Determinants of Professional Excellence of Engineering Graduates - An Empirical Study

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Introduction

Indian engineering education system is one of the colossal educational systems. As per the All India Council of Technical Education (AICTE) report of 2012-13, it has 3,384 colleges admitting 1.63 Million students[1]. The system has almost no attrition and is graduating more or less the entire intake. The study of Blom and Saeki[2] shows that 64% of employers are only somewhat satisfied or worse with the current engineering graduate skills. Earlier, NASSCOM and McKinsey report (2005)[3] had found that 75% of engineering graduates are not employable by multinational companies. A recent report by Aspiring Mind found that there is a drop in employability in all roles and at all locations. It has noted that the decrease in employability is generally low from Tier 2 to Tier 3 city colleges, whereas it is high from Tier 1 to Tier 2 city colleges. (Tier 1 cities are highly commercialized metropolitan cities such as Mumbai and Delhi. Tier 2 Cities are basically smaller cities with 1 million population. They are usually regional hubs such as state capitals or industrialized centers. Some examples include Pune, Cochin and Mangalore. Tier 3 cities include minor cities such as Nasik, Baroda, Trichy, Madurai, etc. They consist of cities with a population of less than a million and are considered to be just beginning to wake up and take form.) It also found that there are at least 13,000 employable engineers in tier 3 cities, a group which gets neglected by companies simply because of their campus locations[4]. These and other students have to look out for employment on their own and require varying durations to succeed.

Our paper analyzed professional performances of such students. The analysis involved 65 students from computer engineering who graduated in 2010-11 from one of the best engineering colleges in a tier 3 city. The faculty mentor scheme at the college allowed us to assess their career journey to measure employability and on-job performance – our response variables. The paper investigates the reasons for the success by studying various explanatory variables such as academic performance, social status and non-academic performance. The Analysis of relationship between response and explanatory variables is a major contribution of the paper. The paper is organized as follows. This introduction section is followed by the background. The subsequent section discusses the experiment and is followed by the results section. The paper ends with concluding remarks.

Background

Koontz and Weihrich[5] claim that an organized enterprise does not exist in a void; it is dependent on its environment from where the inputs are being received. The enterprise then transforms the inputs into outputs. In case of educational institutes, the students who get admitted to colleges (inputs); come from different socio-economic backgrounds and have talents in different areas. The college transforms them through the process of teaching and learning, resulting in students being able to perform in professional spheres (outputs).

Hobbs[6] claims that parents' socioeconomic status - signifies parents' education, occupation and income - are linked to students' academic performance. It means, students from high socioeconomic backgrounds perform better than their counter parts from lower socioeconomic backgrounds. Considine and Zappalà[7] studied 3,000 students in Australia and found that the ‘social’ and not the ‘economic’ components of the socioeconomic status equation have more influence on educational outcomes. Felder, et al.[8] observed differences in academic performance between students from rural and small town backgrounds. McMillan and Western[9] argue that - according to the cultural capital theory - students from families closest to the academic culture have a chance of greater academic success. Gokuldas studied employability of 500 undergraduate engineers from one of the leading engineering colleges and found that non-technical education was a stronger predictor of employability than grades obtained in technical education[10]. Waychal and Dixit[11] have applied supply chain management principles to engineering education and found weaker correlation between the entrance examination and graduation performance. Roth and Clarke[12] have found that grades are useful predictors of starting as well as latter salaries earned by graduates.

Experiment

We chose a tier-3 city engineering college that is doing extremely well in academics and is facing problems in placement. It offers various courses such as Mechanical Engineering, Electronics & Telecommunication Engineering, Computer Engineering, Information Technology, Civil Engineering and Electrical Engineering. More than 50% of the student intake happens to be the first generation college learners and more than 80% belong to - the family of farmers or laborer– lower social class. Further, almost all the students’ medium of instruction in K-12 is their native language and medium of instruction in the college is English. These aspects pose significant challenges in producing employable graduates.

We chose a class of computer engineering that graduated in 2011. They had sufficient time to seek employment and perform on the job. We contacted all the 65 students of the class and sought updated information about their career journey, domicile and non-academic activities during their college days. We received data form 43 students out of which, five were not employed. Some of them had opted for higher studies and some others had decided to be full-time parents, resulting in 38 valid responses. This information along with the college records about academic performance and family background provided us the required basis to decide response and explanatory variables that are described in the next sections.

Response Variables

We chose employability and on-job performance as two response variables and have described them in the next sections.

Employability assessed students’ journey towards employment in terms of wait times, employers and starting positions and salaries. On-job performance was assessed based on their current organizations, positions, salaries and other special achievements such as performance awards. Based on the responses, five experienced faculty members with some exposure to industry rated each student (without knowing students’ names) on employability and on-job performance following the Delphi method[13] with a shortcoming. The method relied on five and not ten experts. We posited that the issue is not so complex to go for such a large number of experts. The higher rating on employability indicated quicker and better first employment and that on on-job-performance indicated better performance in terms of organization, position and salary package.

Explanatory Variables

Based on the literature survey, we chose academic performance in different examinations, domicile and social status of family, and participation and achievements in co-curricular and extra-curricular activities as explanatory variables. They are described below and tabulated in table 1.

Academic Performance

This was measured based on a set of three scores. The first was, marks at high school examination that is conducted by a state level board; the second was, marks at engineering entrance examination that is conducted by a different state level board and the third was, marks at engineering examination that is conducted by a regional university. We acquired all these marks from the college records and retained them as continuous variables. Further, we treated them independently and did not go for aggregating them to a single variable for academic performance. The reason being, all the scores are not very well correlated with each other[11]

Social Status

This has two sub-variables – place of domicile and family background. The place of domicile could be a small village, town or metro. We also considered their exposure to different domiciles due to their relations. The higher value indicated urban and lower value indicated rural domiciles. The family background ratings were derived based on their parent's educational and professional status. The higher number indicated that parents are highly educated and better employed. We did not consider financial status of the parents. We used the Delphi method for rating of individual students with the help of the same experts who rated the response variables. We retained the two variables as independent and did not aggregate them into a single social status variable.

Explanatory Variables	Details	Method used for Measurement
Academic Performance	Common Entrance Test Marks	Based on College Records.
	High School Examination Marks	Based on College Records.
	Engineering Graduation Marks	Based on College Records.
Social Status	Domicile	Delphi
	Family Background	Delphi
Non-Academic Performance	Co-Curricular Activities	Delphi
	Extra-Curricular Activities	Delphi

Table 1: Explanatory Variables

Non-academic Performance

This has two sub-variables – co-curricular activities and extra-curricular activities. The co-curricular activities essentially included computer engineering related activities that were not a part of their curriculum. They consisted of participation in technical events such as coding competition, acquiring additional qualifications such as certification in a computer language, participating in workshops and presenting papers in conferences. The extra-curricular activities had a very poor or no relation with computer engineering. They included participation in various sports activities, community services and other activities such as performing arts, fine arts and stage activities (dramatics, elocution, quiz, etc.). We used the Delphi method for rating of individual students with the help of the same experts. We retained the two variables as independent and did not aggregate them into a single non-academic performance variable.

Sr. No.	**Parameter**	**Employability**		**On Job Performance**	
		Pearson Correlation Value	**P Value**	**Pearson Correlation Value**	**P Value**
	Academic Performance				
1	CET (Common Entrance Test – for engineering admission)	0.137	0.411	0.101	0.546
2	High School Marks	0.391	0.015	0225	0.175
3	Graduation Marks	0.466	0.003	0.320	0.050
	Social Status				
4	Family Background	0.360	0.027	0.274	0.097
5	Domicile	-0.135	0.419	0.128	0.445
	Non-academic Performance				
6	Co-Curricular	0.117	0.562	0.024	0.905
7	Extra- Curricular	0.279	0.168	0.447	0.022

Table 2 :- Correlation between Explanatory and Response Variables

We found correlation between the explanatory and response variables using pearson correlation coefficient using Minitab version 17. Our null hypothesis was that the explanatory and response variables are not correlated and wherever p value was less than 0.05, we rejected those hypotheses. The result is tabulated in table 2 in which valid correlations are underlined.

The performance at the degree examination has the highest correlation (0.466) with the employability. It also has good correlation with the on-job-performance (0.32). The subject knowledge appears to be important to acquire employments and perform better therein. The performance at the high school examination and the family background are also found to be correlated with the employability. The high school performance may have helped them to do better in the screening aptitude tests and the family background may have given confidence to face interviews. The family background was also correlated with the on-job-performance. The best correlation in case of the on-job-performance was with the extra-curricular activities. The activities may have helped individuals to work better in teams - a very critical for the on-job-performance. The correlation between the co-curricular and the on-job-performance may not have been observed due to limited extent and poor quality of those activities.

Conclusion

Indian engineering education system is under 'observation' due to its huge promise, on one hand and 'employability' scare, on the other hand. While the promise is rooted in some of the amazing performances by Indian engineers and the total number of engineers that are graduating every year; the scare is rooted in the numerous studies that are casting aspersions on employability of the engineers. It is, therefore, imperative to study and analyze the employability. This paper has made an attempt to do so by setting up an experiment in an engineering college of a tier 3 city. Even though, the college has been doing extremely well in the university examinations, it has been facing problems in placement. Many students are left on their own to search jobs. The college faculty members do keep in touch with them and offer all the help. That has allowed them to gather data on their employability and on-job-performances. We have correlated those two variables with their academic performances right from high school, their social status and non-academic performances.

We found engineering degree performance having the strongest correlation with the employability and the extra-curricular activities with the on-job-performance. The family background had correlation with both the employability and on-job-performance. While the family background of students cannot be changed; their degree performance and participation in extra-curricular activities can be enhanced. All the colleges, especially, in tier 3 cities, can focus on those aspects.

The study was carried out in a department in a college. We require expanding it to other departments and even other colleges to check its broader applicability. We also require considering other locales. It would have been helpful to involve industry personnel in the Delphi expert team – especially for rating on-job-performances and co-curricular activities. It also would be worthwhile to explore relative impact of different extra-curricular activities on the professional excellence.

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