Investigating the impact of service/social enterprise learning projects and employer involvement in engineering education

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Abstract

In 2007 it was decided to refresh and invigorate a level 7 MEng module in enterprise education in order to improve student participation and engagement. Given the nature of on-going research work being undertaken in the Department of Mechanical Engineering at the University of Sheffield at that time, it was decided to look at projects that had a broader civic and social element as part of this exercise. To that end, various methodologies were considered, including the concept of service learning, defined as ‘a method under which students or participants learn and develop through active participation in thoughtfully organized [sic] service that is conducted in and meets the needs of a community; […] helps foster civic responsibility; and that is integrated into and enhances the academic curriculum of the students […] and provides structured time for the students or participants to reflect on the service experience’ (US Code 12511, 1990).

Whilst common in the US, this method is less well developed in the UK and very unusual in the delivery of entrepreneurial education for engineers. This project set out to investigate the effectiveness and impact of this technique within a UK HEI using a range of techniques, including interviewing and surveying all stakeholders. Factors assessed by the survey work included the potential for developing enterprise skills, student engagement and the value of external contributors. This paper presents the results of this study, which show that students’ expectations of starting up companies increased through the project and that their understanding of a key issue for the project (disability) also increased. Those involved in the teaching and delivery of the module have seen increased engagement and learning outcomes; however, the results of the project were inconclusive in terms of the value of service learning to the students per se, with approximately 50% disliking the “service” element of the module. This requires further work with respect to the fact that the module has shown increased engagement and learning outcomes over previous years, the most obvious answer being that the module delivers in terms of learning outcomes but takes the students out of their comfort zones and asks them to deliver significant outputs whilst simultaneously being under pressure from other modules.

Keywords: service, social, learning, enterprise, employment, internationalisation, teams

Background

Service/social enterprise learning is a credit-bearing learning experience (Barnett, 1990) in which students take part in a social project that allows them to deploy their engineering design skills while working with “real” customers, practitioners, employers and businesses to produce a solution to a social problem. This is then presented to judges as a business. The project has been running in this format since 2007. Prior to this, students were given purely commercial projects with no direct personal or civic customer. These projects were well received, but the level of engagement and participation was found to be average. In 2006 the module recruited 35 students and a year later, when we implemented the first social project, the number of students who took the module
doubled. Whilst the module is now not fully optional (as some departments have made it core for their students) the module recruited 132 students in 2011, once again breaking the previous year’s record. Initially, the module was taken only by level 7 MEng students from the Department of Mechanical Engineering but is now taken by MSc and occasionally PhD students from all seven departments in the faculty. Through the years, students are repeatedly reported to have benefited from and engaged more with this learning model, particularly in terms of the development of social responsibility (Bringle and Hatcher, 1996). There has been some analysis of this teaching approach but the full impact has yet to be assessed. This is critical to the development of this type of learning, particularly if it is to be embedded more widely in the UK.

Rationale

Service learning is a type of learning less widespread in the UK than the US and is not common practice in UK HEIs, particularly in engineering.

The literature suggests three main potential “beneficiaries” of this type of learning: students, institutions and communities (Dutson et al., 1997).

The benefits observed during previous investigations concur with the literature (Cohen and Kinsey, 1994):

- Students: increased satisfaction, engagement and employability
- Institutions: increased level of engagement with the community, external contributors and recognition
- Community: engagement with the university, problems tackled and some solutions developed. Increased sense of receiving help and also of helping the student learning experience.

Understanding the impact of this learning technique in depth was deemed necessary to enabling HEIs in the UK to adapt, implement and make the most of it.

The approach

The research methodology underpinning this study is phenomenography, which characterises the qualitative differences in the outcome of students’ learning through the students’ own accounts of their experience of the module, in whole or in part. This was recorded through interviews and surveys. In addition to the students’ experiences, the customers/practitioners/employers were similarly canvassed for their experiences of being involved in this learning model.

More specifically, the study included:

- two student surveys:
  - questionnaire (response rate 100/132)
  - TurningPoint survey (response rate 80/132)
- one focus group of current students (3 students)
- external questionnaire (4 externals)
- customer interviews (1 customer)
- collation and analysis of responses.

Assessment

Students were given the following brief at the start of the semester.

1. Background
Kieron Norton is a ten-year-old boy who is in his sixth year at school. When he was born he weighed only 595 grams. He was in an incubator for six months and was diagnosed with cerebral palsy.

Cerebral palsy (CP) is an umbrella term encompassing a group of non-progressive, non-contagious neurological disorders that cause physical disability in human development, specifically the human movement and posture.²

Kieron has regular therapy which has helped him with his balance and to talk more, but he still needs to use his communicator.

Kieron goes to Fountaindale School in Mansfield, which provides an inclusive education for pupils aged 3 to 19 who have Physical and Communication disabilities.

For more information visit Kieron’s web page: www.livingwithcp.com

2. The challenge

“Making Kieron’s life easier”. Using your engineering skills, design a product that will aid young Kieron and other people born with cerebral palsy to operate more easily in their day-to-day lives.

3. Assessment.

A. 10% Group - Initial solution and business model
B. 40% Group - Business plan report
C. 40% Group - Poster presentation (with elevator pitch)
D. 10% Discretionary points
E. Individual effort factor provided through peer review (WebPA).

A. The initial solution and business model had to be three pages long, not including the cover sheet. One page had to cover the engineering solution (annotated sketches were acceptable at this stage), the second page had to explain what needs the product met, its target market and foreseen competitive advantages, and the last page had to describe the business model that the students intended to adopt.

Formative feedback was provided for this piece of assessment.

B. The business plan had to contain a sound structure and be written in a business-like manner. It had to include an executive summary and a cash flow projection for the first year of business.

Every report had to be unique, as every team should have approached the project differently. Therefore, the length of the report was left up to each team. It was recommended, however, that the actual plan did not exceed 15 pages, with no limit on the appendices. The authors had to maintain a clear and straightforward written style which would enable the reader to gain an easy and quick understanding of the report.

Marking criteria were provided to the students.

¹ http://www.livingwithcp.com/
² http://en.wikipedia.org/wiki/Cerebral_palsy
C. Each team had to produce an A1 poster including the information they considered to be the most relevant or eye-catching in order to obtain support from stakeholders, bankers, staff or whomever the plan was intended for. At the end of the project the posters were presented to a panel of academics, business people and the customer, all of whom assessed its quality and content. Team members were questioned by the panel. It was expected that students would be able to answer questions and comment on their business plan and technical solution. A representative member of the team delivered an elevator pitch no longer than 80 seconds.

Marking criteria were provided to the students.

D. Discretionary points were awarded only when the team provided work beyond that stated as part of the project and which demonstrated a clear level of innovation and creativity.

Summative feedback was provided for B, C, D and E.

E. Peer assessment using WebPA, an online peer moderated marking system. Each student in a group marked their own and their team members’ performances. The grades given were then used to weight an overall group mark.

Students were asked to consider what type of “human resource” they would need to take their project to successful completion and then to group themselves in teams of 7-10. They had 11 weeks to complete the project.

Evaluation

The students were invited to complete a survey at the beginning of their module (lecture 2) which was in keeping with the requirements of the ethics committee at the university and the data protection act. Various questions were asked about the module, but only the results pertaining to the concept of service learning and its effectiveness (or otherwise) are shown here.

The students were asked to describe, in a sentence, what they thought the module was about. In both groups, they related the module to applying engineering skills to business or business planning, although the design aspect was also considered important. Six mentioned social enterprise. Responses to a further question asking what their expectations of the module were showed that all of the students expected to learn about the business world and how to deal with “real” problems.

When asked what their understanding of social enterprise was, all students broadly responded that they understood a social enterprise to be one that helped society or people. The students were also asked what their personal understanding of disability was and all responses again indicated a broad understanding of disability (physical or mental limitation of everyday activities). The students were asked whether they had had experience of interacting with people with disabilities and there was a fairly equal division in both groups between those who had and those who hadn’t. A further question explored whether the students felt confident that they were able to interact with a person with disabilities in a professional and ethical way. Almost half of the students in both groups did not respond to this question.

The majority of students in both groups indicated that they had not had experience of enterprise education prior to attending the University of Sheffield. Only five compulsory students and three optional students had experience of running a business. However, a third of these students had had experience of enterprise education before attending the University of Sheffield. Almost half of the students in each group indicated that they intended to start a business.

The second survey of the students was undertaken on completion of the module on the day of poster presentations and judging (19 May 2011). The method used this time was a TurningPoint Technologies voting stick system. The survey was conducted after the judges had seen the presentations and posters and questioned the students. The judges then left to deliberate and it was at this point that the survey was conducted (i.e. before the awards and prize-giving).

Throughout the response process upward of 70 to 80 students responded out of the 132 undertaking the module. The first question was whether the module met their expectations. 21%
indicated that it had exceeded their expectations and 61% indicated that it had met their expectations - an exceptionally good result. However, for 11% the module did not meet their expectations. In response to the question ‘did you enjoy this module?’, 68% did and 28% did not.

In response to whether, given the choice, students would do the module again, 49% indicated that they would and 40% that they would not (10% were undecided). This is an informative result that requires further exploration, particularly as 75% of the students for whom the module was compulsory said that they would choose to do the module. There seems to have been a change of mind as a result of actually doing the module. This result should also be compared to student satisfaction as indicated by responses to the first question (82% saying that the module had either met or exceeded their expectations).

Perhaps of more interest is the positioning of the module in the degree. 63% of student respondents indicated that they would have liked to have undertaken the module earlier in their studies. This may also be a factor in the negative responses, along with the fact that very few students had experienced enterprise education before university.

The next two questions were whether there should be more modules working on “real” problems:

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<th>Yes</th>
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<td>72%</td>
<td>20%</td>
<td>8%</td>
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and whether there should be more modules working on a “real” problem but with a business focus:

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<th>Yes</th>
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<th>Don’t know</th>
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<td>48%</td>
<td>43%</td>
<td>9%</td>
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There is a drop from nearly three quarters of the students wanting more modules with a “real” problem to just under half when that “real” problem has a business focus.

Part of this research is to assess the impact of service/social enterprise learning and the next question was whether there should be more modules working on a “real” problem with a social enterprise focus. The responses were surprising:

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<th>Yes</th>
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<td>34%</td>
<td>53%</td>
<td>13%</td>
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The assumption that students engage more with projects that have a social enterprise focus is not borne out by these results. These results are particularly surprising, as numerous students have provided very positive informal feedback about the nature of the project after the module was concluded.

When asked whether they enjoyed working with students doing different degrees to their own, 53% said they did (26% had no opinion). This highlights a desire for more interdisciplinary and possibly interfaculty modules. That 26% have no opinion may indicate that these students do not need to think about this as they are already experiencing it.

In response to whether this module had changed their understanding of disability, 45% indicated that it had and 44% indicated that it had not. This may be a reflection of the students having indicated considerable engagement and understanding of disability in the earlier survey. Responses to the next question (‘If you didn’t before, would you now feel comfortable working with people with disabilities?’) confirm this, with 55% indicating that they would. 73% indicated that the module had given them a better understanding of the needs of people with disabilities.
There is a broad understanding of what a social enterprise is. This is not surprising, as a social enterprise can take many forms and for that reason is not specifically defined. This could also explain why 27% of respondents thought that a social enterprise did not fall into any of the definitions. This outcome also reinforces the earlier conclusion regarding whether students value social enterprise projects or not.

The final question was whether the students would have enjoyed the module as much if the project had been purely commercial, rather than having a social and civic element:

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<th>Yes</th>
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<th>Don’t know</th>
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<tr>
<td>Percentage</td>
<td>50%</td>
<td>15%</td>
<td>35%</td>
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This is perhaps a true reflection, a 50/50 split, which may indicate that students are not as socially motivated as initially thought. The other explanation is that they would be as motivated with either type of project.

In order to expand on the survey, and perhaps get more reflection from the students, a small focus group was interviewed. The participants confirmed the value of team working, particularly teams of mixed nationalities, and that they had expected to learn the basics of business start-up and that this expectation had been met. They confirmed that lecturers from the business world (external contributors) were very important in terms of understanding the basics of business start-up. They had engaged far better with the project because of its social focus, although this took them out of their comfort zone. This finding supports the initial hypotheses.

In response to what did not work, they felt that the timing of the module in the last semester of their final year was detrimental. Had it been earlier, they would have had the chance to produce prototypes (not a requirement of the module, but something the teams wanted to do) and submit ideas for business plan competitions.

All focus group participants valued self-directed learning in the module and had undertaken no previous modules like this. They felt that immediate feedback from their external customer helped them to focus their product ideas and they welcomed being able to use their design skills in a “real” context.

Overall, the students wanted a module like this for each year of their degree. They also intended to refer to the module in interviews and on their CVs and clearly understood the skills they had gained from participating in it.

**External contributor survey**

External business people who had contributed to the module over a number of years were surveyed to ascertain their experience of working with the students on the module. All of them not only contributed to the module, but also took part in the judging of the poster presentations.

It was deemed important to understand why they, as business people, had contributed to the module over a number of years. Their response fits broadly into the category of enjoying engaging with the students, in particular seeing that their contribution is appreciated, taken on board and used constructively. They all indicated that they wanted to continue having input into the module and that they would also like to increase this input.

Additionally, they all felt that the value of their contribution was in being able to share with the students their experience of “real world” situations in relation to developing products and business start-up. They also indicated they would like more interaction with the students for the duration of the module, perhaps as mentors. In reflecting on the module over the years, they all indicated that the student engagement was what had impressed them most.

On being asked how they would like to have more input into the development of the module, they emphasised the importance of having a “real project” but would like to have more input into the format of the module and outcomes expected. They would also like to receive feedback from the students on their contribution.

**Customer survey**
At the time of writing, only one customer response had been received: the Woolley Wood School, which participated in the module in 2010. However, the response did offer a very interesting insight in that the customer had worked extensively with volunteering students in the past and had not found it to be a positive experience: ‘having had many students come into school working with our pupils, few are able to deliver what has been expected. As a result, our expectations were that the students would benefit greatly from the association but that the impact on our pupils would not be so.’

Following participation in the module, the customer’s subsequent opinion was that ‘the expectations were greatly exceeded. Students were polite, enthusiastic, constantly seeking clarification, respectful. The ideas were creative and those students who visited the school had obviously taken into consideration what they had seen and information they had acquired. This was reflected in their designs.’

Discussion, summary

The combination of the application of engineering design skills to address a social problem in a business context in the curriculum is an extremely valuable learning experience, not only for the students, but also for the customers, practitioners and external contributors. Perhaps a major feature of this research is that all groups identified that this model of learning should take place earlier in the curriculum and possibly more than once. This would allow prototypes to be developed and encourage students to enter business plan competitions or even start up undergraduate student companies. There is also the suspicion that a major factor in lack of enjoyment of the module is that it requires a considerable amount of work at a time when students are finalising their dissertations.

This cohort of students did not have previous exposure to enterprise education; however, at the end of the module over half indicated that they were now contemplating starting a business. This is very much in line with the direction the government would like to see higher education taking, encouraging a skilled and highly trained workforce to start their own businesses, thereby regenerating the economy. This should therefore make this module a key marketing feature for engineering degrees at the University of Sheffield, and dissemination of the findings to the wider STEM sector is reinforced by this finding alone.

However, at the other end of the spectrum, if students are going out into the workplace they need to clearly understand the skills that they have gained from the module. It is often a feature of embedded enterprise modules that students do not fully appreciate the skills they have gained, although they often report that specific reference to such modules has contributed to the successful procurement of internships or jobs.

One surprising feature is that the students specifically identified as a bonus not just team working but how effective international team working was, which in turn has implications for the global marketplace.

Specific areas of this module (e.g. social enterprise, design, etc.) could benefit from a mentoring system, preferably with alumni acting as mentors.

There needs to be a more longitudinal study of the student experience in order to fully gauge the benefit of this learning model. It is anticipated that, once they have gained more life experience, students will be able to articulate the benefits of having undertaken it more clearly.

Key features of the module were identified:

- Cross-disciplinary: this is a truly interfaculty module
- Students enjoyed working in teams with members from other engineering disciplines. They also valued working with mixed nationalities. They indicated that this enriched their learning experience
- Few students had experience of enterprise education before attending university
• Students recognised the need for understanding business/management within their engineering degree

• At the beginning, low numbers of students indicated that starting a business was an option they would consider. At the end of the module, 57% indicated that they would or were likely to consider starting a business.

• Students and practitioners both emphasised the need for the module to take place at least once and earlier in the engineering degree

• Development of prototypes should be included in future development of the module

• Alumni entrepreneurs are clearly very valuable; they are almost peer role models and should perhaps be engaged more in the module development

• External contributors from the world of business are critical to this module and learning experience. The majority would like to make a greater contribution, particularly to the development of the module

• Customer experience is very positive, particularly in relation to the businesslike way the students behaved, and the customers were able to make a direct comparison with the less positive behaviour of previous experiences with volunteering students

• Students need to be able to reflect on skills they have gained through this module and how to articulate and record them

• Students need to have a clear understanding from the module outline of what the module entails.

Further development

The module leader expects to continue to develop the module and has a lot of anecdotal evidence from many perspectives about how successful it is. For example, one student had had three years’ work experience prior to starting their degree and could compare this module as a very similar experience to that of working. However, it is felt that, given its longevity, there is a need to get more foundation on the perceptions in order to take the module in the right direction. Although there is no apparent reason, a dramatic improvement in the student work on this module has been seen and the expectations of the judges rise each year. It is difficult for all concerned to remember that this module is only ten weeks of the students’ work.

As to module development, although reluctant to impose another feedback tool on them, the module leader would like the students to take part in deep reflection on their experience of the module. There is also a need for a mechanism for development of prototypes and for exploring ways in which the two universities can work on this module.

The general opinion of students and lecturers is that this module should run earlier in the engineering degree and perhaps more than once. If the module was earlier then the students would have more opportunity to develop their ideas and possibly enter competitions and award schemes. There should also be wider dissemination of this approach.

References


US Code 12511, (1990) Section 40 Legal definition of Service Learning.
