

Enterprise and Business Planning for Engineers

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Abstract

Enterprise is an important element of government strategy to increase productivity and support the creation and maintenance of a healthy economic climate. Whilst there has been lively debate about best ways of embedding entrepreneurship into the engineering curriculum, so far no definitive approach has emerged.

Conscious of the importance of the enterprise agenda in higher education, the Department of Mechanical Engineering at Sheffield University aims to remain at the forefront of the competition by meeting customer expectations and fulfilling their needs. We have therefore made a concerted effort to increase students' entrepreneurial and intrapreneurial potential over the past three years. Consequently, several modules and degree programmes have been created specifically to meet these needs.

This case study presents two modules as representative examples of how mechanical engineers are gaining an insight into the entrepreneurial world.

Background and key features of the modules

1 Enterprise and Technology

Module size	Single
Open / restricted	Restricted
Core/Option	Core
Availability on/off campus	On campus
Total student study hours	100
Number of weeks	10 weeks

This module was designed with the main objective of encouraging first year students to think of themselves as potential entrepreneurs, not to be afraid of the word 'enterprise', and to think of enterprise as a route to commercialise their engineering skills. Additionally, the module was developed in a rather unconventional way, whereby students would receive the knowledge through quotes and analogies and then reflect on the knowledge acquired through group dynamics.

2 Business Planning

Module size	Single
Open / restricted	Restricted
Core/Option	Option
Availability on/off campus	On campus
Total student study hours	100
Number of weeks	10 weeks

This highly innovative business planning module uses a "reality teaching and learning" approach. Students are given a real commercial problem provided by real customers. They are asked to apply their engineering knowledge to solve the problem and write a financially and commercially viable business plan for it. They receive just 10% to 15% traditional lecturing. The remainder is based on case studies and workshops, and presentations from relevant speakers such as bankers, customers, intellectual property consultants and real

entrepreneurs. The students receive support from research groups in the department and get advice from a 'real world' mentor who provides support, guidance and focus.

Both modules are delivered to students from a range of engineering subject disciplines including mechanical, civil, automatic control and electrical engineers, and occasionally some law students. The resulting interdisciplinary environment provides a valuable and enriched learning process for the students.

Why run the modules?

Engineers are the ultimate technology designers and yet commercialisation is often difficult for them to visualise. Conventional enterprise and business planning modules can seem boring and pointless particularly for Mechanical Engineering students. However, our students have the opportunity to study unconventional modules to support and encourage them to realise their technical skills in a more commercial way. Both modules have been developed by the Department of Mechanical Engineering in collaboration with the White Rose Centre for Enterprise.

What skills and abilities are enhanced and developed?

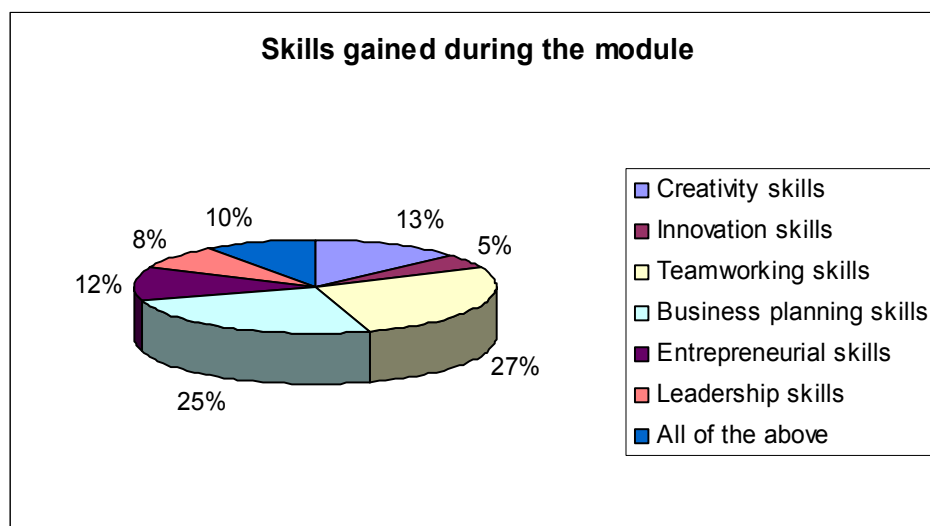
1 Enterprise and Technology Module

This first semester module in year 1 encourages the students to develop basic entrepreneurship skills such as communication skills, risk assessment and risk taking, creativity skills, basic finance and marketing, and overcoming fear of failure.

2 Business Planning Module

The module is run in the final semester of the Masters in Engineering programme. At this point students will have obtained the necessary knowledge and skills to put a business plan together. These skills include: understanding customer needs, spotting business opportunities, conducting market research, and carrying out financial analysis. The aim of the module is to bring those skills together by providing students with a real commercial problem with an actual customer. Recent studies in the Department show that the learning process is dramatically enhanced when students are faced with a real situation, with potentially real results.

The graph overleaf shows the Students' own perception of the skills acquired on the Business Planning module.



What skills and attributes do students need to embark on the modules?

The only requirement for the Enterprise and Technology module is to be open minded.

For the Business Planning module students will be expected to have acquired the necessary knowledge and skills to address marketing, financial, intellectual property, operational and entrepreneurial issues. As this module is taken by students from different engineering subject areas, backgrounds and skills levels, there is considerable emphasis on realistic scenarios, calling on the students' capacity to deal with various kinds of problems such as team working and team management.

Role of the lecturer

For both modules the lecturer is principally a facilitator and a "mentor". For the Enterprise and Technology module the lecturer guides the students through the world of the entrepreneur using quotes and pictures, and reinforces the learning process with practical exercises. For the Business Planning module most of the lectures are provided by practitioners and experts such as marketers, intellectual property lawyers, bankers, VCs, Business 'Angels' and successful entrepreneurs.

Links with outside agencies and employers

Links with outside agencies and employers are numerous and strong. These include the White Rose Centre for Enterprise (WRCE), UK Science Enterprise Centres (UKSEC), the National Council for Graduate Entrepreneurship (NCGE), the Cambridge-MIT Institute Alliance (CMI), and Business Link South Yorkshire. There are also links with business enterprises and commercial companies, and with the Higher Education Academy – Engineering Subject Centre.

How is the module assessed?

Students on the Enterprise and Technology module are required to produce a reflective portfolio using a creative format or several creative formats to illustrate what they've learned. They also required to work in groups and analyse a case study and produce a report.

For the Business Planning module student teams are required to hand in their business plans at the end of the semester. The business plans are assessed by external consultants e.g. bankers, and a panel of academics. Teams also present a poster and complete an elevator pitch (a timed presentation) for their 'company'. The assessors together with the 'customer' then decide on the best solution to emerge and the winning team receive a prize from the customer. There is also an opportunity to pursue the project further if the team and customer agree.

Issues and barriers

Both modules have been effectively embedded within the engineering curriculum and the enterprise culture in the department has reached its strongest point to date. Moreover, initial negative responses by some academic staff have now given way to positive and constructive support for the work.

With regard to the Enterprise and Technology module, it is important to recognise that whilst the end result is very positive, engineering students invariably expect to be taught in a traditional manner. It can therefore be very challenging to convince some students in the early stages of the importance and value of group work and group dynamics as vehicles for effective learning.

For the Business Planning module, it is necessary to identify and involve real customers with real commercial problems, as well as practitioners who are willing to contribute to the activities. Identifying and gaining commitment from external organisations can be very time consuming. Nevertheless, the success of the modules reflects their interest and involvement. At the same time, an increasing number of supportive academic colleagues have offered me details of potentially new external contacts.

What evidence can be provided to show if the modules were a success?

A very important success factor is that students are encouraged to reflect on their learning processes. Consequently their creativity skills seem to be strongly reinforced. There is also a rich source of positive feedback from students for both modules. To give two examples:

'This module introduced me to the business field which is something I have never been interested in but now after the business plan assignment I feel I am ready to consider building a business on my own'.

'Thank you very much for teaching me this module and making it different to the others. So that there was some variety, which gave me the chance to think differently about life and others around me'.

Reflections and future developments

An enterprise-lab has recently been launched, with space dedicated specifically to the practical learning and development of entrepreneurial skills. The E-lab is aimed at existing students, alumni, and staff interested in getting involved in the entrepreneurial world. By providing the right environment and infrastructure, as well as the right support and mentorship, we anticipate that enthusiastic members will get involved in enterprise learning, technology transfer, and/or spin outs. The space provided by the enterprise lab will certainly be a key feature of the Enterprise and Technology, and Business Planning modules.

References

Rodriguez-Falcon, Sarmiento and Ward, (2004), '*Engineers ascend the entrepreneurial trial*', International Engineering Education Conference, Wolverhampton University.

Rodriguez-Falcon, E. M., Handscombe, R. D., & Patterson, E. A., (2004), "*Developing the Entrepreneurial Engineer*", 'The Impact of Employability' Conference, University of Central Lancashire.