An evaluation of an Online Student Portfolio for the Development of Engineering Graduate Attributes

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ABSTRACT: An online student portfolio was evaluated as a means for engaging students with the concept of graduate attributes, and for documenting student attainment of graduate attributes. Students rated the portfolio system as easy to use, and indicated that it helped them to appreciate the skills and knowledge they had developed.

Keywords: online portfolio; graduate attributes; assessment; evaluation

INTRODUCTION

Internationally, engineering education accrediting bodies (amongst other disciplines) have moved toward outcomes-based assessment of graduate competency. This is typically realized in the form of a list of graduate attributes that students should exhibit by the completion of their undergraduate studies. Such an approach requires both student engagement with the concept of graduate attributes, and the means to document individual student attainment of the necessary graduate attributes. The literature suggests that online student portfolios are a means for achieving both of these requirements. This paper presents the development and evaluation of an online student portfolio as a means of engaging undergraduate engineering students with the concept of graduate attributes. The trial was embedded in a final-year study unit that addressed professional practice issues. Students were asked to deposit 'evidence' (written work, presentations, computer programs, audio recordings, videos, photographs, etc.) of, and reflection on, their attainment/understanding/development of specified graduate attributes. To evaluate the development of student understanding of graduate attributes and the student usage of the online portfolio system, a pre- and post-semester student survey was conducted.

GRADUATE ATTRIBUTES

Arising from the push in higher education for quality assurance, accountability for outcomes and capability of graduates [**1**], specifying a list of qualities or capabilities that graduates will attain provides a benchmark against which the performance of a higher education institution can be measured. Graduate attributes are typically expressed in terms of: a) discipline-

specific attributes that relate to the particular program(s) the student is studying; and b) generic attributes that are common to all or most graduates. In engineering education, the idea of specifying required student outcomes in terms of graduate attributes has been embraced internationally for some years [**2, 3**], and this remains the case in Australia [**4**], the USA [**5**], and the UK [**6**].

In the literature related to graduate attributes, there can be observed varying levels of sophistication in approach. The range includes:

- identifying and prioritizing desirable graduate attributes [**7**];
- identifying where and at what level in the curriculum attributes should be covered [**8, 9**];
- designing assessment to explicitly measure graduate attributes [**10**];
- evaluation of the effectiveness of delivery of graduate attributes [**11**]; and
- evidence-based certification of attainment of graduate attributes [**12**].

Once the list of appropriate graduate attributes has been agreed upon, there is a need to consider where in the program/curriculum the various attributes will be addressed. This is because: a) no single element of a program could hope to be responsible for more than a small part of the total graduate attribute formation; and b) each attribute will, typically, involve staged development across the program, increasing in depth and sophistication as the student progresses through their studies [**13**]. Implementing graduate attributes in a program of study is a complex process, and there must be coordination in curriculum design to ensure adequate coverage of the required attributes [**2**]. The common, core units in a program of study carry a particular burden in the coverage of graduate attributes, and the use of elective or optional units for sole exposure to particular attributes should be avoided [**10**].

Designing a program curriculum to expose students to a range of graduate attributes is a necessary step, but, in itself, it does not ensure that students have developed the desired attributes. One element of such an assurance is including assessment tasks that seek to

measure the student's attainment of the desired attribute(s). Of course, it is often possible for a student to complete a unit of study by attaining the minimum pass mark, but not actually cover a particular attribute. A 'pass student' may progress through their entire program and successfully complete their studies having avoided a range of graduate attributes that were designed into the curriculum and dutifully assessed [**14**]. It is important to make the distinction between processes which ensure that a program will contain opportunities for the student to learn and practice desired attributes, and processes which seek to certify actual student attainment of graduate attributes. Student portfolios are one means by which individual attainment of graduate attributes can be assessed.

STUDENT PORTFOLIOS

All three of the undergraduate engineering accrediting bodies in Australia [**4**], the USA [**15, 16**] and the UK [**17**] identify student portfolios as one possible strategy for demonstrating program outcomes and student attainment of graduate attributes. Love & Cooper (2004) summarize the benefits of portfolios as:

- they can contain many different types of evidence;
- they resolve many types of assessment problems in equity and moderation;
- they provide a richer picture of students' learning and competency;
- students are actively involved in the building of the portfolio;
- they are well suited to authentic learning environments;
- they can be used in a wide range of contexts; and
- they provide a means for students to manage their own professional development.

Importantly, for the task of assessing outcomes of an entire program of study, a portfolio can act as an integrator, bringing together and assessing the whole program [**18**], including allowing students to demonstrate attainment of particular attributes that may not have been explicitly summatively assessed at any point during their studies [**17**]. Student portfolios can be designed for multiple uses, including assessment of student attainment of attributes [**16**], assessment of the effectiveness of institutional programs in delivering graduate attributes [**19, 20**], and other uses for a wide range of stakeholder groups [**21**]. Portfolios can help students engage more actively with, and take more personal responsibility for, their studies and assessment [**15, 19**], and provide a focus for student reflection on their studies and development [**14, 22, 16, 23**].

It has been found that the portfolio requirements and the structure/format in which portfolio items must be submitted need to designed around the intended use of the portfolio, and made clear to students who will be using the portfolio [**24, 19**]. Additional effort in compiling the portfolio can be minimized by basing it around assessment items/artifacts already currently produced by students [**25, 19, 26**]. Of course, this approach can only be employed if the assessment tasks undertaken by students clearly relate to the assessment of attainment of the required graduate attributes. It is well known that students take a strategic approach to study, and the learning activities they engage most fully with are those most clearly associated with what will be assessed [**27**]. Not surprisingly, it has been observed that attaching assessment credit (marks) to the completion of portfolio tasks is an effective motivator for student engagement [**15, 19, 23**]. Others reporting the use of student portfolios for the assessment of outcomes in engineering education include [**28**], [**29**] and [**30**].

While it is possible to employ a paper- or hardcopy-based student portfolio, the increasing use of online technology by students and educators alike, including in assessment, means that many of the reported applications of student portfolios are online portfolios (or, e-

portfolios) [**31, 21, 32, 12**]. Rogers & Williams (1998) suggest that the benefits of online portfolios include:

- ease of use;
- gives students secure control of their portfolio;
- a multimedia archive of the material can be produced;
- the portfolio contents can be searched;
- materials can be easily updated and replaced;
- students and staff can access the portfolio online, anytime;
- portfolio marks can be automatically logged and managed;
- students can be provided with feedback online; and
- the portfolio structure can be aligned with the required graduate attributes, so that student submissions are focused on the outcomes to be measured.

In an engineering education context, reporting on the development of the 'Polaris' online portfolio system [**33**], Campbell and Schmidt (2005) noted that electronic portfolios are emerging in many disciplines, and while their reported use in engineering has been limited, it is also on the increase, with documented applications in parts of a study unit, the whole of a study unit and the whole of a program. They further note that:

- much of the work now produced by engineering students is 'electronic' in nature, hence, well suited to an online portfolio system;
- a portfolio system can feature multiple examples of work and can show student development over time;
- student portfolios are likely to become an important part of the recruitment process;
- there is a need to strike a balance in the structure of the portfolio system between the mandatory criteria required as evidence (with the consequence of all portfolios looking

identical), and giving students some freedom of expression in the content and appearance of their portfolios;

- the portfolio system is a means to engage students in exercises to help them understand their developing professional skills, and, by its nature, creating a portfolio is a reflective exercise, helping students to self-assess their performance and to reflect on the 'whys' of their program;
- providing an area in the portfolio for reflective journaling is crucial, and the Polaris system includes reflective questions to help students create descriptions of the work they deposit;
- a student portfolio system has many benefits for an academic institution, including the collection of accreditation materials; and
- while the Polaris system has been optional for students to use, the level of use by students has grown strongly over a number of years.

ONLINE STUDENT PORTFOLIO TRIAL AT DEAKIN UNIVERSITY

The School of Engineering and Information Technology at Deakin University in Australia offers a four year Bachelor of Engineering (BE) at undergraduate level. The program is delivered in both on-campus and off-campus modes. The first author had academic responsibility for the fourth-year, final-semester engineering management / professional practice study unit SEB421 Strategic Issues in Engineering. This unit consists of three modules:

1. Technological Forecasting and Assessment;
2. Policy Design in Engineering Organizations; and

3. Issues in Productivity Improvement.

The Technological Forecasting and Assessment module discusses methods for long-term forecasting, factors in technological innovations, and the impact of technological changes on business and society. The topics in the Policy Design in Engineering Organizations module are policy structure, designing organizational structure to support policy, and modeling and analysis of policy alternatives. The Issues in Productivity Improvement module focuses on labor and management productivity, productivity improvement techniques, benchmarking and the changing nature of work practices.

Historically, the assessment tasks for this unit included:

- a weekly reflective journal;
- a written case study report on technological innovation sourced from the literature;
- a computer-marked multi-choice test on the content of the first two modules; and
- a major written report and oral presentation covering the semester's unit content and based on an interview with an engineering manager [**34**].

All assessment items were submitted online via the Blackboard Vista Course Management System (CMS) used by Deakin University, except for the oral presentation element, which was delivered in class by on-campus students and submitted on video by off-campus students. Because of the existing diversity of assessment tasks in the unit, the location of the unit as a 'capstone' in most students' studies and the existing use of online submission for student work, SEB421 was chosen as a context to evaluate the use of an online portfolio as a tool for documenting individual student attainment of graduate attributes. The strategy of initially positioning online student portfolios within the context of a final-year professional skills units is noted elsewhere in the literature [**35**].

An initial task in this project was the development of a set of applicable graduate attributes for the students enrolled in Deakin University's engineering programs. For

undergraduate engineering education at Deakin, there are three principal references for required graduate attributes. They are:

1. the Deakin University Higher Education Courses - Operational Policy, which specifies required attributes under the headings of 'knowledge and understanding' and 'skills' [**36**];
2. Engineers Australia Policy on Accreditation of Professional Engineering Programs, which requires that all graduates from accredited programs should have a specified list of generic attributes [**37**]; and
3. Engineers Australia Australian Engineering Competency Standards – Stage 1 Competency Standards for Professional Engineers, which represents the level of preparation necessary for entry to professional practice, and corresponds to completion of an accredited 4-year Bachelor of Engineering degree. Competency is specified by a range of 'units of competency', which in turn include a number of 'elements', which in turn include a number of 'indicators' [**38**].

Based on these reference documents, a list of 32 graduate attributes was synthesized, under 12 broad categories. Based on these identified engineering-specific graduate attributes, a subset of attributes was selected that apply to the context (both content and assessment tasks) of the unit SEB421, those attributes were:

1. **Proficiency in engineering design** – proficiency in employing technical knowledge, design methodology, and appropriate tools and resources to design components, systems or processes to meet specified performance criteria.
2. **Ability to communicate effectively, with the engineering team and with the community at large** – high level of competence in written and spoken English. The ability to make effective oral and written presentations to technical and non-technical audiences.

3. **Manage own time and processes effectively, prioritizing competing demands to achieve personal and team goals and objectives**.
4. **Fluency in current computer-based word-processing and graphics packages**.
5. **Capacity for creativity and innovation** – Readiness to challenge engineering practices from technical and non-technical viewpoints, to identify opportunities for improvement. Ability to apply creative approaches to identify and develop alternative concepts and procedures.

While the first item did not directly relate to SEB421, it was included to (hopefully) create student enthusiasm and motivation for the portfolio task by providing students with an avenue for individual expression related to their chosen discipline specialism. Previously, SEB421 included an assignment task, worth 10 % of the unit mark, based on students compiling an online reflective journal relating to their unit studies across the semester. This was replaced by the online portfolio task described below. Note that in the following, 'DSO' refers to Deakin Studies Online – the online course management system used by Deakin University.

> This assignment seeks to identify a specific subset of the graduate attributes that apply to your engineering studies, and to get you to personally reflect on how you have developed and demonstrated these knowledge, skills and attitudes. To demonstrate your individual attainment of these graduate attributes, you need to submit two items for each of the five attributes:
>
> 1. **Evidence** – Tangible evidence, in an electronic form that you can upload into DSO, that demonstrates your attainment of the specified graduate attribute. Possible evidence formats include written work (Word files), presentations/visual aids (PowerPoint files), computer programs (code source files), audio recordings (sound files), short videos (video files), photographs, etc. You can be creative here, but, please keep in mind that

uploading large files into DSO may cause problems, and, the file formats you choose should not require any special software for opening/viewing.

2. **Reflection** – Reflection on one's experiences is recognized as one of the most important means by which practicing professionals (such as engineers) continuously build their knowledge from their experiences. Please write at least 200 words of personal reflection on your attribute evidence that demonstrates that you understand the importance and relevance of the attribute to your development as a technology professional.

The literature on student portfolios identifies that student reflection is an important part of extracting learning value from a portfolio, and the reflective journal had been an intentional and overt component of SEB421 in the past. For this reason, student reflection on portfolio entries was included/retained in the new assignment task, and both the submitted 'evidence' and student reflection elements were assigned marks. Given the trial nature of this project, it was decided to retain the overall 10 % mark weighting, for the initial trial at least, so that the students' unit result would not be unduly impacted by unforeseen issues in the implementation of the trial.

A range of options for an 'online portfolio' system based on the Vista CMS were investigated. Based on the constraints that students had to author/create their own portfolio content, and that the portfolio entries had to be gradable, an online portfolio system was created based on the Vista online assignment submission system. A separate assignment submission form was created for each of the five portfolio items and integrated into the general assignment folder for the SEB421 section in Vista. Students selected the portfolio item to submit, attached the 'evidence' and 'reflection' files, and made their online assignment submission using Vista. While the final portfolio system arrangement was

somewhat unconventional – it would be more common for students to create one or more web pages combining text, graphics and other elements – it proved to be functional.

As this was a trial, it was decided to conduct a formal evaluation to establish students' prior knowledge of graduate attributes and use of portfolios, to determine how their knowledge of graduate attributes developed through using the portfolio and to determine attitude to usage of the portfolio system. The evaluation included pre-semester and post-semester surveys of students during semester 2 of 2006 – these surveys are included here as Appendixes. The surveys were designed to be simple and short, with the aim of minimizing completion time and maximizing response rate. The types of data collected were primarily either factual/quantitative or open-ended/qualitative items – these do not lend themselves to psychometric validation, other than by direct repetition of items in the survey, which was avoided to keep the survey as short as possible. As required by the Deakin University Human Research Ethics Committee, these surveys were anonymous and voluntary.

EVALUATION

Pre-semester Questionnaire

During week 1 of the academic semester, the initial questionnaire was posted to all off-campus enrolled students, and on-campus students were invited in the first class to complete the questionnaire. In-class and postal questionnaire returns were collected and the data keyed. Table 1 presents a summary of the survey group demographic information. The gender and mode of study characteristics of the entire commencing class group were known, permitting a comparison of the population and respondent groups. The population and respondent groups

were both relatively large, and the study mode results satisfied Cochran's rule (no expected frequency less than 1 and no more than 20% of expected frequencies less than 5), permitting a chi-square goodness-of-fit test. While the gender results did not satisfy Cochran's rule, they did permit a small-sample test of proportions based on the Binomial distribution. There was no significant difference between the respondent and population groups with regard to gender and mode of study. The comparatively high response rate and good match between the demographic characteristics of the sample and population groups suggest that valid conclusions about the population group can be inferred from the respondent group.

Table 1 Pre-semester survey group demographic information

Number of valid responses	**Total class enrolment**		**Response rate**
48	79		60.8 percent
Mean age	**Standard deviation**	**Age range**	**Median Age**
26.3 years	7.94 years	20 to 50 years	23 years
Characteristic	**Respondent sample**	**Class population**	**Significance test**
Female	6.4 percent	5.1 percent	Small sample Binomial
Male	93.6 percent	94.9 percent	$p > 0.43$
On-campus	68.8 percent	65.8 percent	Chi square test
Off-campus	31.2 percent	34.2 percent	$\chi^2_1 = 0.12$, $p > 0.73$

There was a significant correlation between respondent age and mode of study. The mean on-campus age was 22.3 years and the mean off-campus age was 35.6 years. The numbers of respondents for each study mode was relatively large, permitting a two-sample t-test of the difference between the means, confirming that the means were significantly

different (T_{14} = -5.63, $p < 6.3\times10^{-5}$). This same result has been obtained in a range of surveys of Deakin engineering students over more than a decade; off-campus students a typically mature aged, while on-campus students are predominately conventional entry students from secondary school.

Initially, 45.8 percent of respondents were aware of the concept of 'graduate attributes'. 52.1 percent of respondents were aware that Engineers Australia has a list of attributes that all students in engineering courses should develop before they graduate. 33.3 percent of respondents were aware that Deakin University has a list of attributes that all Deakin students should have an opportunity to develop before they graduate. 66.7 percent of respondents thought that there is a link between study and assessment activities, and the development of student graduate attributes. While more than half of respondents were aware that Engineers Australia specifies required graduate attributes, only one third were aware that Deakin University does the same. One third of students did not appreciate the link between study and assessment, and the development of graduate attributes. The 2005 Australian Universities Quality Agency (AUQA) audit of Deakin University made the recommendation, "…that Deakin University communicate to students more effectively the nature and aims of the Deakin Advantage [the then current name of the suite of Deakin's graduate attributes] and assist them to document the discipline-specific and generic skills they are developing throughout their course." [**39, p. 19**] The results obtained here reinforce that AUQA recommendation.

There was a significant correlation between a respondent reporting that they were not aware of the concept of 'graduate attributes, and also reporting that they were not aware that Engineers Australia specifies required graduate attributes. The respondent distribution was small with two categorical variables, permitting a Fisher's exact test of independence of the categorical variables ($p < 0.0004$, *Fisher's exact test*). There was also a significant

correlation between a respondent reporting that they were not aware of the concept of 'graduate attributes, and also reporting that they were not aware that Deakin University specifies required graduate attributes ($p < 0.0001$, *Fisher's exact test*). These results suggest that there was a strong division in student understanding of issues related to graduate attributes; those students that indicated that they were aware of concept of 'graduate attributes' also were aware of the engineering professional body's and Deakin's requirement for development of graduate attributes, and those students that indicated that they were not aware of the concept of 'graduate attributes' were not aware of the specification of required graduate attributes by the engineering professional body or Deakin.

43.8 percent of respondents reported understanding the purpose of a student professional portfolio, 14.6 percent of respondents reported having previously used a paper/hardcopy student portfolio as part of assessment and/or demonstration of their knowledge and skills, and 14.6 percent of respondents reported having previously used a electronic/online student portfolio as part of assessment and/or demonstration of their knowledge and skills. Exposure to student portfolios was low; less than half of respondents understood the purpose of a student portfolio, and prior use of student portfolios was reported by less than one in six respondents. It is likely that students encountering a student portfolio for the first time will require proper orientation to understand the purpose and operation of any portfolio system.

Post-semester Questionnaire

During weeks 12 and 13 (the final two weeks) of the semester, on-campus students participated in assignment presentations, ensuring a good attendance. As students completed their presentation, they were invited to complete the follow-up questionnaire. The

questionnaire was posted to all off-campus students in week 12 of the semester. In-class and postal questionnaire returns were collected and the data keyed. Table 2 presents a summary of the survey group demographic information. The gender and mode of study characteristics of the entire completing class group where known, permitting a comparison of the population and respondent groups. There was no significant difference between the respondent and population groups with regard to gender and mode of study. The comparatively high response rate and good match between the demographic characteristics of the sample and population groups suggest that valid conclusions about the population group can be inferred from the respondent group. As noted in the initial survey, a significant correlation between respondent age and mode of study was also observed here.

Table 2 Post-semester survey group demographic information

Number of valid responses	**Total class enrolment**		**Response rate**
50	70		71.4 percent
Mean age	**Standard deviation**	**Age range**	**Median Age**
25.3 years	7.24 years	20 to 50 years	22 years
Characteristic	**Respondent sample**	**Class population**	**Significance test**
Female	6.0 percent	5.7 percent	Small sample Binomial
Male	94.0 percent	94.3 percent	$p > 0.54$
On-campus	78.0 percent	72.9 percent	Chi square test
Off-campus	22.0 percent	27.1 percent	$\chi^2_1 = 0.41$, $p > 0.52$

By the end of the semester, 100 percent of respondents were aware of the concept of 'graduate attributes' – this was significantly different to the initial awareness ($\chi^2_1 = 36.86$, $p < 2\times10^{-9}$). 96.0 percent of respondents were aware that Engineers Australia has a list of attributes that all students in engineering courses should develop before they graduate – this was significantly different to the initial awareness ($\chi^2_1 = 24.86$, $p < 7\times10^{-6}$). 94.0 percent of respondents were aware that Deakin University has a list of attributes that all Deakin students should have an opportunity to develop before they graduate – this was significantly different to the initial awareness ($\chi^2_1 = 39.26$, $p < 4\times10^{-10}$). 94.0 percent of respondents thought that there is a link between study and assessment activities, and the development of student graduate attributes – this was significantly different to the initial awareness ($\chi^2_1 = 11.71$, $p < 7\times10^{-4}$). 100.0 percent of respondents reported that they understood why professional and/or educational institutions specify lists of attributes that university graduates should develop.

Respondents were asked to report the frequency of their usage of the online portfolio system based on a scale of daily, weekly, monthly and other. The responses were: daily – 8.0 percent; weekly – 46.0 percent; monthly 36.0 percent; and 'other' – 10.0 percent. Of the five 'other' responses, two were given as 'fortnightly', two were given as 'once only' and one was given as 'three times'. While student were only required to submit five portfolio entries (which potentially could have been made all at the same time), and the minimum required frequency of access could have been low, more than 50 percent of respondents reported accessing the system weekly or more frequently. Students who had made their portfolio submissions were encouraged to 'publish' their submissions and make them publicly available for other students to view; 35 portfolio items were published by students in the class. The availability of these published submissions may have be a factor that encouraged students to access the portfolio system frequently, to view the exemplar submissions from their peers.

Respondents were asked to rate the ease of use of the online portfolio system based on a scale of 1 = very difficult to 5 = extremely easy. The mean response was 3.98, with a standard deviation of 0.74. The median response was 4. The range of responses was 2 to 5. 96.0 percent of respondents reported that they clearly understood the purpose(s) of the online student portfolio. While the implementation of the online portfolio system using the standard features of Vista version 3 was not particularly straightforward or user-friendly, these results indicate that students did not find the system particularly difficult to use. Respondents were asked to indicate what aspects of the online portfolio system that they found most useful. The responses were grouped into categories, and Table 3 presents the categories and ranked frequency of occurrence.

Table 3 Reported most useful aspects of the online portfolio system

Reported <u>most</u> useful aspect	**Frequency of reporting**
Helped to develop an understanding of skills gained	15
Assess / appreciate the skills of other students	4
Recognize what students lack compared to professionals	4
System was simple / convenient	4
Ability to gradually build a portfolio	3
Access to information	1
Unsure	1

The most frequent responses relate to students developing an understanding of the skills that they and/or their peers have developed during their studies, as well as being able to appreciate perceived gaps in their skills compared to practicing professional engineers. A number of

respondents indicated that the system was easy to use. Respondents were asked to indicate what aspects of the online portfolio system that they found least useful. The responses were grouped into categories, and the table below presents the categories and ranked frequency of occurrence.

Table 4 Reported least useful aspects of the online portfolio system

Reported least useful aspect	**Frequency of reporting**
None / nil	10
Was all useful	2
Unsure	1
All	1
Requirement to publish was not clearly stated	1
Didn't give good feedback	1
Should have time goals to submit across the semester	1
400KB file size limit was difficult to maintain	1
Slightly complex system of file submission	1
Unsure of answers	1
Not knowing about it until last six months so I couldn't use much work from previous years	1

The most frequent 'negative' responses were, in fact, that there were no 'least useful' aspects or that the online portfolio was a useful exercise. A number of the negative comments relate to operational aspects that arose in this initial trial, and have already been noted for future adjustments to portfolio requirements and processes. One student raised the issue of being

able to include their work from prior years of their study. This is related to the idea of having a student portfolio that spans a student's entire program of study (and possibly beyond).

Other Results

The average number of portfolio items per student was 4.37 (out of 5). The maximum possible mark per item was 2.0 marks; of those enrolled students that submitted at least one portfolio entry, the mean mark obtained was 1.84. The average number of files/attachments per student portfolio was 16.0. The average combined size of files per student portfolio was 7.0 MB (1 MB = 1048576 bytes). The smallest individual file/attachment submitted was 869 bytes (text file). The largest individual file/attachment submitted was 46.3 MB (zipped video). The overall file storage requirement for all portfolio attachments was 609 MB. The types of file formats submitted by students are presented in table 5.

Table 5 File formats submitted by students in the online portfolio system

programming source code files in various text formats	Adobe Acrobat files
Graphics Interchange Format graphic images	Microsoft Word files
AutoCAD computer aided design (CAD) files	Microsoft Excel files
Tagged Image File Format graphic images	Microsoft Project files
Windows Movie Video video files	Plain text files
Microsoft PowerPoint files	JPEG graphic images
Executable program files	SolidWorks CAD files
Real Media video files	QuickTime video files
Bitmap graphic images	

Even though the portfolio assignment was open all semester, and students were encouraged to make the submissions progressively throughout the semester, a number of students elected to submit all five portfolio items at the one time, close to (and in some cases late on) the due date. A more progressive submission of elements of the portfolio would have allowed students to spread their portfolio workload across the semester, and to receive feedback on their early submissions in time to have a formative function in improving later submissions. It would also have eased the peak portfolio assessment workload that occurred around the due date. In future, the individual elements of the portfolio may have to be assigned due dates in a sequence across the semester to encourage students to spread the load.

CONCLUSION

There is little doubt that graduate attributes will continue to be a focus generally in higher education, and certainly in engineering education. There will almost certainly be a move toward certification of individual student attainment of graduate attributes, rather than simply certifying that programs of study provide opportunities for students to participate in activities designed to develop particular graduate attributes. Student portfolios are one means for collecting artifacts, performances, reflections and other evidence to document student attainment of graduate attributes. Given the growing influence of online learning environments, coupled with the fact that much student work is now electronically generated, it is likely that online portfolios (e-portfolios) will play an increasing role in the graduate attributes arena.

A trial of an online student portfolio as a means of engaging undergraduate engineering students with the concept of graduate attributes was undertaken. Based on an online portfolio structured around a sub-set of appropriate graduate attributes, students in a study unit were asked to contribute both evidence of and reflection on their development of these graduate attributes, and their contributions were marked as part of the formal assessment for that unit. To evaluate the development of student understanding of graduate attributes and the student usage of the online portfolio system, pre- and post-semester student surveys were conducted.

The awareness of issues relating to graduate attributes (particularly awareness that Deakin University specified a list of graduate attributes) rose dramatically from the beginning of the semester. Participation in an assessable activity (the online portfolio) structured around an identified sub-set of engineering graduate attributes, and the provision of background information about graduate attributes as part of the assignment requirements appears to have developed this increased awareness. Students generally rated the online portfolio system as easy to use, and indicated that it had helped them to appreciate the skills and knowledge they had developed in their undergraduate studies. These results suggest one effective strategy that can be used to raise awareness and student engagement with graduate attributes.

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APPENDIX 1: PRE-SEMESTER QUESTIONNAIRE

SEB421 – Online Portfolio for Graduate Attributes - Initial questionnaire

This questionnaire is aimed at determining your perceptions of the introduction of an online student portfolio, and, the development of your understanding of graduate attributes. Please note that participation is voluntary, all data will remain anonymous and confidential.

1. About you

Please state your age at your last birthday [ ] Yrs

Please indicate your gender (circle M or F)

Please write your course code (i.e. S356 / S367I / etc)

Please indicate your study location (please circle one) On-campus Off-campus Off-shore

2. Graduate attributes

Are you aware of the concept of '**graduate attributes**'? Yes No

Are you aware that Engineers Australia (the engineering course accrediting body in Australia) has a list of attributes that all students in engineering courses should develop before they graduate? Yes No

Are you aware that Deakin University has a list of attributes that all Deakin students should have an opportunity to develop before they graduate? Yes No

Do you think that there is a link between your study and assessment activities, and, the development of student graduate attributes? Yes No Don't know

3. Student portfolios

Do you know what the purpose of a student professional portfolio is? Yes No

Have you ever previously used a **hardcopy/paper-based** student portfolio in your studies as part of assessment and/or demonstrating your knowledge and skills? Yes No

Have you ever previously used an **electronic/online** student portfolio in your studies as part of assessment and/or demonstrating your knowledge and skills? Yes No

APPENDIX 2: POST-SEMESTER QUESTIONNAIRE

SEB421 – Online Portfolio for Graduate Attributes – Follow-up questionnaire

This questionnaire is aimed at determining your perceptions of the introduction of an online student portfolio, and, the development of your understanding of graduate attributes. Please note that participation is voluntary, all data will remain anonymous and confidential.

1. About you

Please state your age at your last birthday [ ] Yrs

Please indicate your gender (circle M or F)

Please write your course code (i.e. S356 / S367I / etc)

Please indicate your study location (please circle one) On-campus Off-campus Off-shore

2. Graduate attributes

Are you aware of the concept of '**graduate attributes**'? Yes No

Are you aware that Engineers Australia (the engineering course accrediting body in Australia) has a list of attributes that all students in engineering courses should develop before they graduate? Yes No

Are you aware that Deakin University has a list of attributes that all Deakin students should have an opportunity to develop before they graduate? Yes No

Do you think that there is a link between your study and assessment activities, and, the development of student graduate attributes? Yes No Don't know

3. Online student portfolio

On average, how often did you access the online student portfolio for SEB421? (please circle one) Daily Weekly Monthly Other (If 'Other', please state how frequently)

On a scale of 1 to 5 (1 = very difficult; 5 = extremely easy), how would you rate the ease of use of the online student portfolio system? 1 2 3 4 5

Do you feel that you clearly understood the purpose(s) of the online student portfolio requirement? Yes No

Do you feel that you understand why professional and/or education institutions specify lists of attributes that university graduates should develop? Yes No

What aspects of online portfolio system did you find most useful?

What aspects of online portfolio system did you find least useful?

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