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Domain Cognizance and Essential Skills required for Employability of Electronics and Telecommunication Engineering Graduates in Maharashtra (India) - An Alumnus Perspective

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Abstract

Engineering colleges in Maharashtra has produced thousands of Electronics and Telecommunication Engineering graduates. Employability of Engineering Graduates has become a biggest concern for the Institutions, Industries and related government agencies. Year by year, the Intake reduction of engineering institutesis becoming the problem of concern for the faculties, Private college owners and ultimately all direct and indirect stakeholders related to the education system.This research paper is the portion of the research work in understanding and analyzing the employable parameters of engineering graduates from Maharashtra (India).The research work is based on the feedback of Alumni of these colleges from E&TC stream. Feedback on four variables is considered for assessment of Skills. The data used in the research is obtained from alumni who graduated between AY 2000 to AY 2018.Descriptive and inferential statistical analyses is used to analyze the data.

Keywords: *Employability skill, Electronics and telecommunication Engineering, Engineering graduates, t-Test, Friedman's test*

I. Introduction and Literature Review

Now a day, the bigger reason for concern than unemployment is the employability of the candidates. Leaders of the industry look for the specific skill set and quality in the candidate which they are willing to appoint as a young dynamic workforce but there is a huge gap, candidates lack that required quality along with skill set. Detailed and industry oriented curriculum, quality content and quality teaching by experts will add essential values to the candidates [1]. The Set of skills of engineering graduates with regards to industries along with the community is in intense need of keen observation [2]. In this highly competitive professional era, for the identification of soft skills along with required hard skills, this study is a thorough effort [3]. Studies are getting momentum which emphasizes enhancement of various employability skills into their students [4]. Dr.

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Samuel et al research, showed that 'Attitude' is crucial in Campus recruitment process [5]. Considering student's and employer's perception, the policy-making community on how best to further develop research and policy on employability skills. The study showcased that employability skills which are expected in the professional world are missing on a major scale in freshly graduated students and require a very strong awareness [6][7][8]. Employability skills of undergraduate students which includes students from bimolecular science, Engineering, various sandwich branches and MBA are analyzed from Employers point of view in this study[9][10]. Theemployability skills required for management graduates are explored by the research study of this author [11]. Possible dimensions were investigated by employing Exploratory factor analysis and study yields us that Graduate students are in intense need of guidance and awareness to develop the requires employability skills essential in Global Market [12] [13] [14].

In the University of Luton,Petia Petrova conducted a survey which included the undergraduate students from Tourism, it was concerned in securing employment considering students assessment of knowledge, personality and skills [15]. General attributes, characteristics and skills holds a very strong bond in employers mind. Reliability or motivation are among them. The present research work is focused to address the engineering student's employability dearth. The study is based on colleges situated in Mumbai and Pune which reveals necessary employability skills [1][16] [17] [18]. A wide set of employability skills in educating candidates which will enhance the personality along with employability and will ultimately results into nation's progress are studied by author [19]. Lack of Soft skill and aptitude is not focused to a particular area but distributed across the country. Practical application of theoretical knowledge are significantly dominated by Presentation skills, communication skills, team work attitudes [20]. No Practical application of theoretical knowledge is the factor that is cause of unemployability among the Students studying in various institutions across India. The objective of reducing the knowledge gap of applying theory to practice which will thus increase employability rate of E&TC engineering students has a tremendous impact of Soft Skills, Analytical knowledge, knowledge on quality, domain knowledge and the faculty's knowledge on practical applications [22].

Objectives:

This paper aims at analyzing the employable parameters of Electronics and Telecommunication Engineering (E&TC) graduates in Maharashtra (India) based on inputs from Alumni of various colleges from the same region.

The objectives of the proposed study are:

- To study and understand the important variables of employability skills of E&TC Engineering students in Maharashtra
- To suggest a comprehensive domain-specific model to address to the skill-set gap to enhance the quality standards of engineering colleges in Maharashtra.

II. Research Methodology

The objective of this study is to evaluate and assess the employability qualifications of E&TC engineering Maharashtra graduates and to shape alumni. Descript-relationship research style is used. The majority of literature limits samples to a specific area, does not take Macharashtra engineering study into

consideration and, in general, no survey is carried out on the basis of the feedback from Alumni of engineering colleges. A questionnaire package was developed to be evaluated by E&TC graduates. Soft skills, professional skills etc. and 20 domain-specific questions were asked. A 5-point type scale of Likert was used with the following answers:

1: Agree

2 : Strongly Agree

3 : Neutral

4 : Disagree

5 : Strongly Disagree

The survey has been sent by e-mail to the alumni and the app with the Google Docs link. A sample size of 55 was found to be adequate among 70 respondents, and it was requested that the respondents complete the questionnaire using Google docs. Initially, the pilot study was conducted and the final questionnaire propagated. A total of 0.956 Cronbach alpha values were expected to suggest that the questionnaire was highly correlated and reliable. This paper limits discussion of soft and professional skills and the specific field.

III. Survey Instatement

The questionnaire for the research survey was structures in two components.

a. The questions were about life skills, innovation, and professional skills.

b. Domain specific questions grouped into Technical skills and Modern use of technology.

Most of the areas were missed in the prior researches. The questionnaire helped in The real difference for the factors was caught. The variables are dependent and independent in Table 1, and the sample grouped in 4 variables in Table 2.

Table 1: Dependent and Independent Parameters

Independent variable	**Dependent Variable**
The ability to demonstrate Leadership	Life skills were developedby concerned departmentin college.
Training in Verbal Communication	
Training in Written Communication	
Problem solving skill	
Critical Thinking skill	

Organizing & managing Symposiums, Events	
To acquire international certification.	
Write different competitive exams such as GRE, GMAT, and CAT.	

Table 2: Questionnaires and the Grouping

Group Number	Nomenclature	Group name	No. of Questions asked to E&TC Alumni
Group 1	TS	Technical skill	18
Group 2	MTT	Modern tools and technique	04
Group 3	SS	Soft skill & professional skill	10
Group 4	TLP & Others	Teaching learning process, R&D, Innovation & other skill	09

Research Hypothesis:-

a. H01: There is no disparity in the various dimensions of the factors influencing employability between men and women.

b. H11: There is no significant difference between mean grades of different skills influencing the skills of Maharashtra engineers.

H11 's sub-hypothesis:

• Ho The mean levels of technical expertise that affect Maharashtra engineering graduates' abilities in employability do not differ greatly.

• Ho There is no substantial difference between soft skills that affect engineering graduates of Maharashtra's ability to employ

• Ho The mean rankings of TLPs which influence employment skills of Maharashtra engineering students have no significant difference

• Ho The mean ranks of MTT that influence the employability of Maharashtra engineers do not differ significantly

IV. Research Findings:

Questions asked (Modern tools and techniques) and the responses analysis:-

Table 3: Segregation of responses

You were expert with the concept of Programmable Devices, PLA, PAL, CPLD, FPGA and implementation of digital system using VHDL when you passed BE. (All in %)	You were Expert to Use of ESAOA Framework to facilitate, implementation and knowledge management of embedded software & R&D projects. (All in %)	You were able to Use RT UML for system level, hardware, and software modeling. (All in %)	You were skilled on RFID system & you were able to handle projects on RFID (All in %)	
31	5	5	25	Agree
0	4	2	5	SA
24	**35**	**38**	**27**	Neutral
29	**35**	35	24	Disagree
16	20	18	13	SD
0	2	2	5	Blank
MTT	MTT	MTT	MTT	Total 55

For the question i.e. “You were expert with the concept of Programmable Devices, PLA, PAL, CPLD, FPGA and implementation of digital system using VHDL when you passed BE”53% of the respondents are neutral and disagree where as 16% of all were strongly disagree. And for the question “You were Expert to Use of ESAOA Framework to facilitate, implementation and knowledge management of embedded software & R&D projects.”70% of the respondents are neutral and disagree where as 20% of all were strongly disagree. Also the respondents replied to the questions “You were able to Use RT UML for system level, hardware, and software modeling.” The proportion as 73% of the respondents are neutral and disagree where as 18% of all were strongly disagree. And to the fourth question “You were skilled on RFID system & you were able to handle projects on RFID “, 51% of the respondents are neutral and disagree where as 13% of all were strongly disagree.

Thus the overall group of questions pertaining to modern tools and techniques usage shows that majority of them were not well versed with the latest techniques such as PLA, ESAOAetc. When they graduated from the college.

Table 4: No of Male and Female Participants

Total M	36
Total F	19

Table 5:Mean and SD of TLP variables.

Mean and SD of Agreement on Teaching learning process /R&D/ Other Skills Influencing the Employability	**Mean**	**SD**
The Curriculum offered to you boost your confidence in your first job	2.18	1.281
The Syllabi content of all engineering subjects were enough to get job	2.82	1.377
You got Opportunity for innovation during college period	2.75	1.517
College gave you exposure and guidelines to write and publish research papers	2.46	2.045
College gave you exposure and guidelines to write and publish patents	**3.02**	2.084
College encouraged you to be a part of various professional memberships bodies such as CSI,IEEE, IE, ACCS,ACM ETC to upgrade your knowledge and skill"	2.48	2.183
College made a provision for Awareness on Higher Education opportunities	2.48	2.867
You were sufficiently trained by Training and placement department/College to face interview and get selected.	**3.21**	2.928
Knowledge gained in practical classes in laboratories is useful in Industrial work	2.66	2.539

It is observed from table 5, variables affecting the teachinglearningprocess, research and innovation and employability of the engineering graduates in the sample are identified through mean score values. The variables are classified into two groups. **The variables recorded in 3.0 and above mean score are rested as primary variables. And the variables score less than 3.0 mean scores are considered as secondary variables.** Based on the same, primary teaching learning process variables affecting the employability of the engineering students are support to patent publication with the mean score of 3.02 and SD of 2.084;traning from T&P department with the mean score of 3.21 and SD of 2.92.Rest of seven variables can be termed as secondary variables from alumni point of view.Similar analysis of other 3 groups of variables is also done and the output is as mentioned below.

Based on the same, Technical Skills variables affecting the employability of the engineering students are the expertise in virtual agents with the mean score of 3.85 and SD of 1.522;Machine learning and deep learning with the mean score of 3.73 and SD of 1.740.Therest of the primary variables are domain knowledge, voice over IP, fuzzylogic, network security and ethical hacking, IOT, Intelligent automation and robotic process automation, video analytic.Rest of seven variables can be termed as secondary variables from alumni point of view.

Based on the same, Modern tools and techniques variables affecting the employability of the engineering students are expertise to use ESAOA framework with the mean score of 3.86 and SD of 2.076; use of RT UML with the mean score of 3.87 and SD of 2.30,skills on RFID systems with the mean score of 3.25 and SD of 2.72,The remaining one variable can be termed as secondary variables from alumni point of view.

Based on the same, soft skills and Professional skills variables affecting the employability of the engineering students are to acquire international certification with the mean score of 3.29 and SD of 2.16; Encouragement to write different competitive exams 0with the mean score of 3.21 and SD of 2.34.Rest of eight variables can be termed as secondary variables from alumni point of view.

Table 6 Mean and SD of overall variables.

Overall Mean and SD of Various Dimensions of Variables Affecting Employability of Engineering Graduates	Mean	SD
Teaching Learning Process	24.07	18.82
Technical Skill	**60.74**	33.20
Modern Tools and techniques	13.94	8.60
Soft and professional skills	**26.54**	16.68

It is observed from table 6, overall variables affecting the employability of the engineering graduates in the sample are identified through mean score values. The variable Technical Skills recorded the total 60.74 of mean score as the highest of four groups indicating alumni emphasized on the imparting more technical skills during the college days for employability.

V. Analysis Of Data Using Inferential Statistics

Data Analysis Using T-Test:

H01: There is no difference between Male and Female with respect to various dimensions of factors influencing the employability.

Table 7Group statistics

Group Statistics					
V2		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Avg of TLP	1(M)	35	2.534	.8643	.1461
	2(F)	19	2.489	.9876	.2266
Avg. of SS	1(M)	35	2.431	.7650	.1293
	2(F)	19	2.068	.7079	.1624
Avg. of TS	1(M)	35	3.083	.7254	.1226
	2(F)	19	2.979	.9473	.2173
Avg. of MTT	1(M)	35	3.414	.8945	.1512
	2(F)	19	3.074	.9837	.2257

Table 8 Independent Sample Test

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TLP	Equal variances assumed	.578	.451	.173	52	.863	.0448	.2590	-.4749	.5645
	Equal variances not assumed			.166	33.053	.869	.0448	.2696	-.5037	.5933

SS	Equal variances assumed	.108	.743	1.708	52	.094	.3630	.2125	-.0634	.7894
	Equal variances not assumed			1.749	39.622	.088	.3630	.2076	-.0567	.7827
TS	Equal variances assumed	1.354	.250	.451	52	.654	.1039	.2306	-.3587	.5666
	Equal variances not assumed			.416	29.691	.680	.1039	.2495	-.4059	.6137
MTT	Equal variances assumed	.057	.812	1.290	52	.203	.3406	.2640	-.1891	.8703
	Equal variances not assumed			1.254	34.144	.218	.3406	.2716	-.2113	.8925

We interpret the results of t test as per the rule, If P <0.05, reject H0and accept H1.The means are significantly different. If P >0.05, Accept H0 .The means are not significantly different.

The null hypothesis is rejected at the at 95% level, since P value is > 0.01,with regard to the overall score of variables in the dimensions of teaching learning process, soft skills, Technical skills and modern tools and techniques as key factors affecting employability of the engineering graduates among the select engineering colleges in Maharashtra.There is a difference between Male and Female with respect to various dimensions of factors influencing the employability.

The details of t test are shown in the table 8.

Null Hypothesis: There is no significant difference among mean Ranks of technical skillsinfluencing the employability skills of the engineering graduates of Maharashtra.

Table 9 Test Statistics[a] (Technical Skills)

Test Statistics[a] (Technical Skills)	
N	47
Chi-Square	134.879
Df	18
Asymp. Sig.	.000
a. Friedman Test	

The 1 percent degree of significance of null hypothesis is denied because p is < 0.01. It is also noted that the employability of the engineering graduates is determined by a substantial gap in practical technical skills.

Mean rank values from the table note that, in the show of the expertise in virtual agents, with a mean rank of 13.06, technical skills variables of the employability skills among Maharashtra engineering graduates; in the IOT-based ventures, skills with a mean rank of 11.90; expertise in intelligently automated applications11.69. Capabilities of natural language therapy 11.63.The rest of the 13 variables as shown in the table 9.

Table 10Mean Rank

Ranks(Technical skills)	
	Mean Rank
Programming skills was developed as required by industry	7.28
Industrial visits helped to understand how industry works	7.22
Depth of domain Knowledge acquired during your course of study was worth to handle live projects jobs	8.22
You are skilled at Voice over IP as a real-time interactive audio/video service, operation of the components of a router including, DHCP, NAT/PAT, Routing function, Switching function."	10.90
You were taught Fuzzy logic basic theory and algorithm formulation, to solve real world problems & Exposure to the applicability of neural networks and fuzzy	9.97

logic immediately after your degree course."	
You were able to solve the issues associated with high performance Mixed Signal VLSI Circuits & Analyze and design single stage MOS Amplifiers & Operational Amplifiers."	8.65
You knew Microwave devices and RADAR for industrial and scientific purposes when you were a Final year students.	7.22
Your skills are very high in Network security and ethical hacking in real time industrial application.	11.34
You were expert with quantitative models of image and video processing for various engineering applications, & Interpret and analyze 3D signals in frequency domain through image transforms & Development of innovative design for practical applications in various fields"	11.22
You had a clear idea of Networks Routing, Switching, Scaling of Networks, and Connecting of Networks & you were able to manage Network for an Organization when you passed BE."	8.76
You are skilled on IOT based projects in your college.	**11.90**
You were expert on Intelligent Automation during after your college days.	**11.69**
You were taught through Robotic Process Automation, Cognitive Robotics in your College	10.96
Your expertise is enhanced by your college on Virtual Agents,	**13.06**
You were taught Machine Learning and Deep Learning to use at a high skill.	**12.30**
Your skills are very high in Natural Language Processing.	**11.63**
Your expertise is enhanced on Video Analytic when you passed BE	11.39
Do you have Ability to use ANSI C to develop embedded software?	8.54
Your skills are very high in Development of prototype circuit on breadboard (including interfacing to microcontroller, and control from software)."	7.73

TS/SS/TLP/MTT:-

Null Hypothesis: There is no significant difference among mean Ranks of Soft Skill influencing the employability skills of the engineering graduates of Maharashtra.

Table 11Test Statistics[a] (Soft Skill)

Test Statistics[a]Soft Skill	
N	55
Chi-Square	53.114
Df	9
Asymp. Sig.	.000

Null hypothesis is rejected at the 1% level of significance, since p is <0.01. So, it is noticed that there is a significant difference between mean ranks towards Soft Skill influencing the employability of the engineering graduates.

Null Hypothesis: There is no significant difference among mean Ranks of TLP influencing the employability skills of the engineering graduates of Maharashtra.

Table 12Test Statistics[a] (TLP)

Test Statistics[a] TLP	
N	55
Chi-Square	24.200
Df	8
Asymp. Sig.	.002

Null hypothesis is rejected at the 1% level of significance, since p is <0.01. So, it is noticed that there is a significant difference between mean ranks towards teaching Learning Variable process skills influencing the employability of the engineering graduates.

Null Hypothesis: There is no significant difference among mean Ranks of MTT influencing the employability skills of the engineering graduates of Maharashtra.

Table 13Test Statistics[a] (MTT)

Test Statistics[a]MTT	
N	52
Chi-Square	15.019
Df	3
Asymp. Sig.	.002

Null hypothesis is rejected at the 1% level of significance, since p is <0.01. So, it is noticed that there is a significant difference between mean ranks towards modern tools and techniques skills influencing the employability of the engineering graduates.

VI. Conclusion

- Based on the P value, it is noted that, there is a difference between Male and Female with respect to various dimensions of factors influencing the employability. And it is also noticed that there is a significant difference between mean ranks towards Technical skills, Soft Skill, TLP and MTT; influencing the employability of the engineering graduates.
- Four categories of skills have been identified that contribute to the employability of electronics and telecommunication engineering graduates Technical skills, Soft Skill, TLP and MTT.
- Thus the overall group of questions pertaining to modern tools and techniques usage shows that majority of the graduates were not well versed with the latest techniques while passing out from the college such as PLA, ESAOA etc.
- Based on the same, primary teaching learning process variables affecting the employability of the engineering students are support to patent publication, training from T&P department Rest of seven variables can be termed as secondary variables from alumni point of view. Similar analysis of other 3 groups of variables is as below.
- In the group of Technical Skills variables affecting the employability of the engineering students are the expertise in virtual agents, Machine learning and deep learning ,domain knowledge, voice over IP, fuzzy logic, network security and ethical hacking, IOT, Intelligent automation and robotic process automation, video analytic.
- Modern tools and techniques category variables affecting the employability of the engineering students are expertise to use ESAOA framework,; use of RT UML, skills on RFID systems

- The fourth category is soft skills and Professional skills variables affecting the employability of the engineering students are to acquire international certification, Encouragement to write different competitive exams
- Amongst overall four categories of variables affecting the employability of the engineering graduates in the sample is identified through mean score values. The variable Technical Skills recorded the total 60.74 of mean score as the highest of four groups indicating alumni emphasized on the imparting more technical skills during the college days for employability.

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