Role of entrepreneurial education in nurturing entrepreneurial orientation among engineering students

Sujiv Nair
Department of Liberal Arts, Indian Institute of Technology, Hyderabad, India

Sushmitha Sundar
Indian School of Business, Hyderabad, India, and

Ganesh Mangadu Paramasivam
Department of Entrepreneurship and Management, Indian Institute of Technology, Hyderabad, India

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Abstract

Purpose – The purpose of this paper is to understand whether entrepreneurial education imbibes entrepreneurial orientation (EO) among engineering students. The authors wanted to test whether students' performance in the Technology Entrepreneurship Programme (TEP) influences the propensity of entrepreneurial firms to hire them.

Design/methodology/approach – Data was collected from 1,296 students who were enrolled with the two-year TEP during the academic year 2016–2018 using structured questionnaires. Multinomial and Ordinary Least Squares regressions were used to examine the hypotheses.

Findings – The findings of this study suggest that superior student performance in the programme is positively correlated with the students being hired by entrepreneurial firms.

Practical implications – This study identifies aspects of EO that relates with employability. The positive relationship found between student performance in the programme and chances of getting hired insists on the need to inculcate entrepreneurial values among students at the college level. The findings will also provide valuable insights for graduate entrepreneurs, policymakers, corporates and educators on multiple dimensions for customizing EO among students during their study at college level.

Originality/value – The authors used a live intervention titled TEP as empirical context to explore how training in entrepreneurial, design and management concepts influences EO. The authors also tracked the success of the programme through actual job offers made to the participants of the programme.

Keywords Employability, Entrepreneurial orientation, Entrepreneurship, Entrepreneurial education, Technology entrepreneurship programme (TEP), Entrepreneurship programme

Paper type Research paper

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Introduction

Entrepreneurship can be defined as "a process by which individuals -either on their own or inside organizations -pursue opportunities without regard to the resources they currently control" (Stevenson and Jarillo, 1990). A surge in globalization and liberalization in recent times has increased the demand for entrepreneurial capabilities among young graduates.

The resource-based view of the firm argues that capabilities that are rare, valuable, hard to imitate and non-substitutable are important sources of competitive advantage for firms (Barney, 1991). All else equal, entrepreneurial orientation (EO), which is the ability to come up with new products and services frequently, is a source of competitive advantage that enables firms to perform better (Wales, 2016). However, the literature argues that EO is as much an individual level constructs as much as a firm-level construct (Tseng and Tseng, 2019). This is because, although EO provides competitive advantage to firms, these strategies are driven by choices and decisions made by individual actors such as managers within the firm (Felin and Foss, 2005). Therefore, EO is an important attribute managers and individuals use within a firm which is used to drive superior performance (Cho and Lee, 2018). Although the literature acknowledges the importance of EO at an individual level (Lumpkin and Dess, 1996) to our knowledge, there is very little work that examines the antecedents of EO at the personal level. In this study, by using data from a novel intervention, which sought to imbibe EO within individuals, we take an initial but a crucial first step in understanding whether EO can be taught.

Lumpkin and Dess (1996) characterize EO as "the methods, practices, and decision-making styles managers use to act entrepreneurially". In line with this idea, innovativeness, proactiveness and risk-taking propensity (Miller, 1983), in addition to competitive aggressiveness and autonomy (Lumpkin and Dess, 1996) are the five attributes that embody EO. As we will describe in detail further, our intervention is aimed at imbibing proactiveness, innovativeness, creativity and risk-taking among students. These qualities are managerial attributes that critically determine a firm's ability to come up with new products and services frequently. Innovativeness or the ability to engage in and support new ideas through experimentation and creativity may result in new products or services. However, since innovation requires risk-taking and the commitment of resources to projects (Lyon *et al.*, 2000), proactiveness or the ability to make bold actions by venturing into the unknown (Rauch *et al.*, 2009) is another critical aspect of EO.

The purpose of the paper is to understand whether entrepreneurial education imbibes EO among engineering students. We wanted to test whether students' performance in the Technology Entrepreneurship Programme (TEP) influences the propensity of entrepreneurial firms to hire them.

The theoretical background and hypotheses development

The traditional models of entrepreneurship explain the primary rationale behind EO as economical thinking and the entrepreneurial activity involves searching for a gap where one can add value or fulfil the need of the customer (Casson, 1982). These traditional approaches were also called as a causal approach, which is different from recent models such as effectuation (Sarasvathy, 2008) and bricolage models. The effectuation model suggests that uncertainty in the environment can be a strong driving force for entrepreneurial behaviour, in which the entrepreneur uses his/her personal knowledge, skills and social networks to gain control and seek new opportunities (Sarasvathy, 2008). According to the theory of entrepreneurial bricolage (Baker and Nelson, 2005), entrepreneurship involves finding answers to new problems and opportunities by applying combinations of available resources. Both these modern theories approach entrepreneurship as an effort to tackle

uncertainty and fill the gap created by newer problems/opportunities through creative use of existing resources. The TEP also aims to imbibe these skills to handle the volatile, uncertain, complex and ambiguous environment through effective and creative use of available resources.

Entrepreneurial education

According to Danish Foundation for Entrepreneurship (Moberg, 2012, p. 14) entrepreneurship education is "Content, methods and activities supporting the creation of knowledge, competencies and experiences that make it possible for students to initiate and participate in entrepreneurial value creating processes". We can understand from the definition that entrepreneurship is making use of the opportunities and ideas and converting them into something, which has financial, cultural or social value.

Anecdotal evidence suggests that education might have a positive impact on EO at an individual level (European Commission, 2012). However, whether such improvements in EO translate to better suitability to be hired by entrepreneurial firms is arguably a better measure of EO as opposed to relying on survey evidence, which attempts to measure EO using self-reported attributes. On the contrary to a survey which relies on self-reported characteristics, our data enables us to measure outcomes that are based on understanding whether superior student performance in the TEP, a unique programme that seeks to imbibe EO, affects the propensity of entrepreneurial firms to offer them employment. Past literature also suggests entrepreneurial skills can play a positive role in an individual's successful career, as organizations prefer those skills among their prospective employees (Gibb, 2002).

While the purpose and goal of entrepreneurial education may not be on enhancing employability, the literature indicates employability and entrepreneurialism as interconnected and interrelated skills. Entrepreneurial spirit, adaptability and result orientation were found to be critical in a competitive career search (Kivinen *et al.*, 2000). It often involves the identification of opportunities and taking action to make things happen (Davis *et al.*, 1991). Employers prefer graduates who have entrepreneurial skills (Laguador and Ramos, 2014). A comparative study between graduates whose course focusses on entrepreneurship and graduates who do not focus on entrepreneurship courses showed that graduates focussing on entrepreneurship were employed within organizations on a full-time basis and were more satisfied with their employment opportunities (Charney and Libecap, 2000). We also anticipate that the students who are academically bright would have more chances of getting selected for a programme on entrepreneurship. Therefore, we hypothesize that:

H1. Students with better academic performance will have significantly more chances of getting admitted in a TEP.

Entrepreneurial orientation

EO is among the most important and established concepts within the field of entrepreneurship and the domain of managerial inquiry. The central premise of EO is that an organization can be considered more (or less) entrepreneurial as a collective entity. The underlying motivation for the concept of EO is the need to theoretically separate firms based upon their entrepreneurial strategy-making processes and behaviours to facilitate scientific research into entrepreneurial phenomenon across organizations. As such, EO allows for distancing the intentions and attitudes of organizational members from the organization's overall behavioural orientation towards entrepreneurship. EO posits that all organizations

fall somewhere along a conceptual continuum ranging from conservative (the "low" end) to entrepreneurial (the "high" end). EO research has provided managers with critical insights into how firms may effectively leverage entrepreneurial strategy-making processes and behaviours to achieve important organizational goals such as growth and renewal.

As an organizational attribute, EO permeates a firm's managerial philosophies, decision-making practices and strategic behaviour (Anderson *et al.*, 2009). Entrepreneurially oriented firms support and exhibit a sustained pattern of new entry over time that is generally characterized by innovativeness, proactiveness and risk-taking (Wales, 2016).

Technology entrepreneurship

The area of technology entrepreneurship is in its nascent stage when compared to other areas such as economics, entrepreneurship and management. Technology entrepreneurship is defined as organization, management and risk bearing of a technology-based business (Nicholas and Armstrong, 2003). Other definitions are: creating a new technology-oriented venture (Jones-Evans, 1995), methods entrepreneurs use to access resources and structures to take advantage of the more unique technology opportunities (Liu *et al.*, 2005).

According to Siyanbola *et al.* (2011), the attributes that characterize technological entrepreneurship are many and they are given further. High potential opportunity is an in-depth understanding of the technology offering an edge over others in creating new value to the customers and thus be a niche player in the area. Technology-intensive opportunity is that as it is involved in the process of problem-solving, raising and safeguarding the quality of life, needing technical skills and applications, identifying the potential market and improving the quality of products to improve competitiveness of the firm with expectation of saving in process cost. Unique technology capable of driving a new business is considered important as firms can be viewed as entities which are bidding and competing for customers' purchases, and markets can be evaluated based on the extent to which the profitability of firm hinges on meeting consumers demands if possible, better than its rivals. High risk of failure is that developing new products is especially a risky business endeavour, because a technically feasible innovation might not be economically profitable and the product may not survive the commercialization process. Longer time to market refers to the uncertainty surrounding the commercial success of innovation because it is difficult to predict the time lag between the launching of a product in the market and the growth of sales because of unforeseen circumstances that could influence the demand for the product. The demand of infrastructure, facilities and resources is forcing technological entrepreneurs to face several challenges to development.

We use TEP as our empirical context to explore how training in entrepreneurial, design and management concepts influences EO. TEP is a semi-virtual programme offered by the Indian School of Business in partnership with Telangana Academy for Skill and Knowledge (TASK). TASK was established by the Government of Telangana to enhance skilling synergy between institutions of government, academia and industry. This organization's value proposition is to enable skill development for students and unemployed youth in three broad areas that include technology skills, personal skills and organization impact skills. TEP is tailored specifically to motivate and generate interest in entrepreneurship among engineering students. TEP has three primary goals at its core: firstly, to promote technology entrepreneurship as a viable career option and nurture the culture of entrepreneurship in the region, secondly, to link entrepreneurial and innovative behaviour to educational and career pathways and finally, to provide an environment/experience for engineering students to create investable technology-based start-ups.

TEP is a two-year programme that is delivered through a unique combination of offline and online components. The online courses, delivered through the internet, attempt to inculcate management and entrepreneurial concepts. The offline courses that are delivered in person aim to help students empathize and ideate and to come up with solutions to identified problems. Offline courses also help participants build prototypes to showcase the proposed solution.

The components of TEP can be broadly categorized into three areas: the first one is for courses and online modules that cover topics on product and service design, innovation management and entrepreneurship. The second area is as practicum, hands-on activity-based learning through human-centric design-thinking workshop, engineering design challenge, mentor workshops/boot-camps and industry visits. Third is a part of building their own venture, a series of boot-camps and mentor clinics, to assist students in building their venture. Additionally, classroom sessions on topics such as marketing strategy, negotiations and the management-related topics are held to prepare students be pitch ready for demo day with prospective investors.

TEP comprises coursework spread across four terms, which is offered either offline or online. The coursework in Term 1 introduces entrepreneurship. Coursework in Terms 2 and 3 provides students with deeper understanding of core managerial principles. The coursework in Term 4 is designed to provide students with a deeper understanding of entrepreneurship.

TEP seeks to provide innovative approaches to engineering education through a combination of learning, experience and mentoring. TEP gives students diverse learning opportunities through interactions with global faculty, experiential learning and industry contact. The programme also tried to recreate the classroom experience for the students through the learning management system specially created for this programme. Through the learning management system, students have access to the various modules, interact with other TEP students, faculty, discuss topics on discussion forum and solve their queries with the teaching associates through calls. In terms of expected outcomes of this programme, we anticipate this programme will not only increase the entrepreneurship orientation of the participant but also increase their chances of getting employed in a multinational organization. With this background, we hypothesize:

H2. The students' performance in TEP will have a significant positive impact on their chances of getting employed in a multinational organization.

The above-mentioned research model summarizes the hypotheses set for analysis (Figure 1). It shows that students with higher academic capabilities and performances have a better chance of getting selected in the TEP, which in turn increases their chance of getting employed in an Multi National Company (MNC).

Methodology

Our data set comprises information about 1,296 students who were enrolled with the two-year TEP during the academic year 2016–2018. We accumulated data from several data sources. First, we acquired data on a focal students' background and their prior educational

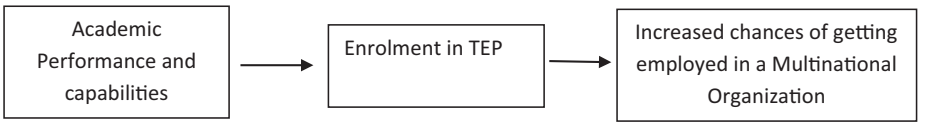

Figure 1.
Research model

performance at various levels. We also classify their backgrounds based on their home city, gender and the current city they were residing in. We measured the performance of students using the marks secured during the TEP. Finally, we also collected information on their job placements after graduating from the programme. In all, our sample comprises 1,296 student observations covering 20 colleges in the Telangana state of India, who applied to the TEP. The preponderance of applicants came from the 101 towns of the states of Andhra Pradesh and Telangana in India. The vast majority of the enrolled students were male students.

Applicants were shortlisted based on their perceived ability to benefit from the TEP. About 573 or about 44% of the applicants were admitted to the programme. Of these, we track the employment outcomes of 101 students and examine how student performance in TEP affects the propensity of entrepreneurial firms to hire these students.

We use several dependent variables in our analysis. For marks in Year 2 in natural log, our first dependent variable is the average of the total marks per subject scored in the first two semesters of engineering in natural log. We use this variable to derive insights about the student's performance prior to the entry in the TEP.

For TEP performance, our second dependent variable is the percentile marks scored by a student in the TEP. To this end, we use *TEP marks in percentile* to measure the performance of a student in TEP. As the name itself indicates, this variable denotes the total marks out of 100 that a TEP participant scores in the programme across all its components. In some specifications, we use term-wise marks once again measured in percentile to explore the mechanisms underlying our average results. In particular, as Terms 1 and 4 imbibe entrepreneurial skills, we examine if the effect of superior performance on placement is more salient for performance in Terms 1 and 4 versus those of Terms 2 and 3.

For enrolled dummy, we distinguish between students who were admitted into the TEP and those who applied to the programme but were not admitted using *enrolled dummy* = 1, if a student was admitted into the TEP. For placement variables, to measure how a student performance influences the propensity to be hired by innovative firms, we consider several measures. First, we construct *MNC* dummy = 1, if a student secured a job with a multi-national company post his/her graduation from engineering. Likewise, we construct *Large Indian Company dummy* = 1, if a student has secured a job offer in a large Indian company. We also built *Small Indian Company dummy* = 1, if the graduating student successfully obtained a placement with a small Indian company post engineering. In addition, we also construct *Higher Education* = 1, if a student has successfully enrolled in a master's programme after graduation. The residual category is a dummy variable, *start-up* = 1, if a student has not secured an employment offer yet or has started up a venture after graduation.

In our estimations, we control for several exogenous factors that might influence performance. First, we construct a dummy variable for each home city. Second, we also control for a student's performance in the intermediate school exam using intermediate marks in the natural log. Third, we control for the type of engineering college entrance exam. Finally, we also control for engineering college marks in Year 1 using the natural log of this measure, whether a student was an exceptional performer in his school using a rank dummy = 1, if the student secured a state or national rank in her school and gender.

Results

We first assess the correlation between the percentile marks acquired by the students in the TEP and his/her ex-ante performance in the engineering curriculum. In Table 1, we have also presented the descriptive statistics along with the correlation coefficients.

Table 1 shows that there is a significant positive correlation existing between the students' academic performance in the first year and second year of engineering education. The mean values of the marks show that the average marks students have scored in their first two years of the engineering education are considerably lower than their higher secondary school marks. An informal discussion with the students revealed that most of them found it difficult to cope with the engineering education initially as most of them were into it because of parental pressure.

To this end, in Table 2, we estimate an ordinary least squares with marks in Year 2 of the engineering college curriculum as a dependent variable. Specification 1 of Table 2 estimates a specification without any of the controls listed. Specification 2 of Table 2 uses all the controls listed. Given that Specification 2 is the fully specified version, we use this specification for interpretation.

Specification 2 of Table 2 suggests that among the applicants, the performance of the students that were admitted into TEP in their engineering college was systematically superior relative to those that had applied but were not granted admission. The performance differential of the admitted students relative to the applicants was about 18.4%. This suggests that the TEP in general admitted academically more qualified students. Note that it is however quite plausible that such students may not necessarily do better in their ability to develop EO. Indeed, anecdotal evidence is replete with examples of several innovators and entrepreneurs who were not the most academically accomplished in their respective student cohorts. In fact, it is quite plausible that the academically accomplished students who have the rigour may not necessarily be creative enough to be entrepreneurially oriented. We therefore examined the job market outcomes of 101 admitted students, correlated with their performance in the TEP and hence *H1* is accepted.

Controls in Specification 2 include home city, intermediate marks, Term 1 engineering marks, type of entrance exam, gender and rank.

In Table 3, we examine the link between student performance in TEP and the job market outcomes. Of specific interest is the influence of *TEP marks in percentile* on the propensity to acquire a job with a MNC or a large Indian firm. As we have explained before, these two

Variable	Mean	SD	1	2	3
Year 1 percentage marks average in college	39.723	33.076	–	–	–
Year 2 percentage marks average in college	38.59	32.19	0.994**	–	–
Higher secondary school percentage marks average	81.9	22.91	−0.122	−0.119	–
Percentile (TEP)	41.2	25.9	0.035	0.038	0.012

Note: **Significance at 0.01 level

Table 1. Descriptive statistics and relationship between the variables

Measures	Specification 1	Specification 2
Enrolled = 1	0.146** (0.068)	0.184*** (0.068)
Constant	3.044*** (0.043)	3.215*** (1.824)
Controls	N	Y
Adjusted R^2	0.003	0.218

Notes: ***Sig. at 0.01% level; ** Sig. at 0.05% level

Table 2. OLS regressions of TEP admission and student college performance (N = 1,296)

entities are relatively innovative and hence any association between performance in TEP and being placed with these entities would likely pick up how changes in a student's EO, will likely improve his chances of being hired by innovative firms. In Table 3, we implemented a multinomial logit specification with the same set of controls as in Table 2. Table 3 suggests that a percentile increase in TEP marks is associated with about a 3% increase in the odds of being placed with an MNC. Given that our sample probability that a given student is placed with a MNC is about 52%, this translates to an effective increase of about 1.5%. Stated otherwise, using sample standard deviations, a student whose performance is about one standard deviation above the mean is about 39% more likely to be placed with an MNC. Table 3 also suggests that a percentile increase in TEP marks is associated with about a 2% increase in the odds of being placed with a large Indian company. Using sample standard deviations, a student whose performance is about one standard deviation above the mean is about 4% more likely to be placed with a large Indian company. Interestingly, our results also suggest that TEP performance is associated with lower odds of not being placed or pursuing higher education by about 3% and 4%, respectively. In all, these results provide preliminary evidence that entrepreneurial education can stimulate EO simply because it increases the odds that a student who performs better in the programme can procure a job with innovative firms, in our case, with a MNC or a large Indian company. The results also support the second hypothesis we have set. Similar results were established by research conducted in developed nations as well (Bell, 2016).

Controls include home city, intermediate marks, term 1 engineering marks, type of entrance exam, gender and rank

To explore the mechanisms underlying the results, we examine the performance in each term in the TEP. Given that terms 1 and 4 imbibe core product development and entrepreneurial skills, we should expect performance in terms 1 and 4 to be more important for job market outcomes. Table 3 uses multinomial logit specification to examine the term-wise effect on job placement. Table 3 suggests that performance in term 1 and 4 was more important for the most innovative set of firms namely MNCs. To the extent that these terms imbibe core entrepreneurial skills these results provide further evidence of the positive link between performance in the TEP and EO.

Conclusions

EO, which is the ability to come up with new products and services frequently, is a source of advantage. It is an individual level construct as much as a firm-level construct. It is a crucial attribute for employees' performance (Cho and Lee, 2018). To our knowledge, there is very little work that examines the antecedents of EO at the individual level. In this study, we take an important first step in understanding whether EO can be taught using data from TEP, a novel entrepreneurial education programme, which seeks to imbibe EO within individuals.

Table 3. Multinomial regression of TEP performance on job outcomes

Variable	MNC	Not placed yet/start-up	Large	Higher education
Percentile (TEP)	0.03*** (0.01)	−0.03** (0.01)	0.02* (0.01)	−0.04* (0.03)
Constant	0.434 (0.725)	−0.403 (0.583)	−0.498 (0.563)	0.578 (0.416)
Controls	Y	Y	Y	Y
Pseudo R^2	0.11	0.22	0.09	0.22

Notes: ***Significance at 0.00% level; **significance at 0.01% level; *significance at 0.05% level

Our preliminary results suggest that superior performance in TEP is associated with a greater likelihood of acquiring a job with entities that are innovative, in our case, MNCs. Moreover, the acquisition of EO is facilitated by a selection process that picks students with a penchant for rigourous coursework as exemplified by the fact that students that are admitted into the programme are those who perform better in their respective engineering college curriculum.

One of the important practical implication of the study is the TEP itself. The programme helped the participants who are mostly from semi-urban middle-class background gain confidence and entrepreneurship orientation, which helped them get job offers from decent companies. The results also insist on the need to equip students with entrepreneurship skills. Especially it is very important for engineering graduates to gain EO to cope with the demands of the uncertain job market. As a policy implication, these insights reiterate the need for a mandatory inclusion of such subjects as part of the engineering curriculum. The finding that students with higher scores in TEP got better job placements aids support to the recent theories of entrepreneurship, which state that EO helps handle uncertain environments through effective use of available resources. This is a major theoretical implication of this study.

These results however need to be interpreted with caution for several reasons. First, our estimates are not causal. We do not account for selection biases that might hamper the validity of the results discussed in Tables 2 and 3. It is plausible that unobserved ability not captured by *TEP marks* influences both selection into the programme as well as job outcomes. One would have to conduct further econometric analysis to rule out selection that prevents these results from being causal estimates. Second, we are also constrained by the availability of job market outcomes pertaining to only a handful of students. We seek more data to validate our estimates and in particular, require job placement data on students with similar attributes who may have opted not to apply to TEP. Third, more fieldwork is required to validate these initial results and qualitatively validate the mechanisms underlying the results. In future work, we plan to roll out detailed surveys that will enable us to underlay the precise set of education-based interventions that will be useful to imbibe EO. We, nonetheless, hope that this initial analysis seeds many questions for researchers to understand the precise set of education-based interventions that can imbibe EO. The limitations of the current study also insist on the need for future studies to include other socio-cultural factors, which might influence the way entrepreneurial training influences employability and EO. This will help us understand the phenomenon holistically.

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Corresponding author
Sujiv Nair can be contacted at: la17resch01005@iith.ac.in