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## Careers and Trends of Engineering Graduates – A Case for Study

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### Abstract

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**Keywords:** *engineering education, employability, career vision, soft skills*

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## **Introduction**

India is a diverse country where the diversity extends to the engineering graduates across states by challenging to make good career options [2]. The States Employability report explores the employability of students from every state is below 8% of their enrolment. The concept of employability skills in any disciplines have a common purpose which is to be practiced effectively in the institutions providing higher education [DEST, 2006]. And their prior goal is to make them graduates employable with vital skill set and opting high-quality higher study opportunities. According to Mohammed. S and Md. Nor. H (2004), new and fresh engineering graduates these days confront with more ‘Challenges and Competitions’ in getting employed compared to previous graduates. A comparison of the Indian engineering colleges with some of the leading institutions shows that it is possible for institutions to have student to faculty ratio of 15:1 or more and yet maintain a significant academics and research output. Most Indian institutions are improving their research output but are below the norms attained by some of the best international institutions. Though, India has been producing a large number of competent and qualified engineers through reputed National and State Universities and Institutions like IITs, NITs, and potential for excellence institutions who have contributed to the success of many Indian companies and industries. A large number of our engineering graduates have also made an impact in the corporate world internationally. Despite these positive outcomes, a critical analysis of trends is required before we can attempt to make any recommendations for the future. As the nature of technology and industry changes, the education system needs to be responsive and adapt to the changing demands. There is a need for engineering educators to be conversant with existing practices in industry while also acting as agents to bring in innovation and improvements. The engineering institutions that were primarily set up for undergraduate teaching started emphasizing research and evolved Master’s and doctoral programs. The Ministry of Higher Education has aggressively embarked on a mission to take in students with soft skills development program in order to produce high quality human capital, knowledgeable, competitive, has the creative and innovative features and move in line with industry requirements and social needs of the country. A reengineering approach is proposed to adopt and implement to shape the career path of students through this analysis presented in this paper.

### **Challenges of employability skills in engineering graduates**

Higher education facilitators throughout the world are facing several expectations in this competitive environment. The informal deregulation and increased contest among public – private sectors are creating a more market-like environment, and influencing universities and colleges to shape themselves and compete for students (Gibbs, 2008). There are many studies focusing on institutions approaches to develop their student recruitment strategies, particularly in an Indian context. Studies on student recruitment tend to focus on student passion on selected course and soft skills with competitive advantage. Even though India produces more than five lakh engineers in the previous year, only 17.45% of them are employed for the IT services sector, while a dismal 3.51% are appropriately trained to be directly deployed on projects. Further, only 2.68% are employable in IT product companies, which require greater understanding of computer science and algorithms. The Placements in core sector is also below 4%. So 9 out of 10 of most engineers are not employable and about half of those who are employable are not recruited by the top companies just because their college isn’t in the top tier of engineering institutes. To conclude the situation, the employability percent decreases with increase in the number of engineering colleges in a particular state, clearly establishing that opening more engineering colleges shall not solve the problem of quality of engineers in the country. It is required that rather than opening more engineering colleges, the state needs to concentrate on improving education standards of current engineering colleges. However, the trouble for most education institutes still lies in enrolment and shutting down of some programs from even leading names and brands in the education sector.

### **Relation between employability and graduates’ skill**

To discuss the relation between engineering education and employability skills, the following two arguments confront the basic requirements to bond each other. Binaca K and Peter. F (2004) defined engineering as “Engineering is a profession directed towards the skilled application of a distinctive body of knowledge based on Mathematics, Science and Technology, integrated with Business and Management which is required through educational and professional formation in a particular engineering discipline. And Robinson (2000) simply defined employability skills as “those basic skills necessary for getting, keeping, and doing well on a job.” The other authors described this as the skills that can be teachable (Lorraine, 2007) and transferable (Yorke, 2006). The employability of

graduates in engineering education is a essential responsibility for the institutions to fulfill the required skill set among students but not providing employment actually. According to Kadderi Mat Desa, 2010, the entrepreneurial skills of the graduates enable to have strength and consistency to build the careers as well as creating jobs through own enterprises.

In this paper, we have four categories of the skill set required to build effective profile after graduation to attract the employers, (i) Academic excellence with Core knowledge (ii) Research and Project Development Skills (iii) Personality Development and Soft Skills, and (iv) Entrepreneurial Skills. The following attributes have identified around the categories for conduct the study and analysis.

### Case Study and Analysis

To analyze the situation for recent years the selected institution VNR Vignana Jyothi Institute of Engineering and Technology in Hyderabad under Telangana State, India, has high reputation and standing in higher platform since its inception in the year 1995. The institution is producing around 1230 graduates with the placement rate of 90% above from nearly 52 companies associated for campus placement drives. For this study, the graduates passed out in academic year 2015-16 in eight branches, Civil Engineering (CE), Electrical and Electronics Engineering (EEE), Mechanical Engineering (ME), Electronics and Communication Engineering (ECE), Computer Science Engineering (CSE), Electronics and Instrumentation Engineering (EIE), Information Technology (IT), and Automobile Engineering (AME).

#### Data Collection

For the study and analysis, sample method is used to collect the data. Primary data collected through questionnaire conducted to all the departments and classroom interactions. Secondary data represent from the institute reports of pass percentage and placements details.

#### Sample size

From the graduates of 2015-16 batches after campus selection drives, 240 samples were collected from eight branches of the institute. Among 240 graduates 140 male students and 100 female students were identified. 12% of the students are admitted through lateral entry in the second year.

#### Data Analysis

The data analyses using descriptive and inferential statistics to achieve the purpose. Descriptive statistics used to disclose patterns of numeric data and to obtain the frequency and percentage, where as inference statistics used to draw conclusions to make predictions and to see the relationship that exists between employability opportunities and skills of graduated engineers. From 240 samples different categories were identified: (i) number of eligible candidates for placements (ii) Candidates placed (iii) Graduates chosen higher studies with employment/with no employment (iv) possibilities of high package placements, (v) difficulties of getting placements from student perspective as well as institute perspective. For the results and conclusion, hypotheses frames based on questionnaire on four categories, tested and concluded with remarks and suggestions.

### Outcomes of Analysis and Discussions

Based on the analyzed data and response for questionnaire conducted for graduates from all departments, a total of 240 responses (30 graduates from each department) were collected out of which 140(60%) male and 100(40%) female. After the survey of total sample, 195 graduates out of 240 were eligible for placements with required criteria. After campus selection for the batch, 154 were employed which is 78.9% while 21.1% of the eligible graduates are still unemployed. A total of 25.8% graduates continued their studies at post graduate level. Among the graduates continued higher study 30.6% were employed and 69.4% were unemployed.

Table 1. Shows the placement and higher study status and gender

Gender	Total respondents	Eligible for placement	Employed eligible	Unemployed	Employed - Higher study	Unemployed Higher study
Male	140	106	91	49	13	24
Female	100	89	63	37	6	19
Total	240	195	154	86	19	43

The table 1 shows 63% of female and 65% male graduates employed in campus selections, still 37% of female and 35% of male graduates were unemployed. From 63% of female graduates employed, a total of 9.5% decided for higher studies and also from 37% of unemployed female graduates 51% chosen higher studies. From 65% of male graduates employed, a total of 14.2% decided for higher studies and also from 35% of unemployed male graduates 49% chosen higher studies. And the graduates around 18% who are not employed and not preferred higher studies came out from the campus, entered into the outside competition for employment. Figure 1 shows the graduates employed, unemployed and higher studies department-wise.

Table 2. Number of graduates employed, higher studies and unemployed-Branch-wise

Branch	Employed through campus selection	Higher Studies	Unemployed	Total
CE	8	12	10	30
EEE	20	6	4	30
ME	21	3	6	30
ECE	25	4	1	30
CSE	27	3	0	30
EIE	17	5	8	30
IT	28	0	2	30
AME	8	10	12	30
Total	154	43	43	240

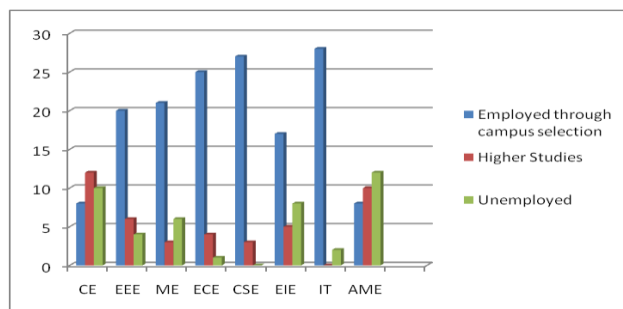


Figure 1. Comparison of graduates employed, unemployed and higher studies-Department-wise

The employability of Computer Science and Engineering and Information Technology is the highest among all the branches which is 27 and 28 out of 30 simultaneously(34%). The next higher highest percentage is recorded to the graduates from Electronics and Communication Engineering with a value of 16%. Figure 2 shows the percentage of each branch graduates placed in campus selections.

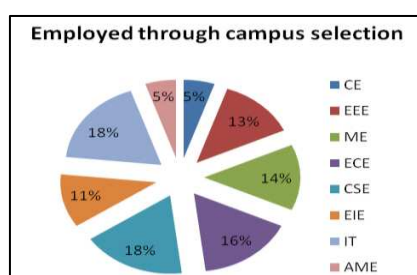


Figure 2. Percentage of graduates employed department-wise

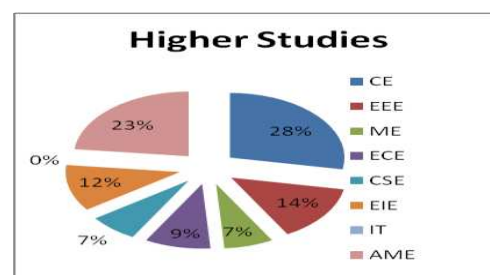


Figure 3. Percentage of graduates opted higher studies department-wise

The graduates opt for higher education is maximum from Civil Engineering among all the branches which is 12 out of 30(28%). The second highest percentage of 23% is recorded for Automobile Engineering graduates. Figure 3 shows the percentage of each branch graduates opted for higher studies. However, Automobile engineering graduates are highest number in unemployment also which is 12 graduates out of 30.

Based on the survey and analysis, 78% graduates are employed in IT Sector while 22% in core sectors. Based on the study, the objectives selected, framed hypotheses and tested in four levels: (i) graduates perception of their profiles and skills (ii) Difficulties in getting eligibility, skill set and placements, and (iii) the institute measures to step forward for good careers and placement of the graduates

### Student Profile building: Institution's support and Student perception

During the four year course, student perception is influenced by many factors, i.e. self goals, motivations by parents and teachers, institution vision and brand, society situations for career options, etc. Here student's perceptions are identified and categorized in four levels: (i) Academic excellence with Core knowledge (ii) Research and Project Development Skills (iii) Personality Development and Soft Skills, and (iv) Entrepreneurial Skills. The perceptions based on questionnaire were rated on five point Linkert scale from strongly agree to strongly disagree. The Cronbach's Alpha was computed to check consistency of set of questions and value got 0.828 which indicates that the items from a scale have good internal consistency. Table 3 shows the frequency of students perceptions on 5-point scale.

Table 3. Frequency on Graduate Perception on accomplishments for profile building through campus initiatives

No.	Categories and Perceptions	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
		f	%	f	%	f	%	f	%	f	%
1.	Academic Excellence with Core knowledge:										
a.	I am good and passionate for at least two subjects course	13	8.3	140	82.1	28	17.9	13	8.3	2	1.3
b.	I can prepare a project proposal at least one discipline	9	5.8	60	38.8	35	22.4	11	7.1	1	0.6
2.	Research and Project Development Skills:										
a.	I can use the basic knowledge of my passionate subjects for certificate courses	20	12.8	120	76.9	13	8.3	3	1.9	0	0
b.	I can publish papers on my projects	11	7.1	106	67.9	27	17.3	10	6.4	2	1.2
c.	I have acquired problem solving skills while working in our labs which are like Virtual Industries	17	10.9	105	67.3	30	19.2	3	1.9	1	0.6
3.	Personality Development and Soft Skills:										
a.	I was able to work as a team for my project and present as a team at Show and Tell Centre	23	14.7	119	76.3	11	7.1	1	0.6	2	1.2
b.	I have an eminent mentor who motivated and guided me continuously with Global Vision.	11	7.1	109	69.9	30	19.2	5	3.2	1	0.6
c.	Initiatives like, going to Finishing School, Soft skill Courses, Show and Tell Programs, enhance my ability to communicate and work with teams	25	16	97	62.1	29	18.6	4	2.6	1	0.6
d.	I have cultivated effectiveness with Covey's 7 Habits for effective Learning and Implementation	20	12.8	112	71.8	21	13.5	3	1.9	0	0
4.	Entrepreneurial Skills										
a.	I am able to identify innovation on my project which can result in a new Enterprise	7	4.5	100	64.1	44	28.2	4	2.6	1	0.6
b.	I have come to appreciate the current Global necessity for sustainability, inclusiveness. Clean Environment and Professional Ethics.	14	9	60	38.5	68	43.6	12	7.7	2	1.2

### Relationships between Graduates profile building and perceptions on their accomplishments

According to the analysis and chi square test which was chosen to see the relations, the graduates' perceptions were measured on accomplishments to building their profile effectively to have bright future with the choice among both employment and entrepreneurship. Table 3 shows the

student's perception on accomplishments is divided into four categories of skills were tested with two factors, Employability factor and Entrepreneur factor. Hence, the end part of the analysis proposed to adopt "Reengineering Process" to solve the issues of students skills set up gradation in the following proposed framework and suggesting to establish mentoring, training and incubation centres to train the students on the parameters of all-round development before leaving the campus.

Strong Academic background with Core knowledge	Research & Project Development Skills	Personality Development and Soft Skills	Entrepreneurial Skills
<ul style="list-style-type: none"> <li>• Percentage of Marks</li> <li>• Attendance</li> <li>• Laboratory Experiments</li> <li>• Core Subjects Selected</li> <li>• Knowledge of Selected Subject</li> <li>• Blended Learning through extra online and offline certificate Courses</li> </ul>	<ul style="list-style-type: none"> <li>• Basic Knowledge of Selected Subjects for Projects</li> <li>• Design of Major and Minor Project Proposals</li> <li>• Research of Project Proposals to identify innovation through gap analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Institute Environment &amp; Culture influence</li> <li>• Personal life control</li> <li>• Attitude and Hobbies</li> <li>• Mentoring and guiding</li> <li>• Language and Communication Skills</li> <li>• Reading and Writing Skills</li> </ul>	<ul style="list-style-type: none"> <li>• Working in teams</li> <li>• Active Participations on events</li> <li>• Identify Leadership qualities</li> <li>• Working on Ideas</li> <li>• Knowledge on Startups</li> <li>• Problem Solving Skills</li> <li>• Institution incubation centers support</li> </ul>

Figure 4. Parameters for graduates required skillset for all round development

Though the conclusions made on the above four parameters from the observations describes the skill categories and the metrics to achieve the skills. The following are the results of the null hypothesis and alternative hypothesis framed with the above parameters and conclusions of the four significant parameters:

1) Strong Academic Background with Core Knowledge: The null hypothesis is rejected, since  $p < 0.027$ , and a conclusion is made that good for at least two subjects during the course is associated with employability. Graduates felt that having skills on more than one subject can open up a opportunity as entrepreneur for them.

2) Research and Project Development Skills: The null hypothesis is rejected, since  $p < 0.005$ , and a conclusion is made that student can use the basic knowledge of subjects and more expertise from Certificate Courses associated within the institute as a part of course will lead them towards employability. CSE and IT students' are able to get the core jobs with skill expertise than other branches succeed as entrepreneurs than acquiring employment.

3) Personality Development and Soft Skills: The null hypothesis is rejected, since  $p < 0.042$ , and a conclusion is made that easy to learn new knowledge skill is associated with employability. Graduates think that soft skills under eminent mentor and career guidance. Expertise on communication skills will make graduates more competitive.

4) Entrepreneurial skills: The null hypothesis is rejected, since  $p < 0.032$ , and a conclusion is made that working on team and participating seminars, conferences, and workshops will help to improve problem solving skills and create a capability for thinking on ideas, and startups. The institute's responsibility is essential to identify leadership and problem solving skills and supporting them through campus incubation centers.

## Conclusions

From the above results 63% of female and 65% male graduates employed and 49% of students chosen higher studies even though some of them are employed. And the graduates around 18% were not employed. On the total employment rate 78% graduates are employed in IT Sector while 22% in core sectors. Four categories of skills have been identified that contribute to the employability rate but only three categories have a significant relationship to the employability and entrepreneurship. These skills are Strong Academic background, Research and Project development Skills, Personality Development

and Soft Skills, and Entrepreneurial skills. By looking at the percentage of employed graduates within 3 months after graduation, shows that graduates are competitive in the job market by add-on the skills they acquired while studying in the university in line with industry requirements.

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