

Entrepreneurship and Innovation for Engineers: An Integrated Approach in Entrepreneurship education

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Abstract

Growth in educational programs focusing on entrepreneurship has been striking in the last decade. At the end of the 20th century, entrepreneurship programs continued to grow and gain legitimacy within the world of academics, although in many places the programs struggled to find legitimacy as a respected subject of study and research. The typical home for entrepreneurship programs has been in schools of business and/or engineering colleges. Undergraduates and graduate students studying business and undergraduates studying engineering have had increasing opportunities to study topics related to the entrepreneurial career track (as opposed to the corporate track). The entrepreneurship education they gain while in college will enable them to be flexible and agile in the workplace. What is it about entrepreneurship education in particular that helps students become leaders, innovators and creative problem-solvers? This paper aims to provide an entrepreneurship education framework using MAIR model.

Keywords: Entrepreneurship, Innovation, and Entrepreneurship education

1. Introduction

The 21st century arena is characterized by a high space and level of education, low patience and compliance with authority, close relationships with customers, and a brisk speed of market. Continued changes due to global competition, environment, technological advances, and population diversity are expected to be very rapid. Generally, entrepreneurs see change as the norm and as healthy. But, and this defines entrepreneurs and entrepreneurship-the entrepreneur always searches for changes, responds to it, and exploits it as an innovative opportunity. Innovation is the specific instrument of entrepreneurship as mention by Peter F. Druker (1993) as below;

“Innovation is the specific tool of entrepreneurs, the mean by which they exploit change as an opportunity for a different business or a different service. It is capable of being presented as a discipline, capable of being learned, capable of being practiced. Entrepreneurs need to search purposefully for the sources of innovation, the changes and their symptoms that indicate opportunities for successful innovation. And the they need to know and apply the principles of successful innovation.”

Nowadays, very important aspect concerns the orientation of graduates towards entrepreneurship and self-employment and the development of their capabilities in this respect. This issue has received prominence in many countries because of the inability to provide sufficient jobs for graduates in conventional employment sectors. This has led to the development of activities both during higher education and immediately after in respect of the process of “transfer to work”, particularly graduate transition to entrepreneurship.

The aim of the paper is to provide a framework which will allow clear choices to be made. To do this, it will seek to clarify some integrated approaches using MAIR (**M**otivation & Confidence, **A**bilities & Skills Development, **I**deas, and **R**esources) model and make distinctions between engineers, manager and entrepreneurs (see Table 1). This model has been used effectively to support engineering/business/entrepreneurship students through the business start up process. It shows the development of first idea through business creation and presents a logical developmental approach. Lastly, this paper also highlights key factors in the enterprise approach to entrepreneurship education and some challenges to the various group for the range of programmes and approaches that might be offered in Malaysia.

Table 1: Differences in work done by engineers, managers and entrepreneurs

Characteristics	Engineers	Managers	Entrepreneurs
Focus	Technical/scientific tasks	People (talent, innovation, relationship); resources(capital, knowledge, process, know-how); Projects (tasks, procedure, policy)	Vision, Desire to Create Innovate, develop and improve
Decision-Making Basis	Adequate technical information with great certainty	Fuzzy information under uncertainty(people behaviour, customer needs, market forecasts)	Imaginative, forward looking, optimistic, goal orientated, risk taking
Involvement	Perform individual assignments	Direct work of others(planning, organizing, controlling)	"Ideas people"
Work Output	Quantitative, measurable	Qualitative, less measurable, except financial results when applicable	Qualitative and Quantitative output
Effectiveness	Rely on technical expertise and personal dedication	Rely on interpersonal skills to get work done through people(motivation, delegation)	Multitasking, problems solver
Dependency	Autonomous	Interdependent with others	Development principally by on-job training and experience, high autonomy
Responsibility	Pursue one job at a time	Pursue multiple objectives concurrently	Opportunity to learn from one's own mistakes and mistakes of others through personal networks
Creativity	Technology centered	People centered (conflict resolution, problem solving, political alliance, network building)	Technology and people centred
Bottom Line	"How" (operational)	"What" and "Why" (strategic)	Both operational and strategic "How", "Who", "What" and "Why".
Concern	Will it work technically?	Will it add value (market share,	Lead changes

		financial, core technology, customer satisfaction)?	
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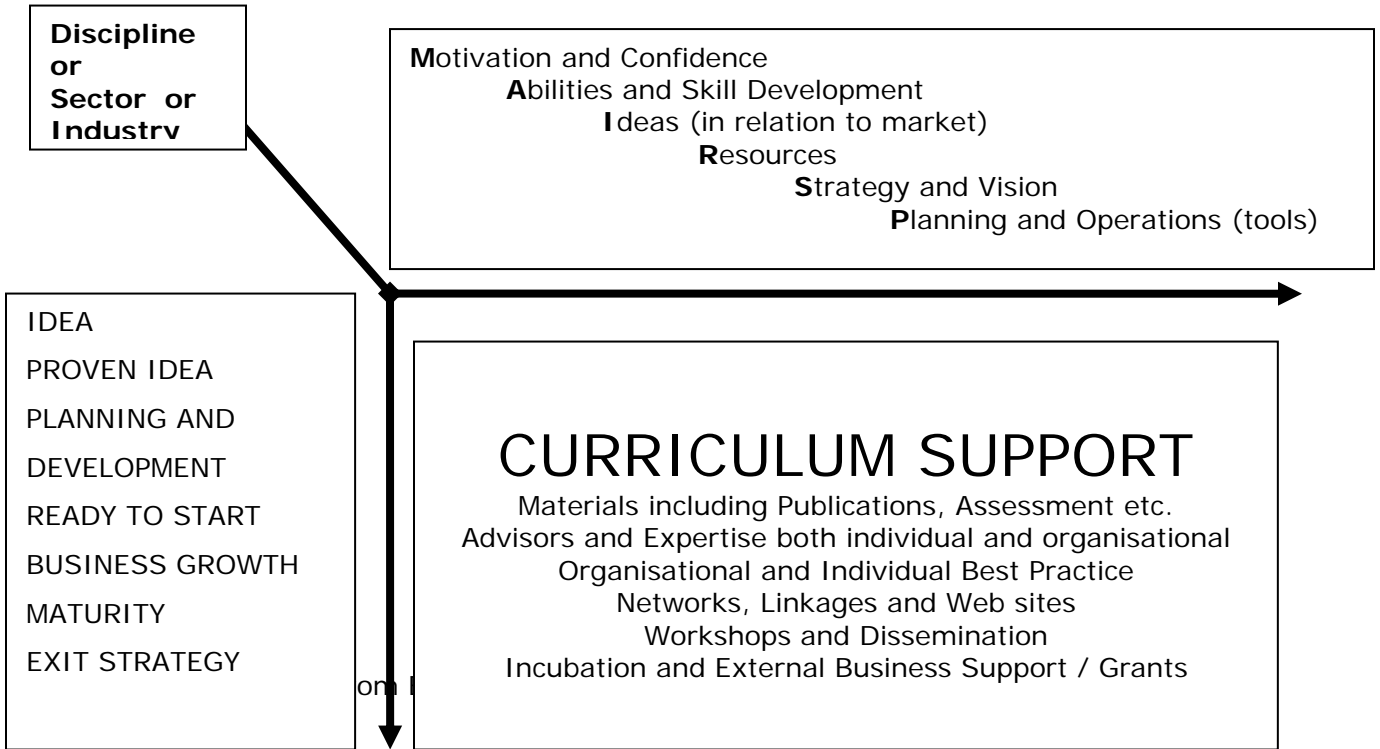
Adapted and revised from P. Morrisson, "Making Managers of Engineer." Journal of Management in Engineering, Vol. 2, No.4, 1986.

2. MAIR Model Framework

The 'MAIR model' presents the personal capacity required to start up – the knowledge, support, skills and confidence. From its origins, 'MAIR' has been adapted and developed and is now more relevant for under/graduates with limited work experience, as it includes more softer elements, such as confidence to start up, as well as the skills and knowledge of strategy and planning (See Exhibit 1). Together these models provide a phased understanding of the skills required throughout the business start up process. This understanding can then be placed in context of a discipline, sector or subject centre to develop an approach to supporting entrepreneurial skills.

These materials have been created to support enterprise learning within all subject areas. The focus has been on skill development, and to support the understanding that the creation of the business plan is not the only way to explore and assess entrepreneurial skills. By recognising the business plan as only one elements of learning, other areas of skills development, including softer skills of networking, negotiation, promoting (pitching) and motivation are recognised as the key to the business start up process. This allows students to gain confidence as they work through a range of sessions and develop the full range of personal strengths required.

Exhibit 1
 "Integrated Approach to Business Start Up"



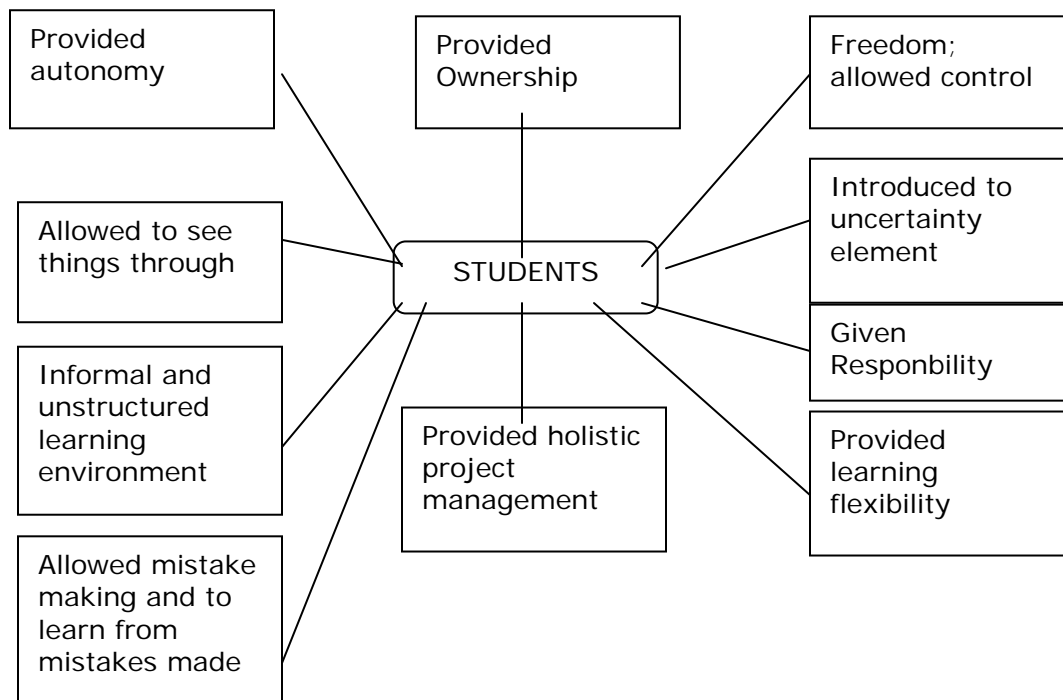
This Exhibit 1 aims to show the importance of curriculum support, yet demonstrates the other support elements which enhance this model of learning and awareness building – publications, external support, advisors etc. Curriculum development is only part of the teaching supporting package and extra support for teaching can be sought from local specialists, guest speakers and related support resources. This matrix has been deliberately designed to reduce the ‘influence’ of the ‘business plan’ – seen by many to be the start and end point of business start up. This matrix aims to reflect the journey of self development of an entrepreneur and reduce the ‘fear factor’ of the business plan through skill development (see Appendix I).

3. The Enterprise Approach to Small Business Entrepreneurship Education

The motivations, preferences and environment of owner-managers can arguably be translated into educational approach likely to develop enterprising individuals. Such an approach will embody the key components of the enterprise environment

including: ownership, freedom, autonomy, responsibility, holistic project management exposure, funding assistance, provision for learning flexibility, informal and unstructured learning environment, allowing students to make and learn from mistakes, allowing students to see through, and providing elements of uncertainty in learning tasks. This “enterprise” approach is summarized in Exhibit 2. The success of the enterprise approach to small business and entrepreneurship education depends upon linking together four key elements, namely: the learner/student, the enterprising teachers/lecturers, the enterprising learning/teaching environment, and the enterprising learning mode (Using MAIR model). The learner and the element of enterprise approach are concise in Exhibit 3.

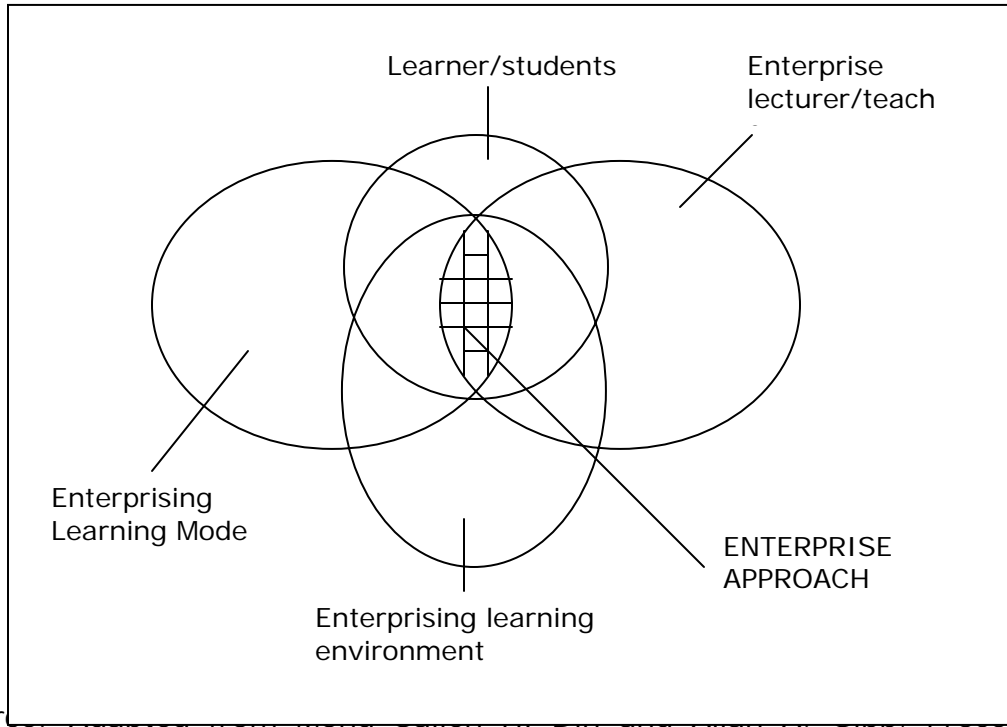
Exhibit 2
Key Factors in the Enterprise Approach to Education



Source: Adapted from Mohd Salleh Hj Din and Allan A. Gibb, Proceeding International Conference on Small and Medium Scales Enterprises, Volume 1. 1996

Exhibit 3

The Learner and the Elements of Enterprise Approach



Source: International Labour Office, *Enterprise Approach to Learning: A Guide for Small and Medium Enterprises*, 1996. Conference on Small and Medium Scales Enterprises, Volume 1.

4. Entrepreneurship Education: The Challenge to Malaysia

This paper also has auxiliary focus on the issue of motivating the graduate population especially engineering/business/entrepreneurship students to make entrepreneurship as a short and long term career strategy. It has argued that this objective cannot be achieved merely by the delivery of the programmes aimed at inculcating knowledge and skills necessary to run a business. This paper has identified the importance of creating a total approach to entrepreneurship education which has major implication for the role of the learner, the role of lecturer, curriculum designing, pedagogy, the design of the higher learning institution and their relationship with the environment, and specific model for learning chosen.

The challenge posed to the various group are summarized below:

For Students:

- To assume greater responsibility in their learning with a shift from the approach of teacher dependency to a wider role as independent learners;
- To develop the ability to diagnose their own learning needs, assess and expand their preferred learning styles;
- Learning by doing problem solving tasks from the beginning until completion giving them insights as well as knowledge through this process by carrying through the tasks;
- To continuously build up an entrepreneurial contact/network to maximize use of the wider human and material resources available outside their present network which are appropriate to their learning needs.

For Lecturer:

- To continuously revise and update the curriculum;

- To involve students in self-diagnosis of their learning needs, preferred learning styles and to help them expand their learning styles;
- To build up their own entrepreneurial network, contacts, and resources for learning/teaching;
- To have the ability to select and perform effective facilitator styles of support for learning;
- To facilitate student learning by focusing as much on the process of learning as on the subject matter;
- To help students to deal with conflicting situations and motivate them to make independent decisions and translate them into actions under conditions of stress and ambiguity;
- To themselves take opportunities to work alongside entrepreneurs, doing consultancy work for small businesses and even run their own business.

For the organizers of Higher Learning Institution:

- To allow greater involvement of small business owner-manager and members of the entrepreneurial network in the process of an enterprise approach to education, providing role images and opportunities for students as well as teachers to practise entrepreneurial attributes;
- To allow institutional setting where teachers and staff are given the opportunity to be enterprising and entrepreneurial, autonomy in teaching style, make mistakes, experiment, have flexible time-tables and learning modes, and create conditions of uncertainty;
- To improve staff awareness of, understanding of and insight into the small business start-up process;
- To develop higher education institutions that are not bureaucratic and where rewards and incentives are based on results, creativity and individual initiative to motivate teachers;

- To encourage a learning environment which is less structured and with better informal communication channels;

For the learning mode:

- To maximize the opportunity for project-based learning

5. Conclusion

This "ideal" model may demand major changes in approach and may represent a radical a shift for many institutions. MAIR model is one of the appropriate approach in teaching and learning mode, facilitating students in terms of learning by doing, gaining insight as well as knowledge through problem solving tasks from the beginning till its completion. Arguably, the long term goals of facilitating the creation of more entrepreneurially qualified young people and ultimately growth oriented entrepreneurs in Malaysia can be achieved by adopting the broad components of the MAIR approach as one of several other approaches.

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Appendix:1
Matrix of Enterprise Approach to Entrepreneurship Education

	Motivation	Abilities & Skills Dvpt	Ideas	Resources	Strategy	Planning & Operations
	Personal ¹ needs	Management skills & communication skills ²	Exit options ³	External ⁴ network	Exit options ⁵	Exit options ⁶
G. Exit Strategy	Triggers to start-up	Idea generation	Gap in the market	Resources	Emerging strategy development	Idea generation techniques
A. Idea						
	Drivers	Self Knowledge	Feasibility study	Market information	Market Segmentation	Techniques
B. Proven Idea						
	Personal motivation	Planning Skills	Market analysis	Professional Expectations	Strategy development	Business plan
C. Planning & Development						
	Personal needs	Negotiation	Communication strategy	Utilising Professional resources	Entrepreneurial Marketing	Practicalities
D. Ready to Start-Up						
	Personal needs & business needs	Management skills	Market analysis	Team Building	Strategic growth	5 year business planning
E. Business Growth						
	Need Development	Management skills	Market analysis - development	Staffing	Strategy - diversification	Benchmarking
F. Maturity						

PROSPECTIVE ENTREPRENEURS' PROFILE – A CONCEPTUAL MODEL

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ABSTRACT:

Questions as to why some people become entrepreneurs have interested researchers for Decades. Growth of engineering colleges in India is exponential. Owing to population explosion, technical institutions are bringing out large number of graduates in all faculties. Viswesvaraya Technological University, Belgaum has more than 150 technical institutions spread across the state of Karnataka. It is the responsibility of universities to measure, rank and record student's competencies and skills. It is necessary to continuously inventory students' attitudes, skills and competencies for an entrepreneurial career and build up a database of prospective entrepreneurs. The study helps for Entrepreneurship Trainer Motivators in designing competency-based curriculum for Entrepreneurship Development Programs.

This paper explains technical education scenarios in detail. Polynomial regression models have been fit for growth in number of institutions and also increase in intake and outturn. Gender, location, employment status and related issues are reviewed, emphasizing the need and importance of Continuous student research for outlining prospective entrepreneurs' profile (PEP). Review of research literature has been detailed. As a research proposal, an empirical conceptual model for determination of students' entrepreneurial personality index (SEPI) has been suggested.

Continuous student research as a soil testing exercise, well planned training program as sowing the right seed, along with conducive innovation eco system reap rich harvest in entrepreneurship culture.

KEY WORDS: Student research, Prospective entrepreneurs profile, Competency-based curriculum.