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EMPLOYABILITY SKILLS OF GRADUATING ENGINEERS VIEWED WITH THEIR SECONDARY EDUCATION

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Abstract: Focusing on employability skills, this paper is about the variations in the skill levels of graduating engineers on account of the different types of schooling they received and the different syllabi they had followed at their higher secondary level. The data had been collected from 619 final-year graduating engineering students of academic year 2014-2015, from five engineering colleges in Ernakulam District, Kerala State, India. The tool used was tested for reliability using Cronbach's alpha and was found to possess high reliability of 0.911. The test of significance through analysis of variance have indicated that students from government owned schools have better problem-solving skills and technical skills than those from the private schools. Students from private schools were observed as having better communication skills and better self concept than students from government owned schools. Variations in skill levels were evident with regard to the different syllabi followed by the students. The need to have more experiential learning opportunities from the school environment is highlighted. Such an intervention would iron out these variations due to school environment and would implant quality skills in them.

KEY WORDS: Employability Skills Secondary Education Government school Private school School syllabus

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Introduction

Skill acquisition has become one of the key priorities for the nations, world over. The ever changing social, economic, political and technological scenarios have no doubt, made almost everyone inadequately skilled, in several spheres. Countries- developed, developing or underdeveloped, are in the process of adopting suitable measures to identify, learn and practise the required skills, for the betterment of their citizens. While some early birds have been quite advanced in such interventions, some are only just catching up. In India, the formal process of skill development was initiated with the introduction of the National Skill Development Policy, 2009[1]. In continuation of this endeavor, the present Government has embarked upon a highly ambitious National Policy on Skill Development and Entrepreneurship, 2015. With a target of skilling 500 million people by 2022, the policy emphasizes on 'skilling at scale with speed and standard'.[2]

As part of preparation of the Second Phase of Technical Education Quality Improvement Program (TEQIP-II), of the Government of India, with financial support from the World Bank, an Employer Satisfaction Survey was carried out in 2009. The Federation of Indian Chamber of Commerce and Industry (FICCI) and the Ministry of Human Resource Development, Government of India , facilitated the process. The study results have been published by the World Bank. This report has identified the employability and skill sets of newly graduated engineers in India. Among the key findings are: a) the skills considered important by the employers, b) satisfaction level of employers with the skills of engineering graduates and c) the skill gaps among the engineering graduates. In the summary part of the report, the authors have given an important caveat that the engineering graduates' skill levels are influenced by their prior schooling, especially in their secondary level.[3] Inspired partly by this report as well as other valuable research findings and research questions, the authors have undertaken a detailed research study on the employability skills of engineering students, and have analysed the findings with respect to certain key factors, including their socio- economic and educational aspects.

School education is one of the important factors in the development of student's skills. The nature and quality of skills/attributes acquired by the student may be influenced by the school

environment The specific objective of this paper is to discuss how the education of engineering graduates at the higher secondary level, makes a difference in their employability skill levels, and to impart suggestions to improve the situation for the benefit of future generation.

1.1. Review of Literature

While there are a lot of studies on employability skills, few studies seem to have been reported depicting the influence of students' school education on their graduate employability skills. Some of these studies have emphasized students' responses on the relative importance of different skills, contributing factors and elements that stand in their way as barriers in achieving their goals. The literature presented below give a combination of research findings on graduate employability skills preferred by employers, relative importance of these skills as conceived by students, and certain factors contributing/hindering students' employability skills.

Migundi et al.[4] studied obstacles faced by secondary school students in Kismu Municipality, Kenya. Inadequate career guidance, inadequate career information and lack of opportunities were listed, among others, as major barriers in achieving their dream careers. At the initiative of the Scottish .Higher Education Employability Forum, The National Union of Scotland[5] (NSU), studied the relationship between co-curricular activities and employability. The results indicated that job applicants with co-curricular experience stood higher chances than those who did not have such experience. It was the active involvement and the specific role performed by the student and the activity rather than the experience as such, that was of interest to the employers, the study reported.

Tomlinson[6] studied students' attitude and orientation towards labour market and found that students were convinced about the experiences and achievements outside the formal university learning as very valuable, just as their degree certificates. The students felt that their certificates alone were not sufficient to get the job of their choice. Alawneh[7] covered attributes such as Self-Awareness, Empathy, Inter-personal relationship, Communication, Critical Thinking, Creative thinking, Decision Making, Problem-Solving, Coping with Stress and Coping with Emotions. Elective chosen at the High School was one among other independent variables studied. It was found that students from science background and those who chose electives out of

their interest scored higher than the rest of the students. The study sample comprised of 176 students at Yarmouk University, Jordan, who took part in the employability skill development course and another batch of 141 students who did not take part in the course.

Importance of Mathematical abilities and experience with Science, Technology and Engineering, have been identified as employability facilitators, by Thompson et al. [8] The study was conducted with participants receiving welfare assistance in North West Florida. Business skills, job commitment and emotional maturity, trustworthiness and freedom from drug and alcohol were the other important contributing factors in employability.Findings of Omar et al.[9] on the other hand, showed no difference among students from different fields of study. Students' academic achievement was also not a factor of importance, as far as their employability skills were concerned.

Research by Shumilova et al.[10] has stated work experience as the most important factor in finding a job. Ambition, motivation, energy and evidence of being an achiever, under the umbrella of 'attitude', were the other important contributors. Students pointed out at the lack of right contacts/ access to professional network and lack of opportunities to gain relevant work experience as the limiting factors in finding a job.

The International Labour Organisation[11] in their report on G20 Training Strategy for a Skilled Workforce, has highlighted the growing demand for non-routine analytical skills. These are considered very essential to cope up with the rapid changes the world over. These skills include, creativity, problem solving, communication, teamwork, and entrepreneurship skills. They foresee a substantial decrease in demand for routine skills, due to the intervention of automation, digitization and outsourcing.

1.1.1. Employability Skills Expected from Engineering Graduates

According to the U.S.-based Accreditation Board for Engineering and Technology programs (ABET),[12] the engineering graduate is expected to demonstrate the ability to:

-apply knowledge of mathematics, science and engineering

-design and conduct experiments, analyse and interpret data

-design a system, component or process to meet desired needs within realistic constraints (constraints such as economic, ethical, health & safety, manufacturability and sustainability)
-function on multi-disciplinary teams

-identify, formulate, and solve engineering problems
-communicate effectively
-engage in life-long learning

-use the techniques, skills and modern engineering tools necessary for engineering practice.

There are other criteria under their 'Learning Goals and Outcomes'. These include, 'understanding of professional ethical responsibility', 'the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and social context', and 'knowledge of contemporary issues'. India, being a permanent member of the Washington Accord since 2014, its National Board of Accreditation[13] has more or less similar criteria for accreditation.

According to Blom and Saeki of the World Bank,[14] very important skills include integrity, self discipline, reliability, self motivation, entrepreneurship, teamwork, willingness to learn, flexibility and empathy (termed as core employability skills) and a set of communication skills. Their study reported that only 36 % of the employers were satisfied with the skills of their engineering employees. Identification of skill gaps was another valuable finding. Wide gaps were observed among most of the skills. Problem-solving skills had the largest skill gap.

2.Research Methodology

2.1 Selection of Study sample:

Sample for this part of the research is comprised of 619 final year engineering students of academic year 2014-2015. Multi-stage sampling technique was used for the selection of sample. In the first stage, five colleges from Ernakulam District, Kerala State, India, were selected at random. In the second stage, from each of these colleges, out of the total of 28 batches of final year students, half of the batches were selected. In the third stage, all the students in these

batches who were willing to participate were selected. Incomplete responses were deleted and the final sample amounted to 619.

2.2 Data Collection:

Data were collected through survey method employing a well-structured questionnaire, finalized after pre-testing and adopting the necessary modifications. Reliability values using Cronbach's alpha showed the total for the set as 0.911.Besides personal Information required for analysis, Part I of the questionnaire contained 52 statements pertaining to employability skills. A few of the statements on employability skills, have been developed based on the format "Assessing Employability", prepared by the University of Kent, UK, with due permission from the concerned authorities. The rest included statements from Rosenburg Self Esteem Scale[15] and contribution from other experts in the field. The statements have been grouped under seven categories: A) Communication Skills, B) Interpersonal Skills, C) Mathematical Abilities, D) Problem-Solving Skills, E) Self Concept, F) Technical Skills and G) Professional Skills. The items were developed keeping simplicity and clarity in mind and were provided in students' native language (Malayalam) as well as in English.

The Communication skill set contained statements pertaining to students' ability to speak and write in English language, ability to speak to an audience, to give class presentations, to express one's ideas in the appropriate situations, ability in the use of information technology while communicating and the ability to listen to others while communicating with them.

The Interpersonal skill set included statements that could assess abilities/ interests to work in a team, skills involved in conflict resolution, attitude towards superiors and colleagues and quality of politeness and friendliness.

Statements under the Mathematical Abilities skill set contained those related to numerical abilities, use and interpretation of statistical data, abilities to work with decimals and fractions and ability to work with mathematical operations.

Students' ability to think, reason and analyse, abilities to handle problems with emotional maturity, and the capacity to take decisions after analyzing and weighing alternatives- these elements constitute the major statements under the Problem-solving skill.

Rosenburg Self Esteem Scale[16], with slight modifications, was adopted to assess students' Self Concept.

Statements on Technical skill category were those depicting technical knowledge, technical aptitude and technical skill, including interest in mathematical applications, scientific applications, and engineering applications.

Professional skill set contained statements to assess personal attributes and general awareness. This set constituted statements that describe honesty, leadership, entrepreneurship, innovations, initiative, time management, aptitude for project assignments, and general awareness regarding business, industry, commerce and economics.

The responses were elicited directly from the classrooms of the students by administering the tool personally. A brief introduction on the purpose of the study was done prior to this. An additional request was made to give students' honest responses to the given statements and other areas. The tool used Likert scale values ranging from 1 to 5, corresponding to Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree and Strongly Agree. Scores for negative statements were reversed during analysis.

2.3. Operational Definitions

Employability Skills

In this paper, the Employability Skills denote the set of abilities and attributes, a newly graduated engineer is expected to possess to obtain an entry level engineering position. They include communication skills, interpersonal skills, mathematical abilities, problem-solving skills, self concept, technical skills and professional skills.

School Education

School education is specifically consisted of the different types of schools attended by the students in the study sample and the syllabi followed by these schools.

Type of school

Type of School is comprised of three categories; a) Government schools-fully owned and managed by government b) Government-aided schools wherein the school receives financial aid from the government towards their expenses including teachers' salary, but the ownership remains with other agencies or individuals and c) Private schools- fully owned and managed by private agencies without any financial assistance from the government.

Syllabus followed by the Schools

Syllabus followed by the students include mainly three categories; a) the State syllabus formulated by the State Government of Kerala, b) the Central syllabus developed by the Central Board of Secondary Education (CBSE), under the Government of India and c) the syllabus of the Indian School Certificate Examination (ISC), framed by the Council for the Indian School Certificate Examination (CISCE). The CISCE is a private, non-governmental board of school education in India.

2.4 Hypotheses

In order to find out the variations in the employability scores of graduating engineering students, based on the type of school they attended and the syllabus followed by them at their higher secondary level, the following hypotheses have been developed.

2.4.1 The employability skills of graduating engineering students do not differ with respect to the type of school they attended at their higher secondary level

2.4.2 The employability skills of graduating engineering students do not differ with respect to the syllabus followed by them at their higher secondary level.

3 Results and Discussions

Table 1. presents the distribution of study ample according to their type of school, at their Higher secondary level.

Table 1. Distribution of students by Type of school at their Higher Secondary level

Description	**N**	**%**
Government Owned	173	27.9
Government-aided	181	29.2
Private	265	42.8
Total	**619**	**100**

The distribution shows that majority of students (42.8%) at the Higher secondary level have been from Private schools. This is followed by government aided and the lowest percentage of students are from the government owned schools.

Table 2. Distribution of students by their School Syllabus (Higher Secondary level)

Syllabus	**N**	**%**
CBSE	227	36.7
Kerala State	371	59.9
ISC	15	2.4
Others	6	1.0
Total	**619**	**100**

Table 2 gives the distribution of the sample students based on the syllabus followed by them at their higher secondary level. As is observable, nearly 60 per cent of the students had studied the Kerala State syllabus. The CBSE syllabus had been followed by 36.7 per cent of the sample. Only a few (2.4%) had their education under the ISC syllabus.

3.1 Employability Skills by Type of School – H.Sc.

As explained under 2.3, type of school management in the State are generally classified into three: a) government owned schools, b) government aided schools and c) fully owned and

managed by private agencies. The quality of teachers, facilities provided in the schools and opportunities for skill development may vary widely among these three types of schools. Table 3 presents the employability skills scores received by the students and the analysis of variance values (F-test, a parametric test used to compare the variances of two or more independent variables) based on their school types.

Table 3

Employability Skill scores by Type of School – Higher Secondary (H.Sc.) Level

Skills +	**School Type**						**F**	**Sig.**
	Government N-173		**Govt. –Aided N-181**		**Private-Unaided N- 265**			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**		
C.S.	29.60	5.51	28.76	5.14	31.04	5.02	10.968	**
I.P.	34.18	2.38	33.65	2.57	33.46	2.53	1.977	NS
Math	21.29	4.14	21.02	4.36	21.69	3.97	1.451	NS
Psolv	21.47	3.23	20.83	3.39	20.37	3.30	5.732	**
SelfC	29.53	4.22	28.49	4.24	29.82	3.96	3.315	*
Tech	21.13	3.94	20.70	4.12	20.06	4.23	3.653	*
Prof.	32.32	4.87	32.08	5.15	31.68	5.00	.913	NS

+ C.S.: Communication Skills, I.P. : Interpersonal Skills, Math: Mathematical Abilities, Psolv: Problem Solving Skills, SelfC: Self Concept, Tech: Technical Skills, Prof: Professional Skills.

NS–Not Significant;** Significant at 0.01 level; * Significant at 0.05 level.

The findings show that students from the unaided-private ownership category have significantly higher communication skills and self concept than those from the other two categories. Students from government owned schools, possessed problem-solving skills and technical skills at a significantly higher level than those from the other categories. The subject knowledge of teachers and quality of instruction may be among the factors for this higher level of technical skills for students from government schools.

Inference: Employability Skills by the Type of School

Hypothesis 2.4.1 is rejected with respect to students' communication skills, problem solving skills, self concept and technical skills and accepted with respect to their interpersonal skills, mathematical abilities and professional skills.The employability skills such as communication skills, problem-solving skills, self concept and technical skills of graduating engineering students do differ with respect to the type of school they attended at their higher secondary level.

3.2 Employability Skills by School Syllabus

As explained under the operational definitions, the employability skills by the syllabus followed by these students for their studies at the higher secondary level, have been classified into three main categories. Additional fourth one is the 'others' category. Table 4 gives the scores received by the students in the respective categories and the analysed results.

Table 4. Employability Skill scores by School Syllabus

Skl	School Syllabus : Hr. Secondary Studies								F	Sig
	C.B.S.E N-227		Kerala State N-371		ICSE N- 15		Others N- 6			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
A	31.46	5.16	28.91	5.14	32.73	4.88	32.17	3.43	13.440	**
B	33.54	2.51	33.81	2.55	33.13	2.09	33.67	2.42	1.754	NS
C	22.15	3.57	20.81	4.37	23.00	4.16	23.50	3.56	6.471	**
D	20.44	3.17	21.03	3.43	20.73	3.56	21.83	2.48	1.649	NS
E	29.77	4.08	29.02	4.17	30.93	3.39	29.50	3.87	1.305	NS
F	20.21	4.16	20.73	4.16	20.67	3.83	21.50	1.97	.871	NS
G	31.74	4.93	32.04	5.05	32.87	4.39	34.83	5.34	1.000	NS

Skl: Skill; A.: Communication Skill, B.: Interpersonal Skill, C: Mathematical Abilities, D: Problem- solving Skill, E: Self Concept, F: Technical Skill, G Professional Skill, NS–Not Significant; ** Significant at 0.01 level

The results point out that the ICSE and CBSE syllabi are more helpful in the development of communication skills in the students, than is the Kerala State syllabus. Findings on mathematical abilities also show that students who studied the State syllabus are at a slightly

disadvantageous position compared to the other groups. The differences are significant at 0.01 level for communication skills and at 0.05 level for mathematical abilities. No significant differences were observable with respect to the rest of the skill sets such as the interpersonal skills, problem-solving skills, self concept, technical skills and professional skills.

Inference: Hypothesis 2.4.2 is rejected with respect to students' communication skills and mathematical abilities only and accepted with respect to their interpersonal skills, problem solving skills, self concept, technical skills and professional skills. Students' communication skills and mathematical abilities do vary with respect to the syllabus in which they had their studies at the higher secondary level.

From the study findings on type of school and the syllabus followed at the Higher secondary classes, it is inferred that except interpersonal skills and professional skills, employability skills of students differ with respect to their previous education. To sum up, it could be stated that graduating engineers' education at the higher secondary level does have an important role in the development of their employability skills, specifically, in their communication skills, mathematical abilities, problem-solving skills, self concept, and technical skills.

3.3Implications:

As is evident from Table 1, there is a surge to enroll students in private schools, despite the fact that educating a child in such schools is a costly affair and although there are adequate number of fully government owned schools at low or no cost, in the vicinity of these private schools. The finding that students from government schools have better problem-solving skills and technical skills, is a matter having greater implications, as these are the skills desired by majority of the employers, not only in the engineering realm but in other fields as well. Employers, at present, are looking at the basic analytical abilities of the candidates, since they think the rest they can impart in them through their own training.

The government school teachers are qualified, experienced, get better training and refresher courses; are well-paid and are more or less permanent employees. In a considerable number of private schools, on the other hand, the teachers are not adequately qualified, are paid relatively

less , are over-worked and hence less motivated, very often have very little experience and receive little opportunity to update their knowledge or skills. Moreover, there are more spoon-feeding than experiential learning in many of the private schools. Probably these could be the reasons for the relatively lower scores in the problem-solving and technical skills of students from the private schools.

While the students from the private-unaided category scored higher communication skills and higher self concept, students from the government owned schools were displaying better problem-solving skills and technical skills- the two essential skills for an engineer. With the mounting educational expenses, many of India's households can ill afford to send their wards to private schools, which charge exorbitant fees for studies throughout the period of school education.

Given these facts, it is imperative that in order to enhance the skill levels of our kids from all sections of the society, government owned schools should plan better strategies to attract and retain the students. It is also felt that the government takes steps to have add-on courses in communication skills, especially in English Communication, so that the students can catch up with their counter parts in private schools. Such interventions could boost children's self confidence as well. It has to be noted here that students from government schools have their interpersonal skills, mathematical abilities and professional skills at par with students from private/government aided schools. Therefore, the two key skills to be given emphasis are the communication skills and the development of self concept.

Another key aspect is the school syllabus. As the number of students following ISC syllabus is negligible (2.4% only as per this study sample), let us focus on the Kerala State Syllabus and the CBSE syllabus. Solid learning outcomes, through enriched experiential learning environment should be the objectives of these syllabi. Through the school education, students should be able to get a very good understanding of the subject and they should also be able to apply this knowledge at the appropriate situations. Innovations, entrepreneurial mind, leadership abilities, self confidence, emotional maturity and social skills could be ingrained in the young minds

through out-of the class room learning opportunities. Gradual changes are to be introduced not only in the syllabi but in the methodology too so that children unfold their potentials effortlessly.

4 Conclusion

It is deemed necessary that more stress is laid on the practical orientation of education, in general. Mere theoretical learning, without the opportunity to put them into actual practice, puts the entire learning system uncreative and unproductive. Therefore, let the head, heart and hands go together in tandem. A detailed study on the different skills of school students covering various aspects of education, would be of extreme value to the research world as well as to the policy makers.

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