

iCrescam - growing attributes of University of Melbourne engineering graduands.

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***Abstract:** Everyone seems to agree that graduate attributes should be an important outcome of university learning, but there is not necessarily consensus on the fine detail of the meaning of the various attributes or what would constitute good evidence that a graduate possesses them. This paper outlines an ongoing research project that looks to apply the processes of reflection, planning and action inherent in the e-portfolio process to the multi-year acquisition of graduate attributes by engineering students.*

Introduction

Many Australian universities promote the idea that their teaching and learning processes contribute to graduate attributes. An Internet search for "graduate attributes" in the "edu.au" domain reveals numerous hits on policy, procedural and marketing documents outlining the claimed attributes of the graduates from the particular institution. For example "Graduates of the University of Sydney should have a stance towards knowledge, the world, and themselves that sets them apart from other graduates in their lives and work." (University of Sydney, 2004). As can be seen from this typical statement, the graduate attributes are often cast as aspirational targets rather than assured facts. The assurance that graduates of a particular institution actually have the attributes is normally tied up with explanations of procedures around support for teaching and learning or via quality control measures such as course experience questionnaires (Griffith University, undated; University of Sydney, 2004). This contrasts to the TAFE sector where competency based assessment is more common as illustrated by the employability skills training website of TAFESA (Anon, 2006)

Organisations representing various professions have promoted the idea that people entering their profession should have a basic set of skills and knowledge in order to be admitted to, or recognised by, the profession. Some of these, such as Engineers Australia, for example, may have no particular statutory powers but none-the-less wield significant influence on education, industry and government. Acts of Parliament establish other organisations, such as the Victorian Institute of Teaching or the Medical Practitioners Board of Victoria, which regulate practice within the profession. The Victorian Institute of Teaching, for example, has a set of graduate attributes which people wishing to enter the teaching profession must demonstrate (Victorian Institute of Teaching, 2009) before they can obtain registration to become a teacher.

Employers and employment agencies similarly use graduate attributes as a key way of describing, and selecting candidates for, vacancies. For example, the Fairfax employment website invites people to build a profile of their graduate attributes in order to match people with potential vacancies. It is interesting that the language of universities does not necessarily match that of the employers. One attribute of University of Melbourne graduates is to be

"active global citizens", which most nearly corresponds with the Engineers Australia professional competency of "Recognize the value of diversity, develop effective interpersonal and intercultural skills, and build network relationships that value and sustain a team ethic" (Engineers Australia, undated). This attribute also aligns with "Cultural alignment - the value fit." from the MyCareer.com.au list of top ten employable skills (Hargreaves, 2009). Without a common understanding of the language, development and communication of attributes is difficult.

While there is often some tangible connection between professional organization lists of attributes and university lists, that springs from the influence of those organizations over the curriculum of the professional courses, the connection with the employer descriptions is often less tangible. A consequence of this is that students may not see the value in developing or being able to communicate graduate attributes during their course of study.

For a number of years Engineers Australia has been exhorting Universities to demonstrate how courses develop in students the required EA Professional Competencies. Universities have trouble demonstrating this because their assessment is more focussed on knowledge rather than skills, which is only one of the three broad categories of Professional Competencies EA are seeking. At the same time, universities are facing the dilemma that they do not wish to increase the assessment workload on students or staff and they are often not keen to reduce the knowledge based assessment in order to make way for Engineering Ability or Professional Attributes based assessment. While universities have responded by demonstrating that students are exposed to the opportunity to attain attributes, this is probably less than Engineers Australia is seeking, since not all graduates take the opportunities to develop the attributes.

As will be explored in further depth, workshops we conducted with students lead us to believe that there is much uncertainty in students' minds about the meaning of graduate attributes and poor skills in articulating them.

The project presented in this paper focuses on work in the University of Melbourne's School of Engineering to develop a process that strongly connects the formal assessment and other tasks performed by engineering students to the attributes that employers are seeking. We are planning to implement a multi-year e-portfolio process where students will iterate through cycles of *experience-plan-implement-reflect-review* to help them be in a strong position to have, and equally importantly, to be able to communicate their graduate attributes.

Literature

To those that are not read in the e-portfolio literature or those that approach the topic of e-portfolios with an information technology perspective, the emphasis is often focused on e-portfolios as a tool for presentation or submission of work for assessment as outlined by Ward and Grant (2008). In such paradigms, the roles of e-portfolios for goal setting or reflection are often ignored (Bratengeyer, 2008). Ward and Grant (2008) also point to additional services and go on to discuss the possibility of e-portfolio tools providing services for holding a set of criteria or standards that can be referenced when planning and recording career or personal development activities. It is in this context that we are interested in the use of e-portfolios.

In 2007, the University of Melbourne conducted a survey of tertiary students across several year levels and three degrees (Arts, Science and Engineering) to discover various aspects of student's knowledge of generic skills and to ascertain where they thought they acquired these

skills (Badcock, 2008). When offered a list of 27 generic skills from which to choose, and asked to select the 6 most important gained from attending University, engineering students chose critical thinking and analytical skills (56%), working with others and in teams (57%) and problem solving (50%). Indeed, the majority of students chose these three attributes. Students poorly targeted the remaining items with the next 15 items from the list being selected by between 40 and 10% of students. In one sense this result can be interpreted as students not having a strong sense of which skills are most important. On the other hand, it may be that students are receptive to learning in particular areas, but the areas show high variability between students. Given that many of the skills are not specifically assessed, students are not likely to choose an area of weakness to improve. We conclude from this work that there is scope to guide students to think about which generic skills employers might be seeking, evaluate what is their own current level of proficiency in that skill area, and deliberately plan to improve those areas where they are weak.

Melbourne School of Engineering Project - iCrescam

The motto of the University of Melbourne is *Postera Crescam Laude*, which means that a place like the University is a community that grows in the esteem of future of generations. The Latin verb *Crescam*, to grow, seemed to be the perfect word for a project aimed at inculcating graduate attributes into students thinking.

The Engineering Learning Unit has mounted a project using action research methodology to develop a student centred approach to demonstration of the acquisition of graduate attributes. The overall goal of the project is to develop a process whereby engineering students can build and communicate their graduate attributes over the whole of their course. This will typically be for a period of 3 to 5 years.

Figure 1 shows graphically the plan for the process. In order to motivate students the process is based around preparing materials for an application for an engineering job. Students use the Job Analyser to explore the type of attributes that typical engineering jobs call for. Students then will use an iterative process of documenting artefacts that demonstrate graduate attributes acquired during various subjects they are studying. An important part of the iterative process for the students includes evaluating the degree to which various attributes have been satisfied and planning where they might concentrate their efforts in the future. At appropriate junctures, for example when applying for a vacation job, students create an e-portfolio to demonstrate the attributes that are called for in the job position description.

An important aspect of this project is that the e-portfolio is just one possible output; there are possibly much more important things happening in the minds of the students during the process. In March 2009, we ran a workshop with around 100 course work masters students to help us understand what students thought employers were looking for in terms of graduate attributes and what evidence job applicants could put forward in either written or oral form to convince an employer that they had the attribute.

Students worked in groups of around 6 to 8 on a single word attribute, such as leadership, ethics or teamwork. It was evident that a lot of discussion about what the attribute meant ensued and that working out what one could provide as evidence was very challenging for the students. It also showed that most students did not have sufficiently practiced language skills to compose and communicate orally a definition and evidence of a typical attribute. From this exercise we drew the conclusion that most students would need to spend time learning and

thinking about the finer detail of graduate attributes if they wish to gain the full benefit when it comes time to articulate their attributes to an employer.

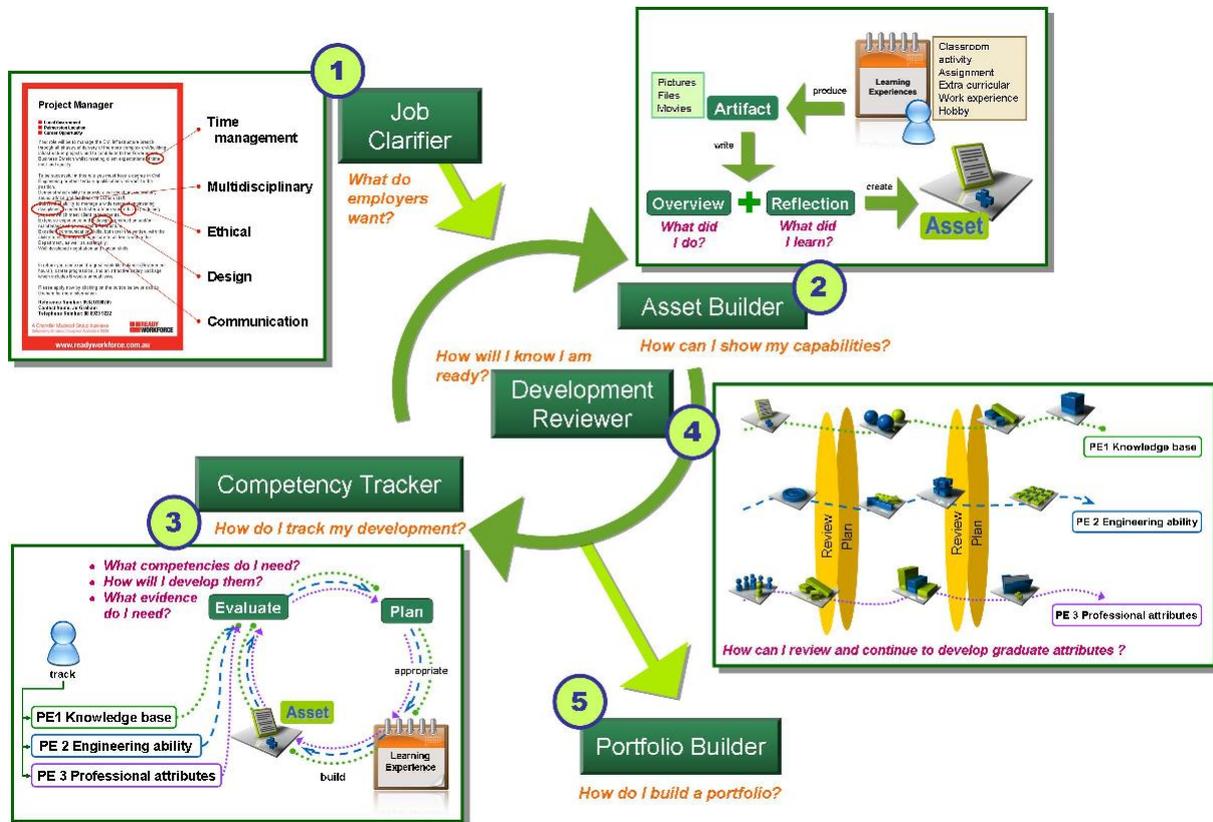


Figure 1: A graphical view of the path and activities students follow in the iCrescam project

A second factor that arose from the workshop and our subsequent thinking about the process was the importance of allowing a significant duration to assimilate and document the graduate attributes. It is generally accepted that to become a professional engineer at least 4 years of tertiary training is required because of the nature in which knowledge is built and refined. Our plan is to introduce the process to the students as early in their study as possible; preferably in 1st year and that the student's catalogue of artefacts should be built continuously over their whole course. This provides some challenges to the modular nature of most University degrees where learning and assessment is pigeonholed into, at most, yearlong subjects or units that are of uniform weighting. Our plan is to integrate iCrescam into part of the assessment requirements of engineering subjects in each year of the degree. Students would be asked as part of their regular student projects or assignments to choose one graduate attribute and write a short reflective statement on how the assignment related to the graduate attribute. In the ultimate semester of study, students would enrol in a subject where the primary piece of assessment is an e-portfolio that responds to a particular job advertisement and which draws on artefacts gathered over their course of study. We expect that the e-portfolio is likely to include various media such as video clips, poster presentations, written work, photographs and so on. We also expect that some students would take the opportunity to provide a voice-

over to explain some of the context of some of the artefacts, thus giving students the opportunity to practice oral composition and presentation skills.

The final details of implementation are still the subject of research and refinement. A reasonable universal driver from the students' point of view is the connection with getting a job and building a career. As a consequence, in each year level in which the students are contributing to the process, we will invite them to choose one or two job advertisements and their associated position descriptions on which to discover what attributes employers are looking for. They will then be faced with the task of clarifying or translating the language of the employers into the language of the professional institutions and the University. Early in the University degree course, we do not expect a lot of planning on the part of the student as to which attribute they may reflect on to produce an artefact. As they progress in their degree however, the students will be encouraged to take stock of their progress in acquiring skills and writing about them in order to make deliberate choices as to which particular attributes they need to develop. For example a naturally reserved person might feel challenged to seek an experience as a group leader if they went most of the way through their degree avoiding that experience. A second aspect of evaluation and planning that will be required in the final semester involves comparing the graduate attributes expected by an employer to those that a student has developed. The main purpose of this is to ensure that graduates are making realistic choices about the calibre of job they apply for. One would hope that students would be able to identify that there is little point applying for senior management positions, but that positions that list experience is "desirable" may well be in their grasp providing they can articulate their graduate attributes fully.

The actual software platform that the project will be mounted on is also the subject of research. We have not discovered any software that allows the implementation of Figure 1 as we envisage it. The various e-portfolio software packages we have examined tend to concentrate on the storage of items and the consequent presentation of them. Our belief is that the *reflective writing, planning and evaluation* aspects of the process are likely to be more important in the long run. Our research is thus concentrating on investigating how students interact with these parts of the process. In the interim we have established a "community" in the Black Board Learning Management System (BBLMS). In the implementation of the BBLMS at the University of Melbourne, student access to LMS can be via subjects, which are limited in duration to the period of active enrolment by the student, usually one semester, or via Communities which behave almost exactly the same as subject web sites but have no prescribed end dates. Thus students can maintain access to the Community for the life of their degree.

Within the BBLMS Community students will be able to access storage space to save items of assessment from other subjects, files of reflective writing, evidence of extracurricular activities that support graduate attributes and so on. During the development phase, each student will be provided with access to a wiki that can contain pages for keeping track of their progress on developing attributes, planning for new experiences and recording their analyses of job advertisements. The wiki can also be used as a presentation tool for their e-portfolio. For the purposes of students discussing and exploring the finer detail of graduate attributes we would like to use a blog or discussion board. Unfortunately there is no easy way in Blackboard of creating a blog or discussion board with access privileges restricted to a small group of students that does not involve significant administrative overheads in creating groups, adaptive release or other mechanisms of access control that require access privileges greater than those normally available to a student. To overcome this lack of flexibility links

will be provided to public domain group, blog or document sharing spaces that small groups of students can self enrol in.

At the time of writing this paper, we are involved in testing a prototype of the process that will involve one iteration of the cycle described in figure 1. In 2010, we plan to extend the project to include a much wider cohort of students and to commence the multi-year implementation of the project. Our vision is to eventually have students contribute to the e-portfolio over their 5 years of study.

Conclusion.

In this paper we have argued that general area of graduate attributes has multiple understandings as expressed by universities, professional institutions and employers. It is therefore not surprising that many students are confused by, or show little enthusiasm in engaging with learning processes aims at improving their acquisition of the attributes. Engineers Australia has a framework that articulates the various attributes graduates from engineering courses should exhibit but understanding the detail is difficult because of the different language used by different stakeholders and it is not immediately apparent how one might demonstrate that they are proficient in the attribute.

The education literature points of the practice of constructing portfolios of evidence that includes reflective practice, planning and evaluation as a method to approach messy problems such as the acquisition and communication of graduate attributes. The University of Melbourne School of Engineering is seeking to implement an e-portfolio that spans multiple years and is intimately engaged with the knowledge based assessment of university learning to enable students to recognize, document and plan the acquisition of graduate attributes.

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