

Future Engineers Australia Management Project: Turning High School Students into Engineering Entrepreneurs

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Abstract

There has been a strong move towards entrepreneurial education in high schools and at universities over the past few years¹. This has been echoed by a call from state governments around Australia to promote enterprise thinking and education in high schools². It also parallels the push within engineering to learn across the traditional boundaries, particularly between engineering and business³.

To meet this call, The Engineering Link Group (TELG) developed the Future Engineers Australia Management Project (FEAMP) in 2003. The project is based around Enterprise Education⁴, and was inspired by the Smallpeice Year 12 Engineering Management course in the UK⁵. The idea was to take high school students in years 11 and 12 and turn them into ‘engineering entrepreneurs’.

This paper presents the design, development and evaluation of FEAMP as a five day residential course for year 11 and 12 students who want to learn more about being entrepreneurs and managers. It is a hands-on activity where the students invent, develop and sell an engineering concept to venture capitalists and ultimately to customers at a trade fair. It has been run successfully for two years, going from strength to strength.

Introduction

“Australia will only reach its full potential with an enterprise culture – a culture that encourages and rewards hard work, ambition and calculated risk-taking.”⁶ In setting this goal in 2004, Prime Minister John Howard committed the Australian Government to “building an enterprise culture within Australia and to foster an entrepreneurial spirit amongst our young people”⁶. The Engineering Link Group (TELG) developed the Future Engineers Australia Management Project (FEAMP) to meet this goal and provide high school students the chance to develop enterprise skills. This was based on the Engineering Link Project (ELP), a four day residential course to teach high school students about engineering⁷.

The major focus of FEAMP was on developing enterprise and entrepreneurial skills within young people, particularly high school students, about to embark upon their careers. These enterprise skills and abilities, apart from equipping the students with an awareness of how their community, including business and industry, works, will also

help the students to deal with an unpredictable and ever changing world⁴. The Curriculum Corporation⁸ identifies five primary motivations for enterprise education⁴ as:

1. An international response to change
2. The labour market is changing
3. There is a new culture in the workplace
4. It allows multi-skilling
5. Enterprise culture needs to be more a part of the wider society

By developing entrepreneurial skills within themselves, students will be more able to deal proactively with constant changes during their working lives. This will also enable students to be more attractive to the current business market, with its shift in available jobs to small business that needs to have a competitive edge. With this shift there is a concomitant focus on encouraging adaptability and versatility within employees who then empowered to move easily from one job to another; another useful product of an enterprise education. Finally, the focus on developing an enterprise culture within students as future career people will in turn have an impact on society, developing a more creative and enterprising outlook⁴.

There has been a strong move towards entrepreneurial education in high schools and at universities over the past few years¹. One of the main reasons for this shift has been that the students themselves are interested in participating in entrepreneurial education programs¹. This has been echoed by a call from State governments to promote enterprise thinking and education in high schools², and financially encouraged by the Federal Government's Enterprise Learning for the 21st Century Initiative⁶. This also parallels the push within engineering to learn across the traditional boundaries between engineering and business⁹.

Future Engineers Australia Management Project

In order to address this call for entrepreneurial education, in particular at a high school level, The Engineering Link Group created the Future Engineers Australia Management Project. The high school level was selected as these students are at the stage of choosing their future careers, and this course was aimed at helping them make more informed decisions. The project was based on the Engineering Link Project (ELP), a four day immersion course designed to teach high school students about engineering⁷. While initially inspired by The Smallpeice Trust's management course⁵, which reasons that engineers quite quickly become Project Managers, the idea of "management" was decided to be not very attractive to senior school students. The focus was changed from a management course to an enterprise course, and while organised by teachers and other volunteers, professional entrepreneurs and business people presented the course content to the students.

The main goals of the Future Engineers Australia Management project were:

1. To help students make more informed career choices
2. To help make studying maths and science more meaningful to students
3. To start to develop an enterprise culture within high school students

The first Future Engineers Australia Management Project was run in Brisbane in January 2004, with the second and probably future programs held in Rockhampton, at the request of Stanwell Corporation, who are the major sponsors.

An overview of the FEAMP process can be seen in Figure 1, showing the stages before, during and after the main part of the camp. Students arrive already grouped into teams of three with an initial idea for a product, process or system that they want to develop, market and sell. During the program they learn skills from the business people, practice these skills, and then apply them to their own products. The course culminates in a trade display, where invited guests from the business, industry and tertiary sectors of the community act as customers for the students to sell their products. The students then are able to evaluate how they went and what they had learnt. This structure ensures student ownership is maintained, and that the students are able to take their idea from inception to completion to evaluation. It also ensures that students are instructed by business people adding a sense of realism to the process. The camp ends with the students developing their own professional development plans, helping them organise their future careers.

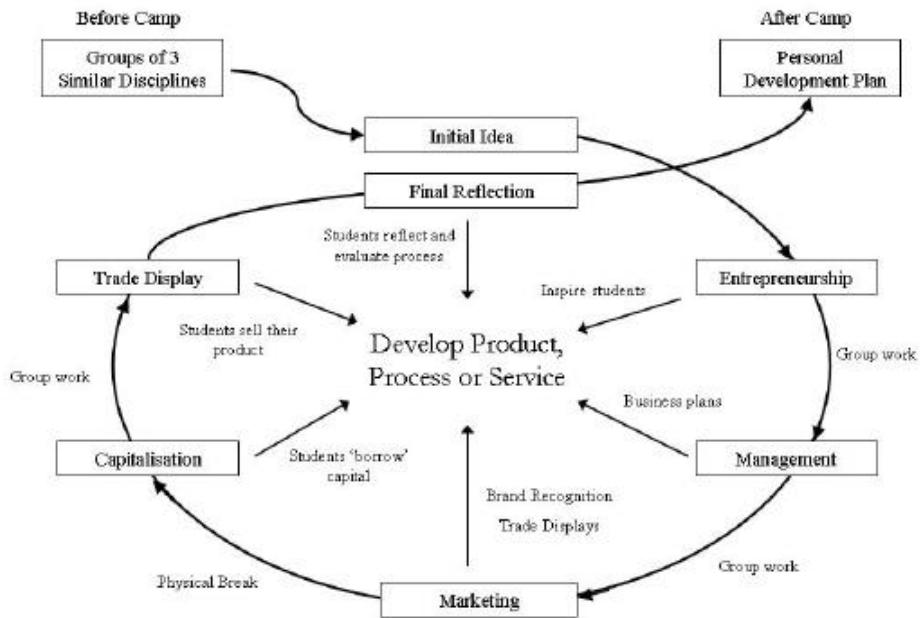


Figure 1: Overview of FEAMP Process

The major focus for the design of the project was to require the students to constantly apply their new enterprise knowledge to their own product, thus demonstrating the relevance and need for the content of the lectures, and its applicability to real life.

The course actually commenced before the students arrived. The students had been formed into companies of three members, based on the engineering discipline each student had expressed a preference for. Each group was required to think of an innovative product for them to develop and market during the course of the week.

Since this is would be a totally new experience for these students, one of the authors who was also an engineer was available through email to offer guidance and support.

On the first day, on arrival at the course, students had a keynote address on innovation from a consultant from the Department of State Development and Innovation, to set the tone and level of the week and to inspire the students for their future careers. This was followed by a management expert who delivered his “MBA in Four Hours” to the students. Included in this presentation was a module on the importance of Business Plans, which the students were required to prepare for their products. This intentionally foreshadowed the finance module later in the week, in which they would use their business plans to ask for capital to start their business and develop their product.

On the second day a marketing consultant presented a talk to help the students market their product and themselves. As before, the students were put through exercises and practice before they applied their knowledge to their own products (in the students own words: “*we learned it then we used it*”). This helped the students eventually market their products to potential customers at the trade fair.

There was no official lecturing on the morning of the third day. Students worked in their companies to finalise business plans, marketing plans and cost analyses in preparation for their interview with the financier. In the afternoon students took a physically active break from their usual working environment, including a visit to Dreamworld or Paintball. It must be noted here that the students themselves insisted on working thirteen hour days in order to produce what they consider a decent result. In fact students have been critical of the shortness of the available time, but the short time frame introduces the real world concept of deadlines, further adding to the realness of the project.

The fourth morning students met an accountant, a partner from Pricewaterhouse Cooper, Townsville, who talked to them about their financing requirements and assisted with their cost analyses. The individual groups then had a meeting with the accountant, where they had to borrow capital to start their business and market their product. Although the students were not told at the time, the accountant expected to finance every group.

The fourth day and indeed the program culminates in a trade fare. Students have ten dollars to spend on their stall decoration to market their product. Business people, engineers and members of the community are invited to inspect and buy the products in a one hour session that evening. As the students were very well aware, this represented a very real and immediate evaluation of their work. This is followed by an official debriefing and an informal drinks session, allowing the students to talk to their buyers and see what they thought.

Overall, during and after each work session, the students applied the skills they had learnt to their own product. They gradually developed their ideas, their company and their product, process or service until the trade fair, where their week’s efforts were displayed and criticised by the buyers.

Evaluation of Program

The first FEAMP in Brisbane drew sixty students from across Queensland and northern New South Wales. This was rather less than hoped for, but still a very healthy number for the initial program. The course ran very smoothly, with all the presenters pleased with the students' efforts and with the reception they received. The second FEAMP, held in Rockhampton was run virtually identically with thirty-five students. While this was fewer students than the previous year, this was not unexpected because of the regional location. This drop in numbers is being addressed for future years.

The success of the Future Engineers Australia Management Project was assessed using a student questionnaire which covered each day's activity, as well as the project as a whole. The student responses from the previous two years can be seen in Table 1. The feedback has been entirely positive, with a high student approval for such dimensions as educational value, comprehension of task, enjoyment, quality of lecture, value for money and relevance to future aspirations.

Questions	2004 (N = 56)			2005 (N = 35)		
	Good	Okay	Needs Improving	Good	Okay	Needs Improving
Entrepreneur						
Ability to understand the session	96% (54)	4% (2)	0% (0)	94% (33)	6% (2)	0% (0)
Management						
Ability to understand the session	36% (20)	55% (31)	9% (5)	40% (14)	54% (19)	6% (2)
Explanation of Simulation / Task	27% (15)	54% (30)	20% (11)	49% (17)	40% (14)	11% (4)
Ability to apply the theory to your project	41% (23)	55% (31)	4% (2)	57% (20)	34% (12)	9% (3)
Approachability of lecturer	46% (26)	46% (26)	8% (4)	66% (23)	40% (14)	6% (2)
Did you learn anything in the session?	98% (55)		2% (1)	100% (35)		0% (0)
Marketing						
Ability to understand the session	77% (43)	20% (11)	4% (2)	71% (25)	29% (10)	0% (0)
Explanation of Simulation / Task	70% (39)	26% (15)	4% (2)	66% (23)	35% (12)	0% (0)
Ability to apply the theory to your project	66% (37)	30% (17)	4% (2)	54% (19)	46% (16)	0% (0)
Approachability of lecturer	64% (36)	32% (18)	4% (2)	80% (28)	20% (7)	0% (0)
Did you learn anything in the session?	100% (56)		0% (0)	100% (35)		0% (0)
Capitalisation						
Ability to understand the session	79% (44)	20% (11)	2% (1)	51% (18)	43% (15)	6% (2)
Explanation of Simulation / Task	77% (43)	20% (11)	4% (2)	57% (20)	43% (15)	0% (0)
Ability to apply the theory to your project	73% (41)	23% (13)	4% (2)	49% (17)	51% (18)	0% (0)
Approachability of lecturer	71% (40)	25% (14)	4% (2)	54% (19)	43% (15)	3% (1)
Did you learn anything in the session?	100% (56)		0% (0)	100% (35)		0% (0)
Personal Development Plans						
Ability to understand the session	77% (43)	20% (11)	4% (2)	86% (30)	14% (5)	0% (0)
Approachability of lecturer	77% (43)	21% (12)	4% (1)	94% (33)	6% (2)	0% (0)
Did you learn anything in the session?	95% (53)		5% (3)	97% (34)		3% (1)
General						
Ability of your group to work together	75% (42)	20% (11)	5% (3)	77% (27)	23% (8)	3% (1)
Do you feel the project enabled you to practice the skills you have learned?	98% (55)		2% (1)	100% (35)		0% (0)
Did you enjoy the camp itself?	98% (55)		2% (1)	100% (35)		0% (0)

Table 1: Student Responses to Evaluation Questionnaires: 2004 & 2005

Students have found that Future Engineers Australia Management Project is well worth attending. The fact that students wanted to attend an academic course in their holidays speaks for itself. Further analysis is required to ascertain whether it improves interest in science and mathematics and makes them more meaningful.

Discussion

Firstly, the students who participated in the Future Engineers Australia Management Project felt it enabled them to make a more informed career choice in the business and engineering fields, thus meeting one of its initial major aims. By learning about and experiencing engineering generally, and in particular about being an entrepreneur and manager, the students begin to understand what these careers involve and whether or not the careers are for them.

Secondly, the evaluation also shows that students enjoy the course and, more importantly, find that they are learning about a very large field of human activity, entrepreneurship, about which they were more or less completely ignorant beforehand. This not only meets another of FEAMP's aims, but alone justifies operating the program for students.

Thirdly, whether it is equally successful at making sciences and maths more meaningful is an area for future study. Our evaluations indicate that the students do find it interesting to have to decide for themselves what mathematics should be used, and that mathematics and science in general is required for their future careers as engineers. This result alone justifies the process.

Possibly even more importantly, these students are a widely unrecognised risk group. They represent the upper end of the intellectual spectrum in their peer groups, and are often discriminated against because of this. In smaller regional communities such people may well be unique and suffer because of this. They can also be very underworked in school, leading to either distraction or empathy with work. They tend to find the subject matter easy to master and lessons are often, to them, needlessly drawn out and therefore dull.

FEAMP, and TELG's other project the ELP, provide an opportunity for these students to meet and work with their true peers. They are not restrained from working as fast as they wish, and they are not obtrusively obvious to rest of their groups. Comments from students suggest that they find this extremely satisfying.

The idea of teaching students enterprise skills using a real to life project does work. It gives the students ownership in the process, motivating them to learn and do better than their peers in an entrepreneurial sense. Student responses show that 98% of those responding enjoyed the course, and 98% found it useful to practice the skills they learnt.

As a final insight into FEAMP, fourteen of the 2004 Rockhampton FEAMP students volunteered to go back to their schools and encourage other students to attend both

this and the ELP. A conference was arranged for them in April this year and they were asked for their thoughts on where the Project could be improved.

Some of their responses included:

- It needs to be longer. At least a couple of days more.
- A full day free is needed to prepare for the Trade Display
- More help must be given to think of a product, possibly suggested ideas.
- The product is not really that important. It's only a vehicle for the course.
- Students who have attended previous course were valuable and must be encouraged to attend.
- Nothing much you could do better. It was a great experience.
- Nothing, it was enjoyable and there was plenty of time for everything.
- Keep doing what you are doing, it's great and has helped me heaps. Thanks.

Conclusion

The Future Engineers Australia Management Project provides high school students with an opportunity to develop entrepreneurial skills in a practical environment. Engineering provided a useful backdrop to allow the students to develop a realistic product, process or service, and to take the initial idea through a development process to eventually sell it to customers. The students were able to develop an appreciation for the need for an enterprise culture, and gained skills that will help them with their future careers.

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Biographical Information

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