Incubation Centres and the Teaching of Entrepreneurship: Bridging Theory and Practice *

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Abstract

This paper argues that collaboration between Higher Education Institutions and Incubation Centres can contribute to the embedding of entrepreneurship in Science, Technology, Engineering and Mathematics (STEM) disciplines. The study aims to address the dearth of research on the teaching of entrepreneurship to non-business students, and to provide a framework to implement a proposed pedagogical approach. Enterprise Ireland has funded business incubation centres on college campuses across Ireland in order to provide a supportive environment for start-up companies. The study presented in this paper is based on the work of the Galway-Mayo Institute of Technology (GMIT) which has two Incubation Centres. The research question addressed is: How can incubation centres support the teaching of entrepreneurship to engineering undergraduate students? The theoretical framework for the study is based on Donald Schön's seminal work on reflective practice. Action research - with particular emphasis on "doing action research in your own organisation" as proposed by Coghlan and Brannick – forms the basis of the methodological approach. The study makes a contribution by developing a process for collaboration between engineering students and incubation centres that can be replicated in other pedagogical situations.

Keywords: pedagogy, entrepreneurship, non-business students, incubation centres

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1. Introduction

This paper argues that collaboration between Higher Education Institutions and Incubation Centres can contribute to the embedding of entrepreneurship in Science, Technology, Engineering and Mathematics (STEM) disciplines. The study aims to address the dearth of research on the teaching of entrepreneurship to non-business students and provide a framework to implement a proposed pedagogical approach.

Enterprise Ireland has funded business incubation centres on college campuses across Ireland in order to provide a supportive environment for start-up companies. The Galway-Mayo Institute of Technology (GMIT) opened two Incubation Centres in late 2005 and mid-2006. These Innovation Centres have a twofold objective: to facilitate the emergence of new market-led and knowledge-based companies in the region and to forge strategic links between the college and the world of industry and commerce. The Centres at GMIT Mayo and Galway offer facilities and a supportive environment to potential entrepreneurs in order to assist them in taking their ideas from concept to full commercialization. The level 8 Mechanical Engineering programme in GMIT includes a “Product Design” stream which contains modules on *Creative Design*, *Industrial Design* and *Innovation and Enterprise*. For a number of years the lecturer responsible for this stream has been collaborating with the incubation centres in order to provide the students with hands-on experience of working on real-life problems. Furthermore, organizations such as Engineers Ireland are calling for graduate engineers to have more rounded skills in the areas of presentation, communication and team-working.

Drawing on Schön’s seminal work on reflective practice (Schön 1983, Schön 1990), the paper focuses on the following research question: *How can incubation centres support the teaching of entrepreneurship to engineering undergraduate students?*

The paper is structured as follows. First a background to the study in GMIT will be provided. Then the theoretical framework of reflective practice will be outlined. Following this the methodology and the research approach will be discussed. The

results of reflection by the students, the lecturer, an entrepreneur and the innovation centre managers will then be presented. A proposed framework for undertaking similar joint education and incubation centre projects is described. Finally conclusions and recommendation for future work will be proposed.

2. Background To Incubation Centres In Ireland

Enterprise Ireland is a government agency responsible for the development and growth of Irish enterprises in world markets and achieving global success (Enterprise Ireland 2015). According to its annual report, Enterprise Ireland companies achieved a record €17.1billion in export sales and created 18,033 new jobs in 2013. Furthermore pay and purchases of raw materials and services produced in Ireland accounted for over €20 billion expenditure in the Irish economy. This section will consider the rationale and vision behind the Enterprise Ireland incubation centres and, in particular, the centres in GMIT situated on both the Galway and Mayo campuses.

Incubation Centres can be defined as:

> "Incubators are places of communication and synergy, making them effective in numerous environments. They enable public and private stakeholders to gather round a common interest. They often are at the crossroads of important networks. They are also places of collective learning not only for the entrepreneurs but also for external stakeholders who come to appreciate the entrepreneurial reality better." (Albert, Bernasconi and Gaynor, 2004, as cited in Byrne, 2005: i).

Since 1997, Enterprise Ireland has invested approximately €50 million in providing incubation centres to the third-level sector, located in both Universities and Institutes of Technology. This has resulted in sixteen centres attached to Institutes of Technology, and four to the Universities. The aim is to encourage the set-up of high-tech, knowledge-intensive enterprises. Currently this translates into over 200 companies employing over one thousand people. Enterprise Ireland aims to support firms that have the ambition to become a high-potential start up (HPSU) with the prospect of growth and the capability to export. Furthermore they encourage prospective enterprises to develop a strategic relationship with the host institution. They also provide a "modern, safe and dynamic work environment" for fledgling

enterprises. However it is important to differentiate incubation centres from office rental space. Incubators provide assistance and management services that add value to their client enterprises through an array of business support mechanisms.

The establishment of the Galway and Mayo incubation centres was part of an overall strategy of building regional innovation capability through Institutes of Technology. Furthermore, the Innovation Hubs are located adjacent to the main buildings of the Galway and Mayo campuses. The impact of the incubation centres has resulted in sixteen high-potential start-ups (HPSU) and thirty three successful spin-outs. This translates to approximately €63 million being raised by client companies and the creation of over three hundred jobs. The Hubs provide start-up services and business development supports in a number of areas: financial, legal, sales and marketing, strategic planning, mentoring and networking. Furthermore assistance is provided for the development of export strategies and expertise in the provision of Intellectual Property (IP), Patenting, Copyright and Trademarks. The following section reviews the literature on the intersection of engineering education and entrepreneurship.

3. Literature Review

Gibb (2002) argues that "the time has come to discard the traditional business school model as a vehicle for the research, development and teaching of entrepreneurship" (p. 234). Indeed, the most intense debate still surrounds the question of "how should entrepreneurship be taught" (Mason and Arshed, 2013: 449). This view supports Pittaway and Cope (2007: 229), who argued that:

> "It is not possible to convey the challenge and complexities surrounding new venture creation using only conventional pedagogies such as lectures and seminars."

Mason and Arshed (p. 455) go on to propose that "real learning needs to be underpinned by experience and reflection in order for students to appreciate better the relevance of theoretical concepts". The present paper aims to address this challenge both through experiential learning and reflection.

According to Luryi *et al.* (2007), engineering programs increasingly aim to include entrepreneurship and innovation in their curricula. Interestingly, there is a considerable literature base on problem-based learning in engineering education (Perrenet et al., 2000). The focus in this type of learning is to provide the students with problem scenarios so that they can learn through a process of action and reflection. The environment of engineering, they contend, has radically changed in the last decade driven by advances in information and communications technology. Furthermore, the globalization of manufacturing and R&D (research and development) has had a significant impact on how engineers work. Among their recommendations is that engineering programs "should involve hand-on business experience based on innovating engineering projects" (Luryi *et al.,* p. T2E-15). The development of the present paper included a review of two major journals in the area of engineering education using the search word *entrepreneurship* that yielded the following results. The Journal of Engineering Education (JEE) had fourteen publications on the subject of entrepreneurship from 2001 to 2009 while the European Journal of Engineering Education (EJEE) had ten publications on entrepreneurship from 2000 to 2012. Examples from the former journal include: Ohland *et al.* (2004), which concludes that entrepreneurship programs add value to engineering students; Creed *et al.* (2002) who argued for a paradigm shift that requires the merger of classroom learning and industry participation, and Mendelson (2001) who proposes joint projects between engineering and business students. EJEE publications include studies by: Silva *et al.* (2009) who argue that teaching product development in an entrepreneurship framework promotes students skills; Papayannakis *et al.* (2008) who contend that entrepreneurship teaching should be part of a more general discussion related to educational priorities, and Casar (2000), who proposes a synergy between research and education.

The concept of business incubators or incubation programmes has been developed as a major strategy for enterprise development in both developing and developed nations since the 1990s (Basu and Biswas, 2013). In addition, an important European Commission report (2008) on entrepreneurial education concludes that "it is questionable whether Business Schools are the most appropriate place to teach

entrepreneurship: innovative and viable business ideas are more likely to arise from technical, scientific and creative studies". Furthermore the report stresses that "if it is to make a success of the Lisbon strategy for growth and employment, Europe needs to stimulate the entrepreneurial mind-sets of young people" (p. 7).

Table 1 provides a summary of some important contributions to the engineering education literature on the subject of entrepreneurship.

Table 1. A summary of relevant paper from the engineering education literature

Authors	Journal	Summary of the main argument from the paper
(Ohland et al., 2004)	JEE	Entrepreneurship programs add value to students
(Creed et al., 2002)	JEE	Paradigm Shift required: merger of classroom learning and industry participation
(Mendelson, 2001)	JEE	Proposes joint projects between engineering and business students
(Silva et al., 2009)	EJEE	Teaching product development in an entrepreneurship framework promotes students skills
(Papayannakis et al., 2008)	EJEE	Entrepreneurship teaching should be part of a more general discussion related to educational priorities
(Casar, 2000)	EJEE	Proposes a synergy between research and education

These publications support the argument of this paper that direct collaboration between an entrepreneur and students has a strong pedagogical basis. Furthermore it contributes to what Lappalainen (2011) terms the "ability for critical engagement and thought, interdisciplinary and original thinking, collaborative teamwork, and socialisation into the engineering community" (p. 513). Recently there has been a body of literature in the field of medicine on the subject of using simulation-based learning as an enhancement of problem-based learning (PBL) (Cant and Cooper, 2010, Lateef, 2010, Steadman et al., 2006). PBL had its origins in 1968 in a medical program at McMaster University in Canada, and subsequently was adopted in other disciplines such as engineering (Smith et al., 2005). This paper argues that

engineering can again find benefit from pedagogical approaches pioneered in the field of medicine. However, any review of the literature must be cognisant of the words of Cooney and Murray (2008) that the debate continues on “whether or not entrepreneurship can be taught” (p. 19). With this in mind, the work of Donald Schön offers a theoretical framework in which to position this study.

4. Theoretical Framework

Donald Schön’s (1983) publication of The Reflective Practitioner is regarded as a seminal work in the debate on the benefits of reflection for practice and research. It was followed by a more recent work that focused on the education of practitioners in the process of reflection (Schön 1990). In these books he criticises the prevailing academic epistemology as having nothing to offer either practitioners “who wish to gain a better understanding of the practical uses and limits of research-based knowledge” or scholars “who wish to take a new view of professional action”. Schön begins with the assumption that “competent practitioners usually know more than they can say” and that they exhibit “a kind of knowing in practice, most of which is tacit”. Furthermore in disciplines such as medicine, management, and engineering, his experience was that professionals were exhibiting “a new awareness of a complexity which resists the skills and techniques of traditional expertise”. Schön laments that the seeds of Positivism were firmly planted in the curricula of American universities and professional schools; a factor which he argues has contributed significantly to the contemporary fissure between research and practice. Furthermore he concludes that the present difficulty in accommodating contemporary phenomena such as “complexity, uncertainty, instability, uniqueness, and value conflict” stems from the positivist origins of technical rationality. He proposes the primacy of *problem-setting* over *problem-solving* for practitioners. Problems-setting he defines as an interactive process in which “we name the things to which we will attend and frame the context in which we will attend to them”. The perennial dilemma of rigour and relevance is presented using the analogy of a hilly landscape. He describes the “high hard ground” as the place where practitioners can effectively apply research-based theories and methods. However the important

and challenging problems exist in the “swampy lowland” of messy situations that do not respond to neat technical solutions. Furthermore according to Schön the earlier models of technical rationality have in general “failed to yield effective results” when dealing with the complex and fuzzy problems of technology management. In order to fit practice into the models of technical rationality and deal with the tension of rigour versus relevance, practitioners become “selectively inattentive” to data that do not fit neatly into their pre-defined categories. In addition, the following comment by Schön seems pertinent to the philosophical debate within the technical disciplines: “among philosophers of science no one wants any longer to be called a Positivist”. Furthermore he observes that the growing rebirth of many areas recently consigned to the positivist graveyard such as craft, artistry and myth is further evidence of the failure of the positivist program. However he is at pains to point out that his problem is not with science *per se* but on the view of science portrayed by positivism. As an antidote to technical rationality, Schön proposes reflection-in-action built on the idea of knowing-in-action which he explains as:

> “Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action.”

Furthermore, the “common sense” that reveals knowing-in-action to us also reveals that sometimes we “think about what we are doing”. Schön believes that reflection-in-action is still not generally accepted in professional practice, even by those who actually carry it out, due to the professions still being viewed solely in terms of their technical expertise. He begins to describe an epistemology of reflection-in-action that “accounts for artistry in situations of uniqueness and uncertainty” to deal with conditions where the model of technical rationality “appears as radically incomplete”. This section has outlined a theoretical framework to present the reflection of an educational practitioner on the teaching of this module. It is argued, following Schön, that the pedagogical approach requires the practitioner to offer his or her tacit knowledge to the classroom experience rather than using a formal lecturing environment. The following section outlines the methodological approach adopted in this study.

5. Methodology

Action Research (AR) originated from the work of Kurt Lewin during the 1940s and has been defined as an approach that "combines theory and practice (and researchers and practitioners) through change and reflection in an immediate problematic situation within a mutually acceptable ethical framework" (Avison et al., 1999). The application of AR has not been without controversy, particularly in debates with positivist science on the justification and generation of knowledge. These arguments were addressed by Susman and Evered (1978) in their influential description of AR as consisting of a cyclical process involving five phases: diagnosing, action planning, action taking, evaluating, and specifying learning. The focus of AR is to address real-life problems through intervention together with the research objective of making a contribution to knowledge. Coghlan and Brannick (2005) emphasise the importance of the social and academic context in which action research is carried out. This theme is echoed in the work of Bob Dick (1993) who describes action research as follows:

- *action* designed to bring about change in some community, organization or program.
- *research* to increase understanding on the part of the researcher or the client, or both – and in many cases some wider community.

Reason and Bradbury (2001) aim to "draw together some of the main threads that form the diverse practices of action research" and propose an almost lofty vision of AR contributing to the world's wellbeing and sustainability; in areas ranging from the economic and political to the psychological and spiritual. The following quotation with its emphasis on understanding and reflection is of particular relevance to this study.

So action research is about working towards practical outcomes, and also about creating new forms of understanding, since action without reflection and understanding is blind, just as theory without action is meaningless (p. 2).

The process of reflection is integral to AR and is emphasised in the literature (Avison et al., 1999, Baskerville and Myers, 2004, Coghlan and Brannick, 2005, Davison et al., 2004). Braa and Vidgen (2000) make the salient point that in the course of research, in addition to learning from the research content, there should also be learning about the process of inquiry. The latter point dovetails with the aim of this paper to provide a reflection by the researcher on the *process of reflection* in an AR study. In relation to this, Coghlan and Brannick (2005), drawing from a number of antecedent publications by authors such as Argyris and Mezirow, propose that this "reflection on reflection" results in "learning about learning". They call this process *meta-learning,* which consists of three types of critical reflection:

- **Content reflection:** this is where you think about the issues and what is happening.
- **Process Reflection:** this is where you think about strategies, procedures and how things are being done.
- **Premise reflection:** this is where you critique underlying assumptions and perspectives.

Coghlan and Brannick then superimpose these three constructs on their version of the action research cycle to develop a Meta cycle of inquiry which is shown in Figure 1 below.

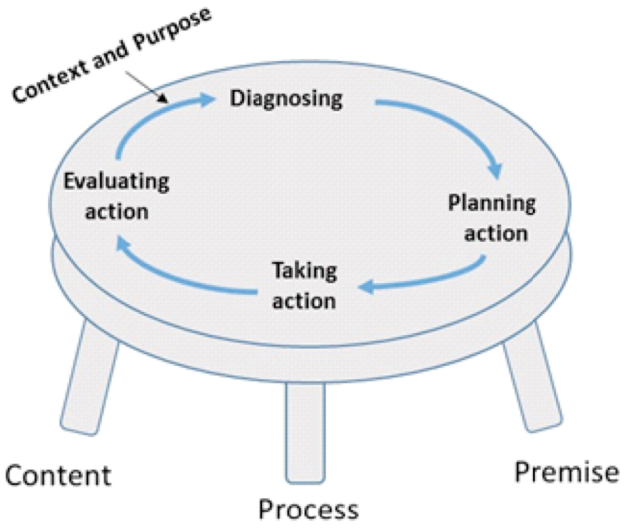

Figure 1. Meta Cycle of Inquiry – adapted from Coghlan and Brannick (2005)

In their conceptualisation:

- The Content of what is diagnosed, planned, acted-on and evaluated is studied.
- The Process of how diagnosis is undertaken, how action planning flows from that diagnosis and is conducted, how closely the implemented actions follow the stated plans and how evaluation is conducted are critical foci for inquiry.
- The Premise reflection consists of an inquiry into the un-stated, and often non-conscious, underlying assumptions which govern attitudes and behaviour.

5.1 Ethical Clearance

Data were gathered for the study by means of the students providing feedback on the module using a structured template. Twenty one students were surveyed in December 2014. Each student was asked to give or decline their assent on using the data for research purposes. Furthermore the students were given assurance that any data would be anonymous. Permission from the incubation centre entrepreneurs and managers to use the interaction for research purposes was obtained by email.

6. Findings

The analysis of the stakeholder engagement and reflection carried out in the study will now be outlined. First, the reflection by the lecturer who acted as a facilitator and mentor during the module; next, the feedback of the students who took part in the modules is presented, and finally reflective interviews with the entrepreneur and the incubation managers are detailed.

6.1 Reflection by the lecturer

The analysis of the lecturer engagement and reflection will now be presented using the taxonomy proposed by Coghlan and Brannick above.

6.2 Content Reflection – the "what"

The lecturer met with the Hub management to establish possible projects in advance of the commencement of the term. The centre administrator contacted all the companies in the Hub by email outlining the proposed format of the module and enquiring if any company would be willing to take part in the exercise. The lecturer met with the client to further explain the pedagogical approach and to clarify requirements and deliverables. This was an important stage in developing a relationship with the entrepreneur at the beginning of the three month interaction. However, it is worth stressing that work for the entrepreneur was kept at a reasonable level given the busy workload associated with the start-up of a new venture.

6.3 Process Reflection the "how"

The entrepreneur completed a short description of the design problem and sent it to the lecturer to review. This draft design brief was made available to the students via Moodle (an on-line eLearning application). The lecturer met with the class and presented an overview of the module learning outcomes and the structure of the project, as well as assessment criteria and expected project logistics. The class was then divided into project teams (three students per team) to review the draft design problem and prepare for a meeting with the entrepreneur the following week. The class project teams met the entrepreneur face-to face. The entrepreneur presented the design problem to the class verbally with more detailed description than in the design brief. This provided an opportunity for the class to get a more in-depth view of the clients thinking, and to put themselves in the entrepreneur's shoes (Leonard and Rayport, 1997). Also the project teams had time to question the entrepreneur based on their initial week long research into the problem domain. At this stage a date was set on which each project team would present their design solution to the client at the end of the semester. Also issues like Intellectual Property (IP) were discussed at this point as in some cases the students are asked to sign a non-disclosure agreement (NDA).

6.4 Premise Reflection: "reflection on the reflection"

Each week the project teams presented a status of their work to the lecturer who in this type of pedagogy acted as a coach and advisor rather than the conventional lecturing mode. The project teams worked on the design problem during the semester using academic and industry standard product design methodologies (Cooper 2001, Eppinger 2001, Ulrich and Eppinger 2004) and with reference to suitable entrepreneurship publications (Burns 2001, Drucker 1993, O'Gorman and Cunningham 2007). The project teams initially completed a detailed project plan in the form of a Gantt chart before undertaking the main task of compiling a business plan. The class project teams presented their design solutions and business plans to the entrepreneur and lecturer through an oral presentation and a project report (in the form of a business case). Distribution of marks was the responsibility of the lecturer who, however, took into account feedback from the entrepreneur on the quality and relevance of each project. The project deliverables included such items as: a set of working drawings, computer-aided design (CAD) models and/or renderings. An artefact such as a mock-up of the design in cardboard or other materials was encouraged but not mandatory. The business case covered typical areas such as industry analysis, marketing plan, supply chain plan, financial plan and assessment of risk.

This section has reflected on the process used by the lecturer to simulate a real-life entrepreneurial experience for undergraduate mechanical engineers in their final year product design stream. Now some excerpts from the feedback by the students will be presented.

6.5 Reflection by the students

Reflection and feedback from the students is built into the module review process. In the final week of the module each student was required to do an assessment of their own contribution to the project. To ensure that this study adhered to ethical standards, all students were asked for consent to use their feedback for research purposes. Now comments by a number of the students gathered during the end of

semester review process will be presented.

> *We got to meet an entrepreneur working in the real world. It was good to see how her business developed and where she plans to take it, but the real positive was to get a chance to work for her.*

Having to present their work to an actual entrepreneur outside the normal academic environment was a positive experience for the students.

> *It also gave a different level of pressure to present an idea to someone outside the class and I felt that pressure was beneficial. I would feel more confident in giving a presentation to people in the workplace after this project.*

The students specifically commented upon the interaction with the lecturer as they completed their project tasks. It is an important point that the lecturer spent many years working in product development teams in industry. Consequently he was able to place most questions in a real-world context. This involved the lecturer to take on the role as a business development manager whose main aim was not to solve the team's problems to provide direction on how they could solve their own issues.

> *There was good feedback in the weekly lab sessions where the lecturer came around and talked to each individual group about their projects and advised the groups on how to change their projects.*

Suggestions for improvement of the module format included:

> *I would have liked to have had more communication with [the entrepreneur] as it would have benefited the project further and it would have given the team a greater idea of the client's needs.*

Each team project was assessed and the same mark given to all students in a project team with 10% of the module marks for the presentation and 30% for the business plan. Project assessment criteria involved inter *alia*; the clarity of the presentation; the uniqueness of the solution; the feasibility of the solution and, as it is an engineering module, the level of technical acumen was taken into consideration.

Other factors which are taken into account include and may affect individual student's grade such as: attendance at weekly lecture/lab /team meetings; teamwork and contribution; construction of an artefact (alpha model).

6.6 Reflection by the entrepreneur

The reflection by the entrepreneur was given using a question and answer format. The author decided to present the findings in this way in order to provide the rich data given by the entrepreneur that requires little comment or explanation as it "stands on its own two feet". The entrepreneur's replies are shown in italics.

How much did you know about the module before we started?

> *I knew very little about this module before it started. The module lecturer had given me a brief overview a couple of months previously.*

In what ways do you think we need to improve?

> *I think the module could be improved by giving the students more time to do research for their business plan. During debrief, the students highlighted problems in areas of research, financial projection and costing of manufacturing. I therefore feel the students would have benefited more if they had more contact time with the Entrepreneur.*

6.7 Feedback from the Innovation Hub managers:

How does this project collaboration fit in with the strategic objectives of the Hub?

- *Very well. [It] links these students to real world projects and gets them to see what it is like to start-up an enterprise.*
- *Promoters of companies get access to GMIT students and some have resulted in part time and full time jobs.*
- *Fits with the aims of the Innovation Hubs. Our clients are often looking at developing new products and doing prototypes and testing.*

This section has presented an analysis of the action research study using the "reflective" framework proposed by Coghlan and Brannick. Now the findings of the study will be summarised in the form of a process that can be replicated.

7. Discussion and Learning

Arising from reflection by the lecturer; the students; and the incubation centre managers; the entrepreneurship module can be described in a number of steps based on the action research cycle discussed in the methodology section. This is outlined below in Figure 2. The process has been distilled from collaboration with entrepreneurs and the Hub managers over a number of years.

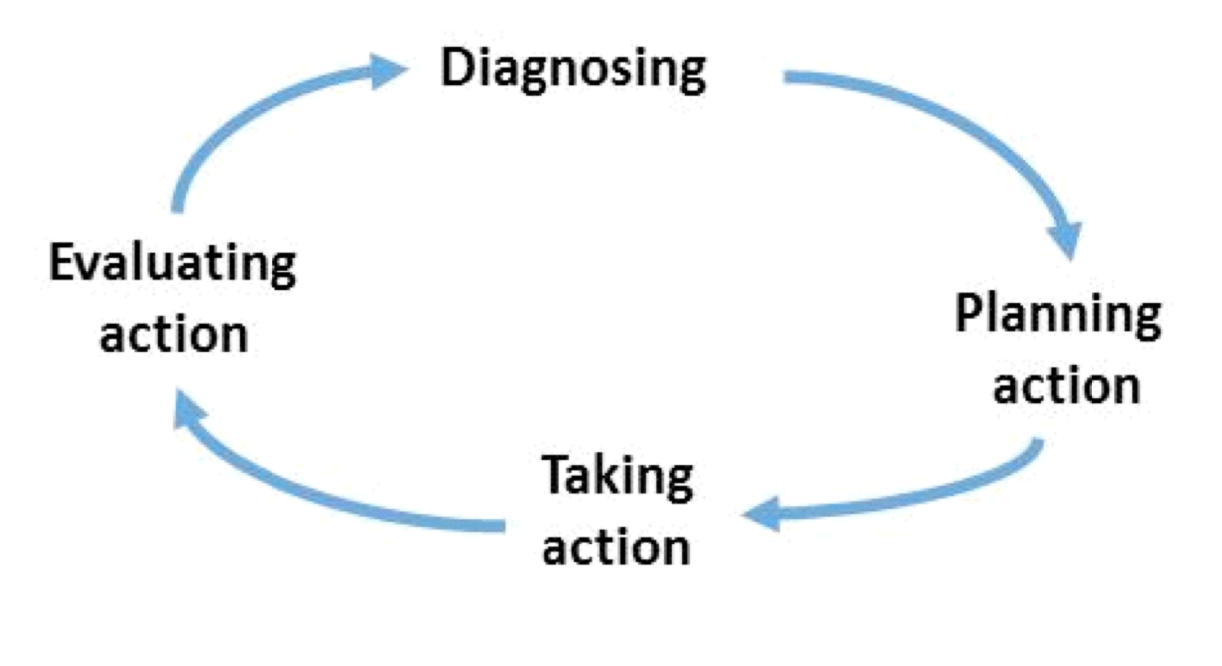

Figure 2. Action Research Cycle for Entrepreneurship Education

Table 2 outlines the summarised process that can be replicated in other similar pedagogical situations.

Table 2. Process outlining the interaction between students and incubation centre clients

Diagnosing	• Lecturer contacts the Hub management for a possible client project • Obtains a short description of the client design problem • Student project teams review design problem

	• Teams meet the client face to face for more detailed questions and information gathering
Planning	• Project teams develop a detailed project plan in the form of a Gantt chart • Teams use established business plan development methodologies • The teams present their project plans to the lecturer who now acts as a coach and project manager rather than a conventional lecturer • Project teams hold weekly meetings during class where individual students have to take responsibility for chairing the meeting and writing up minutes
Taking Action	• Project teams develop a solution to the client's problem over the duration of the semester • A business plan is completed that addresses marketing, financial, supply chain and manufacturing strategies • As this is an engineering class, the project teams are encouraged to produce an early artefact sometimes called *preto-typing* or *fake it before you make it* • Proposed design solutions are given to the client through oral presentation and a project report in the form of a business plan
Evaluating	• Each student is required to do a computer based individual assessment of *their own* contribution to the project • Items that each student are required to report on include: o research carried out o responsibilities undertaken during the project o individual significant contribution o what was particularly innovative in what he/she has done, o a development needs assessment o an indicative performance rating o a project evaluation (including recommendations for improvement)

8. Conclusions

Despite calls to leverage the competencies of campus innovation centres (MacMahon et al., 2010) there is little evidence of actual collaboration in the literature. Furthermore Mason and Arshed (2013) contend that "there is both little discussion in the literature on what experiential learning should take and a paucity of examples of experiential approaches to learning" (p. 449). This paper proposes to address these shortcomings by providing an example of experiential learning by

engineering students collaborating with incubation centres. The work makes a contribution by developing a framework for collaboration between engineering students and incubation centres that can be replicated in other pedagogical situations. Furthermore the study supports antecedent research conclusions that the most influential benefit of such programmes is that they provide inspiration for the students to pursue entrepreneurship careers (Souitaris et al., 2007). In the words of one of the students in this study:

> *It was interesting to be part of the process in developing a product that has the potential of being introduced into the real world.*

While the entrepreneurship education is mainly directed towards the small and medium sized enterprise (SME) sector, it is important to note that "the ability of employees to be innovative and 'intrapreneurial' is increasingly important in enabling large organizations to remain competitive in dynamic markets" (Cooper et al., 2005 p 12).

There are a number of limitations in this paper in that it covers a broad number of areas such as: engineering education, action learning, incubation centres and theoretical frameworks. However, attempting such a synthesis provides a contribution to what is a nascent topic in the literature.

In future work it would be interesting to explore if non-business students developed careers as entrepreneurs in a higher education incubation centre and if the resulting enterprises became spin-out companies (Clarysse et al., 2005). It is also suggested that the development of *e-cells* in the context of India is worth studying. These cells are designed to enable "easy and efficient interaction between its major components spanning students, working professionals, aspiring and existing entrepreneurs, mentors, angel investors, venture capital firms and corporates through initiatives like interactive sessions, competitions, conferences" (Mutsuddi, 2012: 62). Finally the importance of entrepreneurship education is stressed by two leading scholars in the area who have argued that the *entrepreneurial method* now requires to be studied in a similar way to the *scientific method*.

“After four decades of rigorous research into the phenomenon of entrepreneurship, we are beginning to realize that the phenomenon may hide a generalized method capable of changing the way we live, work, and play, and transforming the courses of the careers we build, the shapes of the communities we live in, and the evolution of the socio-political and economic systems we are a part of” (Sarasvathy and Venkataraman, 2011: 126).

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