Improving student engagement with self-assessment through ePortfolios

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***Abstract**: Self-assessment is an integral component of learning from experience and a core skill for engineers to continue their professional development. Programs that accredit engineers need to provide course assessment and learning activities that develop these essential skills. One tool that has been identified as important for supporting development of self-assessment is the ePortfolio. A three year longitudinal study of first-year engineering student engagement with and success in self-assessment using ePortfolios has been conducted. The self-assessment task was embedded within students' ePortfolios that they compiled to display and reflect upon their CAD modelling and engineering drawings. In each of the three years, students were introduced and supported in self-assessment through ePortfolios with similar orientation experiences, focused computer practical sessions, mentor support and developmental feedback from teaching staff and helpdesks. The proportion of students that participated in the self-assessment activity, the depth of their reflection and their ability to predict their final grade compared to the actual grade, were used to evaluate student's self-assessment skill development. A significant positive shift in these measures of self-assessment was observed when the ePortfolio tool was changed from PebblePad to Mahara in 2011. Students were more deeply engaged and thus participated more in the self-assessment activities. Through this process students were demonstrably more accurate in their self-assessment. A link between a student's ability to self-assess and the level of student engagement in the course was also observed. It is proposed that Mahara's simplified interface was able to more clearly articulate what was expected of the students to be successful in the course, compared to a similar self-assessment task using the Profiler tool in PebblePad. Although more problematic to aggregate, using Mahara-based self-assessment has better supported and more deeply engaged our students in the development of self-assessment of their professional engineering skill level.*

Introduction

In the Educating Engineers for the 21st Century report, engineers were defined as technical experts who can operate and manage across boundaries in complex environments providing creativity, innovation, and leadership (Henley, 2006). Higher education was challenged in this report to adjust their programs to include more real-life and practical experiences for students to meet these needs. In parallel to this context, the University of South Australia has adopted experiential learning as the cornerstone of all programs (Lee, 2007). However, one cannot assume that just by having an experience that students will learn what they need to be successful engineering professionals.

Most models of experiential learning are cyclical and have phases: an experience or problem situation, a self-assessment phase, a reflection phase and a planning stage (Kolb, 1984). Thus, to be successful at learning from experience, you need a range of skills including self-assessment, reflection and action

planning. This ability to evaluate one's own work was identified by graduates to be the one professional skill that university least prepared them to do (Boud, 1986). Higher education needs to provide these experiences to adequately prepare students for the professional decisions they will be asked to make in their future careers (Boud, 2008).

The skill of accurate self-assessment needs to be learnt. A meta-analysis of self-assessment research showed that accurate self-assessment varies with a student's level of competence, their year level and the type of activity being assessed (Falchikov & Boud, 1989). In particular, first year students, in practical (rather than theoretical) courses were the most inaccurate at self-assessing their performance. This has been referred to as the 'Dunning-Kruger effect', where incompetent people fail to recognise their own incompetence, yet highly competent people under estimate their level of performance in comparison to others (Dunning *et al*., 2003). Self-assessment can be considered as a skill that can be developed and supported (Falchikov & Boud, 1989), a process that starts with developing learners' self-awareness (Weimer, 2002).

The use of ePortfolios in higher education is increasing (IMS, 2005; AEP, 2008) with the concept being promoted to students for personal development planning, lifelong and experiential learning. Portfolios actively involve students in their assessment,

... by managing and monitoring their learning in both the cognitive and affective domains, documenting their progress and achievement over time, articulating their achievement levels, and more importantly, experiencing success. Portfolios also encourage students to embark on the cycle of lifelong learning (Hertels, 2004; p.108).

There are many ePortfolio tools available for use in higher education and professional contexts, the choice of which can be daunting (Dinmore, 2010). Getting students to engage with ePortfolios can be a significant hurdle (Fielke & Quinn, 2009), with the technology itself often being a significant barrier (Tosh *et al*., 2005). This paper examines the impact of a change in ePortfolio tool on student engagement with self-assessment activities in an engineering course and the flow on effect this has had on the accuracy of their self-assessment and their engagement with reflection.

The evolution of ePortfolio tools for assessment at UniSA

In 2009 the University of South Australia commenced a trial of the ePortfolio PebblePad™ and it was adopted for use in the first year core course Computer Techniques as the tool for students to use to compile a portfolio of their engineering drawing work for assessment. The course has a 6 week module to introduce students to both creating solid models and engineering drawings using SolidWorks™. It also teaches students to create photo rendered images and animations of their models.

PebblePad was used by the students in 2009 and 2010 to upload and display their work, provide a reflection on their learning and undertake a self-assessment exercise using the Profiler tool. During the course students linked their work to a Gateway which allowed tutors to view and provide weekly formative feedback on their work as it developed. At the time of final assessment, the Gateway was locked and progress frozen on the student's work. Feedback and grades were provided back to the students using features within PebblePad.

In 2010 the University of South Australia moved its learning management system to Moodle™ (known within the University of South Australia as learnonline) and undertook a review of available ePortfolio platforms. From this review, Mahara™ was chosen and introduced in 2011 (known as learnonline ePortfolio). For teaching engineering drawing, the ePortfolio task required students to copy relevant Views (templates) and then insert their work into specified locations and then collate their Views into a Collection. The final View had a section for the students to complete as a self-assessment of their learning. During the teaching period, students were asked to submit a URL to a learnonline assignment submission box for tutors to use to view and provide formative feedback on progressive work. Formative feedback was added to their Views. At the time for final assessment, students were required to export a zip file of their ePortfolio and upload it into an assignment file repository in learnonline. Through this process students created for themselves a final copy of their work. Grades and feedback were returned to the student using learnonline.

Introducing students to ePortfolios

In order to help students grasp ePortfolio concepts used within Computer Techniques, several strategies have been used consistently over the last three years. New students are immersed in the use of ePortfolios during a two day first year engineering orientation program (Duff *et al*., 2010) led by trained student mentors who had previously used or been trained in using ePortfolios. Students were provided with a written step-by-step guide to creating and submitting work within the ePortfolio. Weekly 'Helpdesk' sessions were also available and a significant component of the Week 2 Computer Practical was spent on working with students to create their Computer Techniques ePortfolio and begin to upload their work.

Self-assessment activities within the ePortfolio

Computer Techniques students were asked to create a website using their ePortfolio tool that showcased their drawing and modeling skills. One page in this website included a self-assessment, containing a series of questions or prompts to which students needed to assess themselves against (Table 1).

Table 1. Sample of the self-assessment table students were asked to complete

Questions or Prompt	Response
Your knowledge of solid modelling before the course	Scale of 0-10
Your knowledge of solid modelling after the course	Scale of 0-10
Your knowledge of engineering drawings and AS1100 before the course	Scale of 0-10
Your knowledge of engineering drawings and AS1100 after the course	Scale of 0-10
The effort you put into this course	Scale of 0-10
Your expected grade	HD, D, C, P1, P2, F1 or F2
Your reason why you would expect this grade	Text response

Within PebblePad, the website was called a Webfolio and the self-assessment activities were embedded within the Profiler tool. Students were provided with reflective questions (including those shown in Table 1) and used a series of radio buttons to select their answer to a rating. Additional questions related to the achievement of Graduate Qualities were also included in the Profiler.

Within the learnonline ePortfolio (Mahara), the website was called a Collection and the self-assessment activities were text boxes embedded within a template View that students copied from the lecturer's ePortfolio into their own.

Students engagement with the self-assessment task (2009-2011)

Studies of student participation in self-assessment within the ePortfolio were undertaken using techniques established earlier (Dunning et al., 2003; Fielke & Quinn, 2009) (Figure 1).

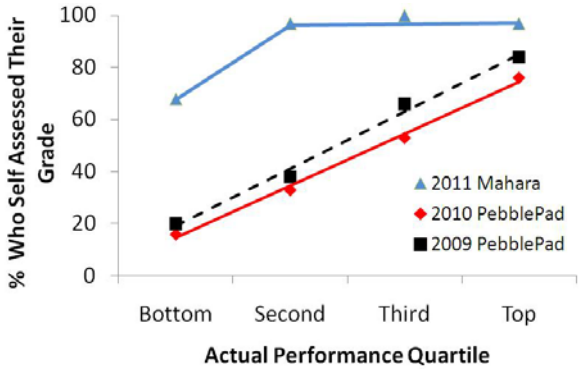

Figure 1. Student participation in self-assessment (2009-2011)

The percentage of students who participated in the self-assessment activity over three years was plotted against the students' quartile of grade achievement. Compliance with the PebblePad self-assessment component of the ePortfolio activity in 2009 and 2010 had a linear relationship when compared to grade outcomes, starting at 20% compliance in the bottom quartile to 80% compliance in the top quartile. In 2011, there was a significant positive shift in the number of students completing the self-assessment activity when presented in Mahara. Only 30% of the bottom quartile of students (8% of the total assignment submissions) did not undertake the self-assessment exercise.

Accuracy of self-assessment (2009-2011)

Analysis of student ability to accurately self-assess their work was compared across the three cohorts with the comparison shown in Figure 2.

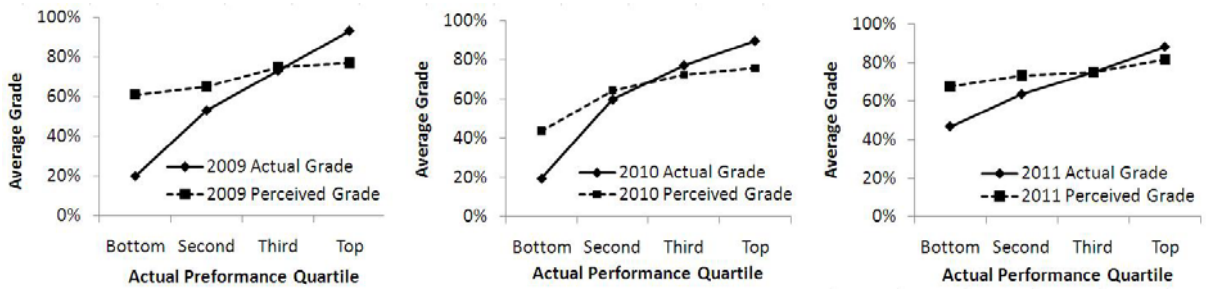

Figure 2. Comparison of actual and perceived grades for assignment (2009 - 2011)

The Dunning-Kruger effect, whereby strong students under estimate their achievement, while weak students over estimate, has persisted over the years. However, the results (Table 2) show that as the course proceeds, the gap between the student's actual grade and their perceived grade is diminishing.

Table 2. Difference between actual and perceived average grades (2009 - 2011)

	2009	2010	2011
Bottom Quartile	41%	24%	21%
Top Quartile	-16%	-14%	-7%

Staff and student feedback about ePortfolios

From a teacher's point of view the structured reflection using the Profiler tool had a useful feature of allowing the teacher to compile reports on the student's responses to their self-assessment activity as a cohort. The self-assessment data within learnonline ePortfolio was manually aggregated.

Formal feedback was gathered from students through mid- and end-of-course survey tools using non-specific prompts including – 'what most needs to be improved in first year engineering?' In 2009 and 2010, PebblePad was the source of many complaints from students reporting a range of issues such as – too hard to use, too basic and lacking features, slow to work with and difficult to work with a large number of files. In 2011, no comments were made about the Mahara tool.

Both students and staff have found the first opening of the Mahara ePortfolio to be daunting when presented with so many options, but once the basics of copying, creating and editing Views plus compiling them into a Collection and exporting were learnt, initial fears quickly disappeared.

Self-assessment, reflection and student engagement

Over 90% of students in 2011 engaged in reflection in relation to their predicted grade. To better understand the relationship between self-assessment efficacy and engagement, a simple thematic analysis was conducted on 139 student responses in 2011 to the prompt "Your reason why you would expect this grade". Students' reflective writing showed considerable depth of understanding and awareness of their approaches to learning at university and related outcomes in a manner similar to Gursansky *et al*., 2010.

When reflection themes were compared to the student's skill at self-assessing, good self-assessors (% difference between actual and predicted grades of <3%) commented more often that they had enjoyed using SolidWorks, felt confident using it, or experienced surmountable problems that would have impacted on their final grade (34% of reflections). Weaker self-assessors (% difference between actual and predicted grades of >7%) provided rationales such as they felt they had completed all the tasks, or had put in a large enough effort, and should therefore get a good mark, or they had run out of time, or did not put in enough effort (63%) (Table 3). This correlation of student responses with their ability to self-assess provides insight into new measures of student engagement.

Table 3. Main responses by students to "Your reason why you would expect this grade"

	Main theme in the response	Average Actual Grade	Average Perceived Grade	% Differ-ence	% of total responses
Good self-assessors	I really enjoyed using SolidWorks	81.9	81.3	0.7%	10%
	I feel confident using SolidWorks and creating engineering drawings	69.6	71.1	2.1%	8%
	I experienced problems that affected my grade	67.6	68.5	1.3%	16%
Weaker self-assessors	I have done all the required tasks	77.1	83.5	8.3%	8%
	I put in a large effort and earnt this grade	72.0	78.5	9.0%	41%
	I did not allow enough time to complete the work	63.3	67.8	7.1%	6%
	I now realise I did not put in the required effort	58.6	68.2	16.4%	8%
	Other				8%

Discussion and Conclusions

This three year longitudinal study of self-assessment skill in engineering has shown that an increasing number of student's have improved their ability to predict their grade as the course has developed and changed its ePortfolio tool and supporting documentation. There were other areas of course development occurring during this period, however these changes were largely peripheral to the ePortfolio and self-assessment learning objectives (e.g. creation of online lecture summary recordings, lecture worksheets and solutions) and are unlikely to have impacted significantly on the observations made and student feedback received, in relation to students' ePortfolio use and self-assessment skills.

The experience for the students using the different ePortfolio tools was quite different, impacting ultimately on learning outcomes, a finding similar to that reported by Tosh *et al*. (2005). Whilst using PebblePad as the ePortfolio platform, many students voiced their discontent and avoided undertaking the self-assessment task altogether. With the 2011 change to Mahara the participation in self-assessment increased to nearly all of those submitting work for assessment. Importantly, a correlation was observed in relation to a students' ability to accurately self-assess and their level of engagement with the course. This may be useful as a more general measure of student engagement. Further studies, to demonstrate the applicability of this simple index as a measure of student engagement in other engineering courses and disciplines, is warranted.

We propose that the template approach in Mahara ePortfolios has made the expectations of the self-assessment and reflection task clearer to a greater number of students. In addition, the difference in submission process between the two systems may also have had an impact. PebblePad uses a Gateway, whereby student's Webfolios could be submitted early and then editing capability removed at a set time. Using Mahara, a more active submission process was required, with students needing to finish their work and export their Mahara Collection through the Moodle-based assignment submission tool. This active approach may have motivated more students to complete all the requirements of their ePortfolio prior to formally submitting their work for assessment.

Accurate self-assessment is a powerful tool for engineering professionals and can help them develop throughout their careers and diagnose and address shortfalls in knowledge, skills and attitudes to meet

the changing needs of their profession. It can also help engineering students identify and gain those engineering competencies most desired by employers. As self-assessment and reflection skills can be learnt, the use of reflection within an ePortfolio in higher education can be used to support the development process. However, the research described in this paper has indicated that the ePortfolio tool itself is an important variable in the way that students engage with learning and reflective self-assessment. Careful ePortfolio tool selection and activity design can be a worthwhile investment that can significantly impact on student learning outcomes.

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