Innovation Education Programs: Towards a Conceptual Framework

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Innovation Education Programs: Towards a Conceptual Framework

Abstract

Purpose - Innovation education has been identified as a key contributor to enhancing the innovative behaviour of individuals, organisations and economies; yet very little literature exists on the development and assessment of innovation education programs. This is particularly so in the higher education and vocational education domains. Our intention is to bridge this gap in the literature, by proposing a conceptual framework of a multi-dimensional innovation education program.

Design/methodology/approach - We employ a transparent and reproducible procedure and critical appraisal of the literature; coupled with emergent inquiry and case study implementation of a leading international innovation education program.

Findings - The study provides a framework by which innovation education facilitators may develop and evaluate their innovation education programs. The proposed framework provides a thematic appreciation of the multi-dimensional relationships between components.

Research limitations/implications – Limited within the context of this case study, geographical context and scant literature on innovation education programs and reproducible procedure.

Originality/value – Provides a conceptual innovation education framework, based upon a successful international innovation management program.

Keywords Innovation education, innovation education programs, innovation, entrepreneurship

Paper type Case study, conceptual paper

Introduction

A considerable literature has accumulated on the discipline of innovation and innovation management (Crossnan and Apaydin 2010; Adams et al., 2006; Ortt and van der Duin 2008); yet sparse in the area of innovation education and innovation education programs (IEPs). Even more fragmented, is literature in the domain of higher education and vocational innovation education and training (Jarvi 2012; Canen and Canen 2002). An extensive literature search has identified a distinct gap in the body of knowledge regarding the development and measurement of IEPs, and this research aims to bridge that gap. To date, no widely recognised and accepted IEP framework exists in the literature. The purpose of this paper is to develop an IEP framework, for use in vocational training and higher education settings. We define IEPs as any pedagogical program or process of education for innovation capabilities and skills, which involve personal, technical and organizational qualities; designed to empower both innovators and non-innovators with the tools necessary to undertake innovative activities (Lewrick et al, 2010).

An analytical review scheme is necessary for systematically evaluating the contribution of a given body of literature, and involves a critical appraisal of the literature (Shane 2012). Whilst apparent in the breadth of the innovation field, such review is scant in the area of IEPs. As such, we employed a transparent and reproducible procedure (Transfield et al., 2003) from the entrepreneurship discipline (Jones et al., 2012; Gregson 2013); more specifically, entrepreneurship education programs (Maritz and Brown 2013; Fayolle 2010; Edwards and Muir 2012; Matlay 2009; Rae 2010). We identified substantial synergies between the innovation and entrepreneurship literature (Lewrick et al, 2010;
Crossnan and Apaydin 2010; Shane 2012), and found using an explicit algorithm, as opposed to a heuristic, to perform a search and critical appraisal of the literature most appropriate (Transfield et al., 2013). As a result, we used the entrepreneurship education program (EEP) framework of Maritz and Brown (2013) as a base upon which to implement reproducible procedure.

Maritz and Brown (2013) developed a conceptual EEP framework through which entrepreneurship education may be evaluated and developed. Our systematic review evaluated this contribution, and applied it within an innovation education context. We then integrated the scholarly work of Donovan et al., (2013); who identified innovation training within the advanced manufacturing industry. In particular, their research involved innovation training, IEP evaluation and effectiveness and curriculum development. The EEP components identified by Maritz and Brown (2013) included context, outcomes, objectives, assessment, content, audience and pedagogy. These components were then integrated within an innovation education context, using emergent inquiry and case study approach.

The case-in-point examined an innovation education program, the joint MSc in Global Innovation Management (GIM), designed and delivered by a consortium of 4 Universities. The collaborative program was developed in the spirit of European Commission’s vision of an excellent and unified European Higher Education Area (EHEA), which aligns with the objectives of the European Consortium of Innovative Universities (ECIU) of which all program partners are members. Key to realising these objectives are the mechanisms of the Joint Degree (Friedrich, 2006). These focus on integration of regulatory and academic systems of all participating institutions to provide unique and excellent learning opportunities and highly valued joint qualifications for students. Given the variance of perspective detectable within innovation management education, for the right partnerships, the joint degree presents an opportunity to provide IEPs with the expanded perspectives sought (Yenez et. Al), for example, multi-national and multi-faculty, within a single study program.

Notably GIM was funded by the European Commission’s Erasmus Mundus program from 2008-2012. The requirements of this scholarship mechanism ensured particularly multi-national student cohorts, which further enhanced the ‘global’ learning environment and broad perspectives of innovation. The program aims to develop in participants the requisite skills and knowledge for effective technology and innovation management practices in different global regions and technology organization contexts. Such integration between EEPs and this case provided methodological sophistication as a tool for generating and testing theory (Gibbert et al., 2008).

The GIM program was developed through a collaborative process addressing Learning outcomes to be achieved as well as skills and knowledge to be attained. This approach is formalised through the EC’s EHEA framework (2005) and the national higher education frameworks of the participating institutions. This framework is widely accepted at national, institutional and academic levels as means of making academic course offerings explicit to students, academia, industry and other stakeholders.

Where evolving disciplines, such as innovation management and entrepreneurship, are required to address new specific learning and industrial challenges, identification of
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Components of Innovation Education Programs

We consider IEPs as educational programs focusing on a management process that considers ‘changes in market, technology and organisation’ in an ‘integrated’ way (Tidd & Bessant, 2011). IEPs often identify specific contexts within which to frame the ‘integrated’ process addressing specific Bodies of Knowledge emerging within innovation (Yanez et. al, 2010, Boutellier et. 2008, Doz et. al., 2012, Drucker, 1999). Such specialisations represent the perspectives and expertise of the institutions delivering the IEP (Van Wyk, 2003) and can make it challenging to develop a singular development and evaluation framework that is relevant to all IEPs. However, given the ‘integrated’ process that is common foundation of all IEPs, there appear opportunities to explore a more specific framework that could assist stakeholders in developing and evaluating programs alongside established academic course development frameworks such as those based on Learning Outcomes (Allan, 1996, Ewell, 2012).

More precisely, we define IEPs as any pedagogical program or process of training for innovation capabilities and skills, which involve personal, technical and organizational qualities; designed to empower both innovators and non-innovators with the tools necessary to undertake innovative activities (Lewrick et al, 2010). We provide an analytical review scheme from the scholarly EEP work of Maritz and Brown (2013) as a guiding reproducible procedure (Transfield et al., 2003). This study identified the following components, inherent to understanding the interrelated nature of relationships between such components: context, outcomes, objectives, audience, content, pedagogy and assessment. We apply the reproducible procedure method after an intensive literature review within an innovation-training context.

Seven components of the IEP have been identified, with relationships between components mostly reciprocal in nature. In specifying basic questions such as why (objectives), what (content), how (pedagogies), and for whom (audiences), IEPs are likely to run more effectively and efficiently, as well as being more susceptible to assessment measures, which will ideally improve programs over time (Maritz and Brown 2013). Such programs consist of various components, containing far-reaching content (O’Connor 2013; Neck and Greene 2011), designed to meet program goals (Jones 2010). We proceed with the reproducible procedure by delineating the components.

Context

A variety of contextual approaches are identified in education programs, ranging from higher education institutions (Neck and Greene 2011), training and development (Jones 2010), Vocational education (Jarvi 2012), non-business disciplines (Jones et al., 2013), international contexts (Fayolle 2010; Canen and Canen 2002), gender (Colley et al., 2003), diversity (Fayolle et al., 2006), competitive offerings (Morris 2010), culture (rae et al., 2010), organization type (Byrne 2010), outcomes (Matlay 2008; Ortt and van der Duin 2008), audience (Fayolle and Gailly 2008), student and educator diversity (Jones 2010), skills, knowledge and attitudes (Matlay 2008), type of innovation/innovator (Crossnan and Apaydin 2010), teaching methods and pedagogy (Fayolle 2010) and evaluation (Harte and Stewart 2012) to name but a few. We have provided such...
contextualization as the guiding coalition; as the first component on our conceptual framework in Figure 1.

The second component, outcomes, may well represent contextualisation in its own right (Harte and Stewart 2012), but we believe inclusion of outcomes to be integral and a distinct component of IEPs.

**Outcomes**

The terms outcomes and objectives are often integrated in education programs (Balan and Metcalfe 2012); we, however, identify these as separate components in IEPs. Objectives refer to the IEP goals, broadly described as pedagogical, social and/or economic (Fayolle 2008; Matlay 2009). Outcomes on the other hand, refer to the actions and activities of participants after intervention in IEPs (Jones 2010). Matlay (2008) found that IEPs do not necessarily match outcomes in terms of skills and knowledge of participants, despite overall satisfaction with the outcomes in relative and absolute terms (Donovan et al., 2013). Outcomes are predominantly identified amongst: skills, knowledge and attitudes (Matlay 2008), participant careers (Nabi and Linan 2011), self efficacy and intentionality (Douglas 2013; Volery et al., 2013), competitiveness (Jones 2010) and practical learning (Rae 2004). Student predominantly consume knowledge in the classroom, and we propose a notion of student knowledge creation (Sawyer 2006). We also place emphasis on the importance of stakeholders regarding outcomes; particularly the influence they may have on such outcomes (Matlay 2009).

The next section on IEP objectives provides a robust discussion leading from outcomes.

**Objectives**

Often regarded as one of the first steps in innovation training, objectives lead to improved design and evaluation of such programs (Maritz and Brown 2013). Objectives of IEPs may be defined into general groupings: pedagogical, social and economic (Fayolle 2010; Matlay 2009). Pedagogical IEP goals help potential innovators learn about innovation and innovation management (Lewrick et al., 2010). Social goals may include innovations in sustainable ventures and activities, and economic goals may include innovation as a critical source of competitive advantage, enhancing capabilities for sustainable growth, economic activity and the wealth of nations (Crossnan and Apaydin 2010; O’Connor 2013). In this context, we see innovation as the production, adoption, assimilation and exploitation of value-added novelty in economic and social spheres; a key factor for competitiveness and growth (Crossnan and Apaydin 2010; Lewrick et al 2010).

We now explore the diversified stakeholders of IEPs.

**Audience**

Audience and stakeholders are usually inter-related in IEPs, and we take cognisance that the student is not the only stakeholder in the education process. Matlay (2009) identifies primary, secondary and tertiary stakeholders, capturing the heterogeneity of all stakeholders (Penaluna et al., 2012). Understanding the demands of the audience has a direct effect and influence on the objectives of the program (Fayolle and Gailly 2008). Jones (2010) identified the context from the perspective of student/participant and
educator/trainer diversity. Despite diversity and heterogeneity of audience, objectives and audience should be linked to one another (Maritz and Brown 2013). The content of the IEP should be designed to meet audience and objectives of the program, discussed hereafter.

Content

Depending on the objectives of the IEP, content will be delivered to a defined audience to achieve such objectives and outcomes. Due to the extant nature of innovation, content may vary substantially between programs (Lewrick et al., 2010). Such typology of innovation is identified across process, product and relational innovations (Zhaou 2005; Ortt and van der Duin 2008). He further identifies sub-types, including radical, incremental, disruptive, continuous, open, technological and frugal to name but a few.

O’Sullivan (2003) identified content around the innovation process, topics included: systems design, systems theory and engineering, knowledge management, innovation management, sociotechnical systems design, strategic planning, quality function deployment, project portfolio management, project teams and workgroups, enterprise modeling, product design and creativity and ideas generation. Johnson (2001) provided specific inputs for innovation education and training, including: R&D product development, new usage of established product or service, changes in markets exploited, operational and logistical innovations, and business model innovation. Yanez et al. (2010) provide a technical perspective, highlighting: an accepted range of management specialties, knowledge of technology and innovation and related management procedures, and topics covering the contextual setting of management of technology and innovation. They include a process that would enable their students to develop and implement new technologies. Specific curricula include: innovation management, research and development, technology management, product development, knowledge management, technology transfer, project management, intellectual property and entrepreneurship. Management subjects are offered on an individual and elective basis.

Notwithstanding specifics and contextualization, content is generally technology based and specifically designed around technical and personal skills (prominence on the former). We next discuss the mode and method by which such content is delivered in IEPs.

Pedagogy

Pedagogy should be seen as a means to achieve the objectives of the program, and not as an end in themselves (Fayolle and Gailly 2008). Pedagogical initiatives are far reaching in innovation education (Lewrick et al., 2010), and may include formal and informal approaches (Fayolle 2010). Matlay (2008) identifies pedagogical initiatives based upon outcomes, whereas Balan and Metcalfe (2012) postulate that despite the particular pedagogy, student engagement remains paramount in education programs. Scholars place emphasis on the theoretical underpinnings of pedagogy (Rae 2004), including network theory and resource-based view (Ireland et al., 2005), practice based view (Crossnan and Apaydin 2010) and knowledge management (Adams et al., 2006). It is important to emphasize that theoretical content does not necessarily lead to more “traditional” teaching methods (such as lectures), and, similarly, practical content is not always taught with more experimental methods (such as business simulations)(Maritz and Brown 2013).
Traditional pedagogy includes: lectures, seminars, workshops, case studies, teamwork, group work, guest speakers and interviews with innovators (Fayolle 2010; Canen and Canen 2002). Less traditional pedagogy includes experiential learning, action learning, simulation, blended-learning and online techniques (Pittaway and Cope 2007; Maritz et al., 2011). Due to competence-based education (Biermans et al., 2012), many scholars believe innovation education necessitates a custom designed pedagogy approach (Jossberger et al., 2010; Jarvi 2012). In particular, Avis (2012) relates to the ambiguities and challenges of learning in innovation and the knowledge economy, placing emphasis on transformation, innovation and capital. This resonates well with the notion of employing pedagogical initiatives based upon program objectives. Assessment of programs always takes cognizance of pedagogy, and we discuss the final component of the IEP in the following section.

Assessment

Since innovation is both process and outcome (Crossnan and Apaydin 2010; Shane 2012), it makes sense that assessment should be all embracing to capture process and outcome. It is important that the individual components of an IEP add value to the entire program, and when viewed as an integrated whole, the components show their influence on one another. Assessment is influenced by stakeholder involvement (Matlay 2009), yet we need to differentiate between the terms assessment and student evaluation. Assessment of IEPs refers to the overall measurement of effectiveness of programs (Jones 2010); whereas assessment of student learning refers to methods of evaluating individual student competencies and understanding of content by way of assessment items such as assignments (Maritz et al., 2011). This study places emphasis on the former; due to the pragmatic and practice-based outcomes of IEPs (Rae 2004).

Assessment is driven by program objectives, content and pedagogies. Assessment is at various critical points throughout the program, differentiated by short and long term assessment. The most challenging of assessment criteria is that of contextualization (Maritz and Brown 2013), and assessment of programs has proven one of the most challenging components of education programs (Fayolle 2010; Jones et al., 2012; Matlay 2010). This research provides a framework, whereby IEPs may be evaluated.

The Global Innovation Management Program

The MSc. In Global Innovation Management (GIM) is a unique 2-year program, jointly offered by the Department of Design Manufacture and Engineering Management (DMEM) at the University of Strathclyde (UofS, Scotland), The Centre for Industrial Production at Aalborg University (AAU, Denmark), the Institute of Technology and Innovation Management at Hamburg University of Technology (TUH, Germany) and the Australian Graduate School of Entrepreneurship (AGSE) at Swinburne University of Technology (SUT, Australia). The program was first delivered in 2008, seeking to enable graduates with first degrees in engineering, science and technology to develop skills to successfully manage the innovation process across international boundaries. Students study at two different Universities, and the two-year duration of the program allows a greater depth of learning, industrial engagement and a rich cultural experience.

Program aims and objectives includes equipping students with skills to transform research outputs into innovative products and services with an emphasis on learning the soft skills
and techniques for working globally. Students are able to apply this knowledge practically, while working on industrial projects in different countries. This further enhances their understanding of international business. GIM addresses new challenges in innovative global enterprises by addressing the following: a practical and global perspective of innovation management, through industry based modules; skills applicable for larger multinational organisations to smaller enterprises; expanded perspectives of innovation management including technology management, R&D, and product/service development with focus on the interface between disciplines involved in the process; and increased research capability focused on activities at the periphery of the innovation process.

Core modules include design methods, global design, innovation management, strategic technology management, international management, supply chain management, people organization & technology, product development project, business planning, product planning, marketing for innovation. Various elective options are available at each of the international institutions.

Methodology

An interpretivism philosophical standpoint (Richardson 2012) was adopted for this research, with an inductive research approach (Samkin and Schneider 2008) to explore IEP components. We implement an analytical review scheme for systematically evaluating the contribution of the innovation and entrepreneurship literature, involving critical appraisal (Shane 2012). We employ a transparent and reproducible procedure using explicit algorithm (Transfield et al., 2003) from the entrepreneurship education discipline in particular (Maritz and Brown 2013). We then provided a case study to provide methodological sophistication as a tool for generating and testing theory (Gibbert et al., 2008), using the process of emergent inquiry (Keegan 2009).

The case-study method (Donovan et al., 2013) included semi-structured interviews, respondents consisting of the program directors or coordinator of each of the higher education partners’ of the GIM program. Semi-structured content was developed from the components of IEPs (Maxwell 2013). Pre-testing was conducted via a control group (Rampersad et al., 2010), with the qualitative data allowing discovery, exploration and theory building (Hampton et al., 2011). Data was edited and categories prepared (Marshall and Rossman 2006), with transcription for categorization and relationships between components. Manipulation of textual data was formatted to eliminate outlying and non-categorised data (Hampton et al., 2011).

Data collection was primarily online using technological media and digital communications, complemented by narratives, various electronic databases and visits between the partner institution program members. Data was centrally stored and collated by the lead investigators at Swinburne University. Respondents included program directors and innovation management staff at each of the partner universities. The research component took place between January and May 2013.

Emergent inquiry was used to describe collaborative or participative action research (Keegan 2009). In essence, this emergent process was viewed to share ongoing, iterative learning between the partner universities. The analysis involves results from semi-structured interviews and/or iterations with program leaders at each of the partner
institutions, in addition to monographs, commentaries and narratives. Emergent themes were coded to avoid replication and bias (Fisher and Reuber 2011).

Case Study Analysis

We provide data within components of context, outcomes, objectives, audience, content, pedagogy and assessment. The rationale was not to intrinsically compare the institutions against these components, but to place emphasis on the integration and applicability of innovation mode of delivery across borders and contexts. Integration of content and context (Maritz and Brown 2013) is paramount between these institutions, which is highlighted in the scholarly activity between the institutions. Learning and teaching and research leadership is personified throughout; student mobility is not the only exchange; but staff mobility has seen an abundance of integration by visiting professors and academics by the partner institutions. What follows is a brief overview of each program, post semi structured interviews. Cognizance is taken that the overall degree or award for the GIM program is a Master of Science (MSc) in Global Innovation Management, awarded as a joint degree between the applicable participating institutions. Technology and innovation management programs typically are delivered by business faculties, engineering faculties and/or specialised centres [Yanez et. al., 2010]. All three identified institution types are integrated in this consortium approach to an IEP.

University of Strathclyde

The University of Strathclyde (UofS) is an explicitly ‘technological’ university that places importance on the integration of teaching, research and knowledge exchange across faculties, disciplines and with industry. Demonstrating progress in achieving such integration is the significant investment in the Technology and Innovation Centre; a high-end hub for world-leading research collocating academics, business, industry and the public sector on the campus (UofS, 2013). The progressive institutional strategy evidenced in tangible outputs has been recognized in the Times Higher award for University of the Year in 2012.

In the context of teaching, emphasis is placed on continual curriculum renewal to effect a stimulating and challenging learning environment and the development of problem solving skills, independent and critical thinking as well as ethical practice to meet the needs of global industry.

The Department of Design Manufacture and Engineering Management (DMEM) of the Faculty of Engineering at UofS is responsible for the GIM curriculum. Fundamentally DMEM is concerned with making organisations perform better through product, process and business development. The department treats innovation management at the following levels: practical (in particular design), operational and strategic. The relevant key departmental competences are: processes including design, production, systems thinking and process excellence; technology development; business strategy; coordination and collaboration; knowledge and information management and; organisational performance. The GIM curriculum at UofS aims to address the core elements of an IEP and the specific challenges of innovation in a global context.
The arrangement of modules in the curriculum is unique to the GIM programme. Figure 2 shows the compulsory curriculum at Strathclyde in year 1. The core intention is a foundation in the Innovation Management process, and essential practical experience of working within creative globally distributed teams (Global Design Module) and with industrial clients on product/service development briefs (Group Industry Based Project). Where design is viewed as the activity which links creativity to innovation (Cox, 2005) and Design Thinking is increasing viewed as an approach within mainstream business (Dunne et. al., 2006), the curriculum seeks to introduce the IEP student to design process (Maclachlan et al., 2009).

Optional modules are then selected from a range of complementary subjects, which allow candidates, to an extent, to tailor their learning programme.

Pedagogically the department holds ‘learning-through doing’ and project based learning at its core. As well as the aforementioned project and team based modules, key features are a business simulation based project in the Management of Innovation class and an emphasis on critical analysis through the design management module.

Observed outcomes following year 1 of the programme are that:

- learning in innovation management is enhanced through a relevant business simulation, progressive topics and case studies
- Experience of synchronous and asynchronous global collaboration/coordination is consolidated
- A broadened perspective of innovation that includes the design process and associated activity, strategic technology management and operations management issues is attainable
- Students are practiced in critical thinking prior to the year 2 thesis project
- The Project based learning experience provides foundation for more immersive problem based learning in year 2 at AAU
- Project management skills are developed through in an industrial, team based context.
- Students are gain summer employment on research projects or industry internships.
- Themes from the curriculum are evident in the employment attained by graduates.

Once completing the 1st year of study, students continue to year 2 of the GIM Masters program at one of the partner institutions. Mobility routes are based on student preference and input from the program coordinators.

**Aalborg University**

The degree is offered within the Centre for Industrial Production (CIP) of the Faculty of Engineering, Technology and Medicine at AAU. In this instance, students apply skills and knowledge in an industrial internship at Aalborg, followed by finalizing their Master theses. The program is delivered in English and intended for graduates of first degrees in Engineering, Science and Technology. GIM students spend one year of full-time study at AAU by entering at the graduate diploma level at 3rd and 4th semester. The 3rd semester is allocated to gaining practical international experience, with aims including: practical
experience, analyses and reflection on educational experiences and professional practice, and to clarify the Masters thesis. This is carried out in collaboration with an industry partner. During the 4th semester, a Masters thesis is completed.

Overall, the Master of Operations and Innovation Management (OIM) is a two-year Master specialization. The OIM program is designed to develop both the theoretical understanding of international aspects of strategy, innovation and change processes, as well as international practical experience hereof in either SMEs or larger organizations. The OIM program is closely connected to the research center, Center for Industrial Production. The program has an annual uptake of approximately 35 students. Integration of the GIM program involves students undertaking an industrial internship at a Danish company to gain relevant global innovation management work experience, and to consolidate the taught content delivered at the University of Strathclyde. Each internship is designated to best reflect students’ interests within the available placements from a secured list of Danish companies.

The pedagogical approach is based on problem based learning (PBL), with close interaction between theory and practice. The program’s content is predominantly structured around global operations and innovation, including global operations development, organizational analysis and design, innovation and change management, global performance management and global implementation. Content is delivered around key knowledge, skills and competencies. Outcomes include the application of new knowledge and skills in the defined facets of innovation and operations.

**Hamburg University of Technology**

The degree is offered by the Institute of Technology and Innovation Management (TIM) of the Mechanical Engineering School at TUHH in Hamburg, Germany. TUHH has developed various academic and industry related program elements, concentrating on innovation and competitiveness. To activate this, they provide the expertise for stakeholders, namely students, scientific partner institutions and partner companies. The second GIM year at TUHH provides candidates with a truly global perspective of innovation management focused both on working on a global scale and on experience of study and industry. It provided students with an understanding of the vast differences in global approaches to innovation management depending on the context; emerging economies, transitioning economies, industrial economies, and knowledge-based economies. Various content related paradigms are offered, from front-end innovation, product development, industrial projects, to intense innovation management projects over geographical and functional borders. TUHH, in particular, use expert visiting academic scholars to provide international innovation management scenarios. TUHH has the added advantage of integrating their Institute for Marketing and Innovation, and Institute for Technology and Innovation Management to provide exceptional student outcomes in innovation management.

In essence, this phase of the GIM program looks at early and late phases of the innovation management process. It concentrates on market research for (radical) innovation, cross functional cooperation at the front end of the innovation process, managing innovation projects over geographical and functional/divisional borders and preparing the market introduction of new products and services.
Swinburne University of Technology

The Academic Ranking of World Universities, and renowned for excellence in science, technology and innovation rank Swinburne University of Technology (SUT) in the top 400 research-intensive universities. The degree is housed within the Australian Graduate School of Entrepreneurship (AGSE), Faculty of Business and Enterprise (FBE) at SUT in Melbourne, Australia. The Master of Entrepreneurship and Innovation (MEI) is a leading, internationally awarded and accredited entrepreneurship and innovation Masters by coursework degree program, and has been recognized as the leading entrepreneurship postgraduate by coursework program in the Southern hemisphere, ranking in the top 5 in the world. The program was a finalist in the 2010 United States of America Small Business and Entrepreneurship (USASBE) Global Entrepreneurship Education Awards (Global Awards 2010: Maritz and Gillen 2010; Mudge 2007). The degree is aimed at graduates from multiple disciplines who can demonstrate entrepreneurial behavior over a period of three years prior to admission. The MEI’s pedagogical approach is based on a theory for practice sake. The program places high importance on participation in networks and collaboration within teams, across business functions and organisations, and indeed across international borders. Increased levels of self-confidence and entrepreneurial efficacy, energy and motivation, inevitably drive students to pursue new opportunities and overcome greater challenges. Content is predominantly structured around entrepreneurial and innovative behavior, highlighting commercialization of high growth ventures. A particular pedagogy employed is the notion to produce new student knowledge, as opposed to traditional student knowledge consumption (Sawyer 2006). In particular, the MEI has been successful with integrating GIM students in coursework units, particularly in the discipline of applied research, in the form of a minor thesis. Over the past three years, approximately fifteen GIM students have completed the MEI program.

At SUT, GIM students develop skills in entrepreneurship and innovation, and the practice of innovation leadership. The learning goals and objectives are based around assessing new ventures and opportunities, planning and managing rapid growth, integrating interdisciplinary approaches and applying innovative solutions. Interactive modules are delivered by academics that are also practitioners in the relevant areas.

Applications

We provide a practice-based view (Rae 2010; Rae 2004) to facilitating the development of an IEP framework (see Figure 1). This is facilitated by the intensive literature review conducted, providing a transparent and reproducible procedure (Transfield et al., 2003) from the entrepreneurship discipline (Jones et al., 2013; Gregson 2013); more specifically, entrepreneurship education programs (Maritz and Brown 2013; Jones et al., 2012; Fayolle 2010; Edwards and Muir 2012; Matlay 2009; Rae 2010). We provide case study methodology (Gibbert et al., 2008), providing an in depth analysis of the Global Innovation Program. We delineate the components of the proposed IEP, based upon our case study analysis.

Context and audience

The GIM program is contextually rooted in postgraduate higher education in the discipline of innovation management. Context and audience are intrinsically integrated due to the partner institutions, student diversity and stakeholder heterogeneity. Further
diversification is in European Union funded higher education initiatives (Erasmus Mundus specific). Further integration of context is within the components to follow. From an audience perspective, student diversity and internationalization is a distinct characteristic of the program. Stakeholder heterogeneity is again emphasized, consisting of academic institutions/partner institutions, students, internship organisations, funding organisations (Erasmus Mundus specific), GIM members and networks, governments, facilitators and researchers.

**Outcomes and Objectives**

GIM equips students with skills to transform research outputs into innovative products and services. Learning the tools and techniques for working globally, students apply this knowledge practically by working on projects with industry contacts in different countries, further enhancing their understanding of international innovation business. GIM addresses new challenges in innovative global enterprise, and includes a practical and global perspective of innovation management through industry based modules, skills applicable for larger multinational organisations to smaller enterprise, expanded perspectives of innovation management including technology management, R&D, and interface between elements of the innovation process, and increased research capacity focused on activities at the periphery of the innovation process. Each partner institution has specific outcomes. Strathclyde in particular provide the theoretical base for the program, specifically from a design, engineering and new product development perspective. Aalborg and Hamburg Universities provide a global innovation management perspective, coupled with industrial internships. Swinburne University of Technology provides an entrepreneurship perspective to innovation management.

**Content and Pedagogy**

The core of the content is initially delivered to students through theoretical foundations at Strathclyde University. Such content includes innovation management, strategic technology management, design management, design methods, supply chain management, people organization and technology, product development project and global design. Optional modules are then selected from a range of design, technology and innovation subjects, including: product design techniques, enterprise resource planning, engineering risk management, systems integration, information management, sustainable product design and manufacturing, product costing and financial management, fundamentals of lean six sigma and systems thinking and modeling. Various pedagogical initiatives are used, such as experiential learning, transformation, problem-based view, practice based learning, theory-based, evidence-based, lectures, case studies, exams, role-playing, guest speakers, internship, simulation, blended learning and individual and groupwork. Further content is delivered at the partner institutions, such as entrepreneurship, technology, global innovation management and research methodology. A content and pedagogy moderator unique to the GIM program is the varying content and pedagogical initiatives across the partner institutions. Not only are innovation and entrepreneurship two different disciplines, their content and pedagogy varies significantly, often similar to inter-disciplinary business education (van Baalen and Karsten 2012).

**Assessment**
Assessment of the GIM program should be embracing to capture process and outcome. We refer to assessment of the GIM program, not assessment items to test knowledge and skills of students. Such assessment forms an integral component of pedagogy. Assessment of the GIM program includes assessment of process, outcomes, impact, behaviours of students, financial, innovation intentions, knowledge gained, return on investment and skills. Of significant and unique value, is assessment against parameters of the funding authorities. Assessment is driven by program objectives, and this component has proven to be one of the most challenging in innovation education programs.

Conclusion

Using the practice-based view (Rae 2010) we now integrate the expansive literature review and Global Innovation Management case findings to develop a conceptual framework of an IEP. The framework is multi-dimensional due to the multiple relationships and dimensions within each program component. Please refer to Figure 1, which provides a conceptual framework of an IEP.

The framework is certainly not exhaustive of all components and sub-components of IEPs, but provides an analytic review scheme of an IEP. Since such frameworks are scarce in the innovation literature, we believe this framework adds to the body of knowledge, particularly regarding the assessment of IEPs. Figure 1 also identifies the interdependencies between the various components.

This study has provided a distinct addition to the body of knowledge in the development and measurement of IEPs, bridging the gap between components and dimensions of IEPs. Such components included context, outcomes, objectives, assessment, audience, pedagogy and content; together with the inter-relatedness of the components. The study provides a framework by which innovation education facilitators may develop and evaluate their innovation education programs. The proposed framework provides a thematic appreciation of the multi-dimensional relationships between components.

Limitations of the framework are based on the transparent and reproducible procedure (Transfield et al., 2003) followed and the case of a leading innovation management provider. As such, this framework is specific to the GIM program, and it is difficult to make generalisations from a single case study (despite multiple institutions involved). Similar conceptualization is recommended for other innovation education programs. We recommend a follow-up study to empirically assess the provided IEP within the innovation education domain.

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Figure 1. A Multi-dimensional Framework of an Innovation Education Program (IEP)

**Context**
- EU, Australia
- GIM
- International
- Institutional
- Higher Education & Publics
- Education level
- Participants
- Setting

**Objectives**
- Pedagogical; social; economic
- Continuing training for innovators; education for innovative dynamism
- Partner program integration
- Become an innovator; become innovative
- Knowledge about innovation; Stimulate an innovative drive; cope with risk; skills and techniques to analyse business situations; encourage innovative activities
- Technical skills, business management skills and Personal innovative skills
- Economics (entrepreneurship; uncertainty and risk; discovery; alertness; knowledge)
- Attributes/traits (need for achievement; autonomy; confidence; judgement; determination; locus of control; self-efficacy)
- Parameters of funding authorities (Erasmus Mundus)

**Audience**
- Socio demographics
- Postgrad students
- HED participants
- Governments, Academic, Consultants
- Diversity
- GIM members and networks
- Facilitators
- Erasmus Mundus
- Intern organisations

**Outcomes**
- Skills
- Knowledge
- Attitudes
- Self efficacy
- Intentionality
- Competitiveness
- Practical learning
- Research competence

**Assessment**
- Process and outcomes
- Education impact
- Attitudes and behaviour
- Cost per participant
- Financing sought/achieved
- Future funding of program
- Growth of organisations
- Innovation intentions
- Jobs created, quality or quantity
- Knowledge gained
- Organisational innovation adoption
- Number of participants
- Perceptions
- Political (international)
- Revenue and Profitability
- Return on investment
- Self-efficacy
- Skills
- Funding authorities/institutions (EM)

**Content**
- Innovation management and process
- Resource planning
- Theory-based, practice-based, evidence-based
- Outcomes-based
- Entrepreneurship process
- Design management
- Technology management

**Pedagogy**
- Assigned readings
- Lectures
- Case studies
- Exams
- Individual or group work
- Transformation
- Internship
- Workshops and seminars
- Interviews with entrepreneurs
- Role playing
- Mentors
- Competitions
- Guest speakers
- Knowledge creation
- E-learning, online learning
- Simulation games
- Blended learning

*Source: Adapted from Maritz and Brown (2013)*