Integrating Entrepreneurship in Informatics Education

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Abstract

The University of Ulster places a strong emphasis on vocational education and work-based learning. Furthermore, the Faculty of Informatics has recognised achievements in technology transfer and industrial collaboration. This paper outlines how the industrial partnerships forged and experiences gained through these ventures have been utilised in the design, delivery and assessment of an undergraduate module in entrepreneurship. Different models for incorporating entrepreneurial skills will be explored including:

- Classroom based teaching, learning and assessment;

- Support for students in industrial placement through the use of a Virtual Learning Environment (WebCT);

- Development of a portfolio of professional competencies;

highlighting the merits and problems associated with each.

1. Background

The EU Enterprise Commissioner Erkki Liikanen has stated that, "Innovation is the key to competitiveness". Moreover "substantial gains from information technology will be possible in the future" [1]. According to the European Innovation Scoreboard 2001 [2], the United Kingdom generates a higher percentage of science and engineering graduates than any other European state. This is particularly significant as the UK also has one of the highest rates of participation in both tertiary education (28.1%) and life-long learning (21%). 4.2% of the workforce are now employed in the high-tech services (telecommunications and information technology including software development). In the same document, the UK is the only state reported to have a perceived strength in education. This may, in part, be attributable to new national initiatives aimed at encouraging and rewarding partnerships between universities and business, the transfer of knowledge and expertise, and the development of employment skills. Such initiatives form part of a "third mission" for higher education to run alongside those for teaching, learning and research, thus ensuring that higher education is responsive to the needs of business, including the wider community, where this will lead to wealth creation. Current activities include:-

- The Higher Education Innovation Fund (HEIF) providing funding to support large, strategic collaborative projects that increase the capability of academic institutions to respond to the needs of business and strengthen business/higher education partnerships;

- The University Challenge Fund providing seed funding to help transform university research through development of its potential business opportunities;

- Higher Education Reach-out to Business and the Community (HEROBC) Fund, developing the capability of HEIs to respond to the needs of business, by putting into practice organisational and structural arrangements to achieve their strategic aims in this area;

and

- The Science Enterprise Challenge leading to the establishment of 12 Science Enterprise Centres in universities around the UK. The Centres focus on three main areas of activity:-

  1. teaching enterprise and entrepreneurship to students;

  2. providing business with knowledge on how to support competitiveness and wealth creation and

  3. encouraging the growth of new businesses by supporting start-up and spin-out companies based on innovative ideas developed by students and staff within the institutions.

These initiatives are part of the evolution of a permanent, embedded third stream of funding to run alongside core funding for teaching, learning and research. The appointment of Business fellowships to work on a range of activities including advising businesses on new technology, monitoring entrepreneurs and helping with business plan development is another aspect of the initiative to stimulate wider higher education business networks.

Such activities provide a platform for core funding to help higher education institutions implement strategies that can contribute to economic growth and competitiveness.

2. Local issues

Northern Ireland is both geographically and economically one of the smallest regions in Europe. It is therefore vitally important to harness local talent and take advantage of graduates with fresh and visionary ideas. At the turn of the millennium, vigorous growth in the computing and telecommunications industries resulted in highly paid employment and a vibrant local economy, as Northern Ireland secured major inward investments from global organisations. However, the recent downturn in this sector has resulted in reduced employment opportunities with an increasing number of graduates attracted to establish their own small businesses. In either case those entering the work force face a broad range of challenges as they seek to develop a career plan.

The University of Ulster has, since its inception in 1985, had a strong emphasis on vocational education and work-based learning, with all undergraduate courses incorporating a compulsory 12 month industrial placement. More recently, through the introduction of the Northern Ireland Centre for Entrepreneurship (NICENT), the University now seeks to formalise teaching and training in entrepreneurial skills in all courses within the disciplines of science and engineering.

The University has been successful in attracting funding from both the University Challenge and Science Enterprise Challenge funds. These schemes are designed to help higher education institutions assist in the transformation of research into good

business and to set up Science Enterprise Centres focusing on teaching enterprise and enterpreneurship to science and technology students.

The Faculty of Informatics at the University of Ulster (which incorporates computing, mathematics and components of electrical engineering) is one of the largest producers of computing science and software engineering graduates in the UK and Ireland, offering a wide variety of undergraduate and postgraduate programmes (22 in total) to more than 3,000 students. The Faculty has a track record of success and recognised achievements in work-based learning through:

- A compulsory 12 month industrial placement for all undergraduate students;

- An advanced MSc in Work Based Learning (offered in liaison with industrial partners) providing a framework within which the work-based learning of professionally employed graduates can be both facilitated and formally accredited. By following this programme, young professionals can be encouraged to develop the skills of academic research and independent thought and analysis resulting in an attitude of self-critical evaluation, continuous professional development and lifelong learning;

- An industry based professional Doctorate of Informatics (D Inf) providing advanced training in computing science and research methods.

As the growth in the economy opens opportunities for entrepreneurs, the University of Ulster's commitment to technology and knowledge transfer provides opportunities for its students and graduates to enhance their knowledge and skills base through strategic collaborative partnerships such as:

- UUTech Ltd, an umbrella company with a remit to take a venture stake holding in start-up companies, to lease out university incubator units and manage university consultancy activities. UUTech provides an important mechanism for exploiting the innovative research activity emanating from the University's large number of internationally recognised centres of excellence;

- A history of strong participation in Teaching Company Schemes (the University hosts 1 of 18 Regional Centres throughout the UK established to support technology transfer and innovation). This scheme provides a unique and powerful combination of technology transfer and training through collaboration between the university and local industry which helps companies to develop both people and technology while making strategic advances.

The Faculty of Informatics has had active involvement in these schemes with particular involvement in:

- Technology and Software Incubator Centre, located on University Campuses which provide a "gateway" to the technological expertise and research facilities throughout the university, together with a supportive environment for new software businesses. Such businesses can attract funding and other forms of business support;

- NIKEL (Northern Ireland Knowledge Engineering Laboratory), a research and technology transfer organisation hosted by the Faculty helping companies in Northern Ireland and beyond gain competitive advantage through the application of advanced software technology;

- Jigsaw, a collaborative research project with NORTEL Networks (NI) Ltd concerned with the use of AI techniques, high performance computing and software engineering.

3. Teaching Entrepreneurial Skills

Business operations have changed as a result of competition and globalisation, with increasing emphasis being placed upon the generation and adoption of new and innovative ideas. In order to be successful in the workplace, graduates must be equipped with entrepreneurial skills necessary for new product development.

In the 1997 UK Inquiry into Higher Education [3], Lord Dearing recommended that institutions should "identify opportunities to increase the extent to which programmes help students to become familiar with work, and help them to reflect on such experience". Building on an extensive and diverse track record of entrepreneurship training, the Northern Ireland Centre for Entrepreneurship (NICENT – a joint venture of the University of Ulster and the Queen's University of Belfast funded through the Science Enterprise Challenge) is actively engaged in embedding entrepreneurship within university culture in Northern Ireland. This initiative has an important role to play in creating a feeder route between the HE sector and the business support network in Northern Ireland.

Entrepreneurship training will become a core element in all courses of study at the University of Ulster and is integral to the University's strategic plan. In the current first phase of implementation, the Faculties of Science, Engineering and Informatics have responsibility for implementing and integrating appropriate entrepreneurship training to incorporate the following learning outcomes:

1. Demonstrate innovative thinking and creativity.

2. Demonstrate knowledge of future trends in her or his subject area.

3. Identify the steps required to research a market for a business opportunity.

4. Explain the impact of intellectual property rights with respect to new idea generation and product innovation.

5. Describe the component parts of a business plan.

6. Demonstrate familiarity with the range of organisational support available to assist with new enterprise development within UU and the local community.

7. Demonstrate team building ability.

8. Identify the steps required with respect to new company set up and incorporation.

9. Identify the key sources of finance available for business start-up.

10. Communicate new ideas effectively.

11. Demonstrate familiarity with an e-learning environment.

It is clear that in addition to stimulating individual entrepreneurship, NICENT activities also have the potential to greatly enhance management and personal skills development.

The Faculty of Informatics is already a practising advocate of innovation-led enterprise in a contextual manner. Many of the NICENT learning outcomes are already well embedded in existing courses. However, against a backdrop of increasing popularity in promoting entrepreneurship, the Faculty is piloting a number of different models for incorporating and assessing entrepreneurial skills including:

- Classroom based teaching, learning and assessment;

- Support for students in industrial placement through the use of a Virtual Learning Environment (WebCT);

- Development of a portfolio of professional competencies;

The following sections highlight the merits and problems associated with each.

3.1 Classroom based teaching

On the BSc Interactive Multimedia Design, second year students study a module on "Professional Issues". In addition to dealing with professional codes of practice and ethical considerations (required for BCS accreditation) the syllabus has been modified to incorporate entrepreneurial aspects. The module is taught by in-house academics with guest speakers on specific topics associated with the commercial and industrial world.

The assessed coursework for this module involves the development and marketing of an entrepreneurial business plan in order to produce a strong case for the product developed (in this case a multimedia product designed in another module). The module uses a process-driven approach, identifying the required inputs necessary for inclusion in the completed business plan.

Practical group work helps students to develop transferable skills in time-management, project management, communication and group working. In addition students have access to communication facilities via WebCT and weekly contributions to discussions (relating to materials covered in class) form part of the overall coursework assessment. Research has shown [4] that to be effective, learning technology must be integrated within the structure and delivery of the course and implemented within an appropriate context. It is therefore imperative that the purpose of these discussions be apparent to the students; the aims and objectives should be clearly defined and the relationship between the discussions, teaching sessions and other assessed work clearly identified.

Assessment of the "Professional Issues" module is currently 50% coursework, 50% examination. From 2002/03, the module will focus more heavily on entrepreneurial skills and will be 100% coursework assessed to reflect the distinctive nature of such skills and ensure that students gain a mature perception of the societal context in which they will work. Use of WebCT will be further extended to facilitate both formative and summative assessment. Surveys carried out by Griffiths et al,[5] show conclusively that students prefer computer-based tests to paper-based methods.

Despite the success of this model, it is not always possible to integrate entrepreneurial skills into syllabi, which are already tight due to accreditation by professional bodies. Alternative strategies have been sought as follows.

3.2 Work-based learning

The development of an entrepreneurial culture among students is underpinned by work experience. In the current academic year, 304 undergraduates within the Faculty of Informatics are undertaking a twelve-month work-based learning placement. Typically students work in software production (as programmers, junior designers, test engineers, configuration managers etc.) or in the associated areas of software marketing and customer support or providing package training to small groups of managers and staff.

Students returning from industrial placement bring knowledge and expertise that enhances the teaching and learning experience of the whole class. In order to harness these experiences, the Faculty of Informatics is currently investigating possibilities for delivering an on-line distance learning module (delivered via WebCT) to support aspects of both the placement process and entrepreneurship. This has the advantage of ensuring continuing academic activity throughout placement.

Students on placement are required to maintain a log book providing a factual record of their work experience together with details of training received, regular duties and any special projects. In addition students prepare a placement report covering not only their technical role but also details relating to the management and market position of the employing organisation. Students find difficulty in preparing such reports in isolation as they have little practical knowledge of other comparable organisations.

In the current academic year WebCT has been utilised as a medium for teaching and learning and to assist team building. Using the current prototype system, students can work collaboratively to resolve issues and achieve common aims, without reducing individual responsibility. Collaboration is not easy but can provide added value in a number of areas, most notably the stimulation and motivation of students who take responsibility for planning, the generation of ideas and the resulting improved quality. In addition students have access to necessary support materials that define essential information, emphasise principles and concepts and incorporate selected publications (including case studies of industrial applications and innovation in practice) which aid understanding.

Students find the current system easy and efficient to use; they value the opportunity to communicate with peers, seek assistance with problems and share concerns. As all Informatics students are placed in IT environments any difficulties caused by accessing such a system are minimal. One constraint however, is the limited ability of students to write clearly, correctly and concisely. Students have welcomed this on-line learning environment finding it an aid to communication generally and particularly appreciate feedback from both tutors and peers. Students are motivated by feedback on their work, and regular formative feedback has been shown to have a marked improvement on students' overall performance [6]

Over the next few years, the Faculty plans to integrate further web-based activities and resources in order to more actively engage with students. On-line tutors will support groups of students and assess their performance. Such a system provides students who have a wide variety of different types of placement a more common curriculum, thus enhancing the overall placement experience. Large scale adoption of such a system will require centralised registration together with student training and induction prior to placement.

3.3 Personal Development Planning

A third model for the integration of entrepreneurial skills is a continuing audit of work throughout academic and industrial placement with the production of a portfolio based assessment. Students on the BEng Software Engineering degree course are required to maintain and develop a "student personal profile" providing documented evidence of their continued competence thus encouraging the student to take ownership of their career and its continuing development.

Such a process must be highly structured and has a substantial mentoring requirement in terms of identifying and reviewing the knowledge, skills and understanding that needs to be acquired and developed and deciding actions to be taken together with responsibilities and time-scales. This profile document starts the process of maintaining a portfolio as part of a Continuing Professional Development (CPD) programme. Students seeking membership of the British Computer Society (BCS) or other relevant professional bodies find this process useful in preparation for membership.

Following a recommendation of the National Inquiry into Higher Education[3], Progress Files are being introduced to help make the results of learning in higher education more explicit and provide the basis for a more consistent approach to recording what has been learnt. Progress Files promote the idea that being able to understand, reflect upon and plan for our own development are important life skills. They help develop and maintain a culture that values learning as a life time activity and help students to develop and equip themselves with the skills to survive and thrive in the ever changing world of employment.

A further attraction of this model for developing and assessing entrepreneurial skills, is the fact that the student profile has the potential to become integrated into the progress file and extended to lifelong learning.

4. Conclusions

There is clearly a need for well-trained entrepreneurial thinkers. The 'dot.com' market is heavily laden with recent graduates whose probability of success when embarking on entrepreneurial ventures is greatly enhanced by some underpinning university-based study of entrepreneurship.

Entrepreneurship education must combine a focus on developing a culture of entrepreneurship with the development of critical personal and team skills. All three current methods of teaching and assessment employed within the Faculty of Informatics have legitimacy – they each exhibit different strengths and measure different qualities.

In integrating entrepreneurship education, the University of Ulster and the Faculty of Informatics in particular, has exploited partnerships between the universities and local business. Such partnerships provide opportunities to disseminate knowledge from research into the community and have a further advantage in so much as industrial collaborations can significantly shape research and curriculum.

Entrepreneurial issues will continue to be integrated and further embedded into informatics curriculum in order to support student activities related to entrepreneurship and provide a means to develop these important skills.

Bibliography

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Biography

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