read and act on feedback received. An optional resource, 'Your Social Style in Teams', was provided to all academics in the trial, to help their students think about how they are perceived by others, and how they may need to manage their social style.

Due to finite human resources, the PODBL units chosen to trial self and peer assessment were based upon the interest shown by academics. Collegiate conversations with many academics revealed that while they were particularly competent in their subject matter knowledge, they sought support in areas of pedagogical knowledge - for example, strategies to engage learners in the content, utilising new technologies, and introducing work integrated learning opportunities. Interestingly, the development of student's teamwork skills was not considered part of the unit chair's responsibility, and academics often referred to teamwork skills as 'soft skills'. The teaching of 'professional skills' was reserved for specialists in that area and was treated as an add-on to the unit design - the assumption being that by providing the opportunity to work in teams would inherently result in the building of student's teamwork skills.

The implication of this approach was that the 'soft skills' associated with teamwork were deemed not as important as the 'hard skills' of the academic's speciality. Concerns about lack of time to address additional criteria in an already crowed curriculum and the stress associated with teaching and assessing a topic outside their comfort zone were also highlighted.

It was clear that in addition to supporting students to develop their teamwork skills, professional development would be required to support academics to teach and assess teamwork skills. Referred to as 'early adopters', the academics chosen to participate in the trial, were willing participants who were keen to work collegiately with

the Learning Support Team to design and implement the strategy into their unit. This way, time associated with 'selling' self and peer assessment of teamwork skills was removed. The support team were then able to provide the one-on-one support required at each academic's point of need.

The design

While the implementation of the PODBL method occurred over two years, trialing the self and peer assessment strategy occurred over three years, as shown in Table 1. The first two years were aimed at supporting 'early adopters' in second, third and fourth year PODBL subjects. If the trial proved successful in the first two years, then a key first year PODBL unit would be included in the trial. This unit was of particular importance as all first-year students are required to pass this unit. The unit therefore sets the expectations around PODBL and teamwork for the rest of their course.

Table 1: The number of PODBL units, across the year levels, that trialed self and peer assessment of teamwork skills, from 2016 -2018.

Year	First year units	Second year units	Third year units	Fourth year units
2016		4		2
2017		3	1	1
2018	2	3	2	1

Future Directions

The success of the trial in the first two years provided the confidence to trial self and peer assessment of teamwork skills in a first year PODBL unit. The trial ends at the end of 2018 and at that point a final analysis of the strategy as a teaching, learning and assessment resource will be undertaken and presented to the School of Engineering. Both student and academic feedback will be used to inform the continued role and the scaling up of this strategy into additional PODBL units. Evidence will be gathered through online surveys and focus group interviews.

Professional development needs are also a priority. To foster teamwork skill development in the school, it is essential that academics are provided with point of need support to develop their confidence to teach and assess teamwork skills. Collegiate interviews will be conducted with the academics who were supported during the trial. The support provided will be evaluated to ascertain the pedagogical value, the quality of service and to determine where improvements and efficiencies can be made.

Throughout this pilot and trial period, the assessment of teamwork skills has been guided by the descriptors underpinning the course learning outcomes for teamwork. Using the trial units, an attempt was made to scaffold student learning outcomes in teamwork across the years, which was difficult given the small number of units trialing the strategy. Our aim is to evaluate and update the current course learning outcomes for teamwork and clearly define minimum standards for each year level. Assessment will then be designed to enable students to demonstrate proficiency at the defined minimum standards for each year level, as they develop their skills towards the attainment of their course learning outcomes. This task will require the collaboration of all course directors in the school to come to a shared understanding of the importance of developing teamwork skills and to elevate its importance as a skill set in the School of Engineering.

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