

The skills towards employment program: lessons learned

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Structured abstract

BACKGROUND

The ability of graduates to demonstrate professional skills is currently a key topic in industry, higher education and government. While attempts have been made to develop these skills in students, employers of engineering graduates are still indicating that these skills are not consistently demonstrated at the expected level. The typical approach of having specific subjects to develop these skills is considered inadequate while the benefits of the well regarded approach of work integrated learning are highly dependent upon the experience had by the individual student. There are many new projects looking at how best to teach and develop professional skills, but there are very few that look at assuring them.

PURPOSE

The Skills Towards Employment Program (STEP) was started in the middle of 2012 to address a perceived gap between the level of professional skills in graduate engineers and the expectations of industry.

DESIGN/METHOD

This paper describes the implementation of STEP and the Engineering Practice Hurdle (EPH); a modular program that spans a student's entire course coupled with the creation of an ePortfolio. Also covered are the challenges encountered and the lessons learned which are derived from the experiences gained through the coordination and setup of the program as well as from anecdotal evidence from students.

RESULTS

While preliminary investigations indicate that many students felt they improved in the targeted skills and that the required activities benefitted them, some key issues were identified. The main issue was the diversity of the cohort, which made it difficult to pitch the material at the correct level and also resulted in a lot of overlap between what some students felt was good about the program and what other students felt was bad. The other key problems were that students struggled with the new style of program and there was an unsatisfactory level of engagement.

CONCLUSIONS

In consideration of the key problems identified, it is recommended that more flexibility needs to be built into these kinds of programs, with an emphasis on students taking a more active role in determining their participation. The importance of preparation and monitoring can also not be overstated.

KEYWORDS

Graduate attributes, professional skills, ePortfolios.

The need for change

With the shift in the role of Universities from elite educational institute to career stepping stone, the question of how we should adapt to this change is constantly with us. The answer that this paper aims to address is how tertiary level education needs to prepare students with professional skills and not just discipline knowledge. Consistent with this idea is the move that universities made some time ago in the adoption of graduate attributes. With this move, universities have performed mappings to show where these attributes are developed, embedded them in subjects and created new ones (BIHECC, 2007; DEST, 2006; Hart, Bowden, & Watters, 1999; Oliver, 2011; Wellington, Thomas, Powell, & Clarke, 2002), but even so graduates are not meeting the expectations of industry (ALTC, 2009; Male, Bush, & Chapman, 2011; Nair, Patil, & Mertova, 2009). The reasons for this are many with some of the key inherent and cultural problems identified below, as previously discussed in greater detail by the authors (Shen, Buskes, Evans, & Ooi, 2011).

Inherent problems:

1. **Conceptual clarity:** Both practitioners and organisations define and understand professional skills in different ways.^{1, 2, 3, 4, 5}
2. **Assessment:** Professional skills are not easily assessed by traditional methods.^{4, 5}
3. **Time:** Professional skills take years of development rather than a single semester.⁴
4. **Expertise:** Not all teaching staff are experts in teaching professional skills.^{1, 2, 5}

Cultural problems:

5. **Isolation:** The development of professional skills is often undertaken by individuals without a cohesive approach.^{2, 5}
6. **Implicit teaching:** Professional skills are often developed implicitly with little or no separate structured teaching and assessment.^{4, 5}
7. **Motivation:** Teaching staff are not typically rewarded for or sufficiently supported in the teaching of professional skills.^{1, 5}

¹ (Green, Hammer, & Star, 2009) ² (S. C. Barrie, 2006) ³ (Male et al., 2011) ⁴ (Hughes & Barrie, 2010) ⁵ (S. Barrie, Hughes, & Smith, 2009)

To bridge the gap between graduate capabilities and industry expectations the authors previously proposed a framework that conceptually addressed the problems associated with the teaching of professional skills (Shen et al., 2011) and in 2012 the framework was implemented. There are two parts to this framework for developing professional skills at the University of Melbourne; the hurdle that assures graduates have a minimum level of capability and the program that gives students the resources to develop these skills.

The Engineering practice hurdle

The Engineering practice hurdle (EPH) is a hurdle on the Master of Engineering degree at the University of Melbourne and has been developed with the following objectives:

1. To ensure graduates have a specified level of ability in required areas of skill.
2. To have as little impact as possible on the workload of staff.
3. To have as little impact as possible on the workload of students.

The first objective is the most difficult as it means overcoming the inherent and cultural problems of teaching professional skills. Objective two is needed as staff currently struggle with their workload and requiring all staff to be significantly committed to the program from the start is likely to result in failure. Objective three acknowledges that some students do have the professional skills required and should not be unduly burdened. The key phrase though is “as possible” so it is still expected that for some students (possibly many) there will be an increase in workload where they are not performing at the required standard.

In order to meet these objectives and therefore to overcome some of the key problems identified, this hurdle has had the following characteristics built into it:

- **Each skill is individually assessed and a requirement of the hurdle.** This characteristic aims to overcome the problem of implicit teaching. One of the main problems with implicit teaching is that a skill like written communication is often only a very small part of the overall mark for a subject, resulting in a student being able to underperform in their writing but perform satisfactorily at their discipline skills and therefore to pass overall. In theory subjects that profess to develop particular skills could include a hurdle on that skill, but in practice there are few if any subject coordinators who would be comfortable failing students who know the discipline material but write a poor report. Without individual assessment it's not possible to assure that a student possesses a required skill.
- **Individual skills can be assessed gradually throughout a student's degree.** This has been done to acknowledge the time required to develop professional skills. As students can submit their work at the end of any semester, they have the chance to get feedback on their capabilities early in their degree and if they are not yet up to the required level they can have more opportunities to try again. This model will also accommodate multiple levels of skills.
- **Activities from outside a student's study can be included to meet the requirements.** Both industry and higher education practitioners acknowledge that important skills are developed outside of a student's academic curriculum (S. C. Barrie, 2007; BIHECC, 2007). This also helps meet objective two as there is no need to find subjects that must conform to particular requirements for the hurdle.
- **Current activities from a student's study program can be used to meet the requirements.** In order to meet objective three, students can use current activities from their subjects to meet some of the requirements of the hurdle. This has two additional benefits; it helps to link the professional skill with their discipline skills and also it can improve the quality of the assignments used.
- **The hurdle is administered at the school level.** This is required to overcome the issues of isolation, expertise and motivation. Additionally a school level approach is required to ensure there is consistency in the assessment of the hurdle.

The hurdle requirement is that students must submit an ePortfolio that demonstrates both their capabilities in specified professional skills as well as some ability to develop these skills through self-reflection. The medium term objective is to have students demonstrate four key skills, at two different levels of ability:

- written communication;
- verbal communication;
- teamwork; and
- personal & project management.

Additionally self-reflection is being developed in the process of teaching the primary skills. These skills were chosen as they have been identified as being important to industry (BIHECC, 2007; DEST, 2002) are identified as learning outcomes by the Australian Qualification Framework (DEEWR, 2011), are level 1 competencies identified by Engineers Australia (EA, 2011), are used in student assessments within the Melbourne School of Engineering, and are likely to be practical to teach. Skills such as problem solving and critical thinking have been excluded at this point as it is felt that these kinds of skills are better assessed within a specific technical context. Self-reflection is not typically identified as a key industry skill but is considered to underpin skills such as lifelong and independent learning and is an important skill for personal development.

EPortfolios

An ePortfolio is used as the major assessment as it is well suited to the characteristics of the hurdle. Pedagogically it is well aligned with the concepts of self-reflection and the gradual development of skills and capabilities and is an assessment method that can persist throughout the lifespan of the student's study program. Additionally an ePortfolio can be used for any kind of digital artifact allowing students to demonstrate their skills developed outside of their academic activities. The ePortfolio tool used is a module that is part of the CareerHub platform (CareerHub, 2013). It was chosen as it was readily available, was reasonably straight forward to use, is associated with the career website and would be available to students even after they graduate.

The current state of the EPH

While the medium term plan (4-5 years) for the EPH is to require all four professional skills demonstrated at two different levels, currently only written and verbal communication are required at a single level. As the hurdle is still at an early stage in its development, it does not yet assess students at a level that is felt to be adequate in the long term. To demonstrate their ability in either written communication or verbal communication, students must submit three artifacts; a preparation piece, a reflection and a final piece as outlined in Table 1.

Table 1: Required Artifacts for the EPH

	Verbal Communication	Written Communication
Preparation Piece	A video recording of a practice presentation showing the presenter and any slides being used. At least 3 audience members must be present to provide feedback using supplied feedback forms or similar.	A draft or plan of the final piece, or a document of a similar nature but smaller in scope. Feedback must be received from an experienced source, such as a staff member or practicing engineer.
Reflection	<p>The reflection for both modules is similar, being a 1-2 page document including:</p> <ul style="list-style-type: none"> • a discussion of their feedback; • the preparation piece's strengths and weaknesses; • the student's strengths and weaknesses; • their own interpretation of their preparation piece; and • plans on how to address these issues in their final piece. <p>This document can not typically be sourced from subjects and is generally required only for the EPH.</p>	
Final Piece	<p>A presentation that is required to:</p> <ul style="list-style-type: none"> • Be at least 5 minutes long. • Cover a technical topic. • Be designed to persuade, educate or inform. • Be created for a need outside of the hurdle (for a subject or for a real audience). 	<p>A document that is required to:</p> <ul style="list-style-type: none"> • Be 1500+ words. • Include analysis or design. • Require research or investigation. • Persuade, educate or inform. • Be created for a need outside of the hurdle (for a subject or for a real audience).

Assessment

Only the reflection and final piece are assessed for quality; this is done using rubric type marking schemes. The reflection is judged according to two categories; the breadth of the student's self-efficacy and the quality of their response. The final presentation is judged according to how its content is structured and presented, how any materials such as slides have been designed and on how well the presentation was delivered. The final written piece is judged by how well it is structured, the level of readability and how well the figures have been presented.

Dedicated casual staff assess the bulk of the ePortfolios; all of the reflections as these are typically external to subjects, and the majority of the final written pieces and presentations. The remainder of the artifacts are marked within subjects which have been identified as having assignments suitable for including in the ePortfolio and who have also agreed to assess the assignments using the EPH rubrics. Typically the rubrics only make up a small part of the students' subject mark, generally using marks that were already being assigned to communications. This has been done to gradually link professional skills with discipline skills, encourage staff engagement, support a consistent method of assessing communications and also to manage the marking workload.

As of the middle of 2013, there are around 500 students working on completing the hurdle with around 250 having made ePortfolio submissions over the previous 12 months.

The skills towards employment program

The Skills Towards Employment Program (STEP) aims to support the students in completing the EPH in two ways; by explaining the EPH and also providing resources for them to develop their skills to the required level. The program is comprised of a series of modules; one per skill per level. The modules in turn are made up of workshops and online lessons designed to help students develop key communication skills outside of any specific subject. Integrated into each of the workshops are career development sessions.

Each workshop and online lesson has an associated self-assessment which students can use to gauge their understanding of the activity content. These have been implemented as STEP is optional; the hurdle being the submission of the ePortfolio. As the capability of the students in communications is very broad, with around half of them having completed undergraduate degrees in other institutions (many in other countries), it would go against the third objective of the EPH to force all of the students to complete all of the STEP activities. These self-assessments allow the students to make an informed decision about completing activities. If a student doesn't achieve 80% or higher in one or two attempts, they are encouraged to complete the activity. These assessments are short (around 5 minutes) online quizzes with questions being taken from pools to allow for repeated attempts. Additionally, the lessons are particularly helpful for the online lessons as students can use them to get feedback on their learning and then repeat the lesson if necessary.

The current state of STEP

In Semester 2, 2013 approximately 1500 students have access to STEP, with around 500 needing to be involved in the current period as they will be graduating soon. Due to accreditation requirements STEP is being implemented in a top-down approach, targeting final year and penultimate year students with earlier years being added in the future. Around 20 subjects have been identified that have activities suitable for using in the EPH; these were chosen to span the final three semesters of the Master of Engineering degree and all 11 engineering disciplines available at the Melbourne School of Engineering. The students in all of these subjects were targeted by an email campaign to encourage them to participate in STEP this semester. Based upon the number of students involved in EPH suitable subjects, approximately 40 introductory workshops, 15 sets of verbal communication workshops and 20 sets of written communication workshops have been organised in semester 2, 2013. Each workshop can accommodate up to 20 students, with average attendances of about 50% for the first workshop, but decreasing numbers for the later ones.

The activities used in 2013 and the topics included in each are explained in Table 2.

Table 2: STEP Activities

	Verbal Communication	Written Communication	Duration
Workshop 1	In this workshop students are given an overview of the EPH and STEP. Additionally they are shown what career resources are available and have the graduate recruitment cycle explained to them. This workshop is identical in both modules.		1 hour
Workshop 2	The second workshop in the verbal communication module looks at designing presentations covering content structure, estimating timings and engaging the audience. Students also give a short speech to their peers. The careers section helps students to understand the impact of their values on their career and also gives an introduction to networking.	This workshop focuses on writing style including understanding the audience, formality and visual aids. ¹	2 hours
Workshop 3	This workshop covers delivering a presentation including body language, speaking and anxiety. Students also plan the introduction to a speech they plan on giving. The careers material focuses on LinkedIn.	The third written communication workshop looks at writing concisely and critical reading. ¹	2 hours
Online Lessons	There are six verbal communication online lessons: <ol style="list-style-type: none"> 1. Planning a presentation 2. Selecting topics 3. Presentation development 4. Slide design 5. Team presentations 6. Academic posters 	There are four written communication online lessons: <ol style="list-style-type: none"> 1. Planning 2. Formal reports 3. Referencing 4. Effective writing 	12-17 minutes each.

¹The careers material is identical in both modules.

The challenges and successes

A number of successes and challenges were identified through the administration of the program, personal correspondence, discussion boards and other communications with students. A formal feedback process is planned for semester 2, 2013. The successes and challenges listed below were identified across the two previous semesters.

Success 1: Students appear to see the benefit of the reflections

Many students have expressed that they felt the completion of the preparation piece, and more surprisingly the reflections, were useful to them in the creation of their final pieces. This is considered a success as it has been noted that students often struggle with the concept of self-reflection (Shen et al., 2011), and that the challenge is how to develop self-reflection rather than make use of it (Cambra-Fierro & Cambra-Berdún, 2007; Kitsantas, Reiser, & Doster, 2004). The reason for this success may be the focused nature of the reflection; students are required to consider their strengths, weaknesses and the impact that these have as a response to one activity in preparation for completing another. This is consistent with the importance of motivation in self-reflection identified by Cambra-Fierro et al. (2007) and Cassidy (2006). While this needs to be further investigated it is a positive indicator that the activities are an appropriate starting point.

Success 2: Students felt that they improved in their communication skills

Although there is not yet any statistical support available, general feedback from many students particularly ones who were less confident of their abilities, indicated that they felt their communication skills had improved. The objective of the program is not to improve all students (although this would be a good outcome), but rather to ensure that all students have achieved a minimum standard. As such, this improvement is encouraging, but will need to be correlated with actual performance.

Success 3: The self-assessments have received a good amount of use.

The self-assessments that were linked to online lessons and workshops, have typically had around 100+ students using them, with many students making multiple attempts. This suggests that there has been at least a moderate amount of engagement with these activities. Kitsantas and others (Kitsantas et al., 2004; Zimmerman & Kitsantas, 1997) discourage the use of assessment as being the sole motivator when developing self-regulated learners, so this level of engagement with activities that aren't associated with any marks is promising but does need to be investigated further.

Success 4: Use of engineering career resources increased

It was noted that the usage of career resources (such as the careers website, consultations and seminars) increased particularly in weeks after students were informed of them in STEP workshops. While career planning isn't one of the main objectives of STEP it is an important part of making students ready for industry. Helping students to engage with available resources has been considered a bonus success. Some misconceptions about the career process were also identified and corrected in workshops.

Challenge 1: The program was perceived to be too late in the degree

As mentioned previously, due to accreditation requirements, STEP is being implemented in a top-down approach. Given the option, starting with first year students would have been preferable, as for final year students, the material covered would have been much more useful to them at an earlier stage. As the intention is for STEP to ultimately be implemented in all years of the Master of Engineering and also linked with the undergraduate engineering subjects, this issue should gradually be resolved.

Challenge 2: Some students felt that the material was too easy

This was an issue in the first iteration of the program. Due to the diverse capabilities of students, there were some who felt they knew most or all of the material covered, while some felt it was all valuable. To cater for this diversity, online lessons were integrated with the communications modules in 2013. These cover fundamental topics that will assist students who have less developed communication skills and may be largely bypassed by students who are more capable. Self-assessments were also introduced to guide students about which lessons and workshops they would benefit from. This also allows the workshops to focus on more difficult and practical skills.

Challenge 3: It was unclear what was required

There appears to be three reasons for this; the early stage of implementation that STEP and the EPH are in, the non-traditional structure being used, and some participants irregularly or only partially reading correspondence and the provided documents.

Time constraints and available resources resulted in the program being developed while it was also being implemented. This resulted in a lack of clarity for students, particularly at the start of the program. As the structure is now more stable and the majority of required documents for the written and verbal communication modules are now complete, this should not be as large a factor in future semesters.

Traditional higher education programs also tend to be structured such that students expect explicit instruction; as a result the flexibility of STEP and the EPH has left a number of students dissatisfied and a little confused. The novel structure has also resulted in a large number of documents being created which students may need to read but are often

disinclined to. As STEP and the EPH become more widely implemented and better known, these issues are expected to lessen.

The correspondence and reading issues became evident in a number of ways; students would express that they were unaware of events or instructions they had been previously emailed about, ask questions that were covered in the supplied resources, ask for a general description of the EPH and STEP, some read the start of the ePortfolio Submission document but not the following step by step instructions and some expressed no knowledge of the hurdle at all, once again after having been contacted about it previously. Connecting with more subjects and with students earlier in their degree is likely to help with these problems, but there is little choice in the use of email as the primary method of correspondence as the number of students is going to increase.

Challenge 4: Low attendance in workshops

For many of the workshops attendance was low. The desired level would be around 15, but some were as low as only a couple of students. There are a number of factors involved:

- workshops are currently registered for rather than timetabled, this means that students have to remember to attend, and avoid the temptation of attending other activities that may be more enjoyable or more pressing;
- the number of workshops required is hard to predict due to the flexible nature of the EPH. As students can choose when to complete the EPH the number of STEP workshops required is likely to have been overestimated;
- correlating student attendance, registration and participation in the self-assessments has been difficult. With improved robust reporting methods, it would be possible to remind students about activities that they have yet to participate in or have not registered for;
- the dissatisfaction with the proposed content as expressed in challenges 1 and 2;
- the communication issues in challenge 3; and
- the optional nature of STEP conflicts with the high workload of senior students. Students are more likely to give up optional activities such as STEP when there is significant pressure from assessed activities like assignments, and senior students typically have significant assessment pressure.

It is expected that this challenge will reduce as reporting issues will gradually be resolved as the reporting requirements are better understood, the program is implemented in earlier years and students as a group become more aware of what the program entails.

Challenge 5: Students are not engaging with the ePortfolio

This is a significant challenge but not surprising considering the limited and highly prescribed nature of the ePortfolio's creation at this point. It has been estimated that students may require a couple of years to engage with tools like ePortfolios, and also that significant staff support may be needed. The only current foreseeable remedy for this is approaching the students early in their study and guiding them to identify how the ePortfolio can help them in their own development.

Conclusion and future directions

While pedagogically the framework of STEP and the EPH is sound, its success or failure resides in the implementation. The key lessons learned are as follows:

1. **Start early.** This is both starting your planning and preparation earlier than you think you need to, and also working with students as early as possible within their degree. Having all the materials ready from the start of the program would have reduced confusion, and starting with first year students would have increased impact and engagement.
2. **Expect and accommodate diversity.** While it was expected students would vary, more could have been done to accommodate this.
3. **Good information is needed for good management.** The extent that good reporting tools and information would help in the running of the program was underestimated. Setting this up is still a work in progress.

Other than the changes already discussed the next stage for STEP and the EPH is evaluation. Key questions include:

1. Are our students' communication skills improving as a result of STEP?
2. Are we teaching the communications that industry wants?
3. Are we assessing students at the level industry expects?

The creation and operation of STEP and the EPH have not been simple or easy, but should we be able to meet the objectives that we have set out to achieve, the benefits to our students will make the investment well worth it.

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