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Embracing Disruption in Engineering Education

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Abstract

Role of an engineer is imperative in improving the quality of human life and India is one of the largest producers of engineers with 23 IITs (Indian Institute of Technology), 31 NITs (National Institute of Technology) and state universities offer technical education in the form of undergraduate, graduate and postgraduate programs. Since India, a predominantly young population, IITs and NITs are not sufficient in number and hence AICTE (All India Council for Technical Education) has approved over ten thousand self-financed private engineering colleges across the country to cater the huge demand for engineering education. Except for IITs, NITs, and other premier institutes, most engineering colleges failed to give quality education to the students, which would get them suitable jobs. As per the research carried out by Aspiring Minds a leading employability assessment company, only 1.7 percent of the engineering graduates are suitable for the new age jobs and top 10 IT companies recruit only 7 percent of the engineering graduates every year which is a serious concern. [1]

*Keywords:*Skill; Performance; Adaptability; Communication; Faculty competencies;

1. Introduction

It has been observed that 94 percent of engineers are not fit for hiring because of lack of skill set and substandard engineering education [2]. In order to improve the skill set of the students and increase the percentage of employable graduates, it is high time for disruption in the process of engineering education in India. The primary objective of our work is to gain deep insights into the present engineering education process, curriculum, assessment mechanism, and faculty competencies. As part of our research, we surveyed the key stakeholders including students,

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alumni, employer and faculty from various colleges across India. We also interviewed freelancer professionals who were never recruited by any company but they are serving many companies today. We were able to identify the reasons for substandard engineering education in India. The rest of the paper includes the related work, survey results, analysis of the surveys, disruptions needed, challenges in incorporating disruptions and ways to address the challenges.

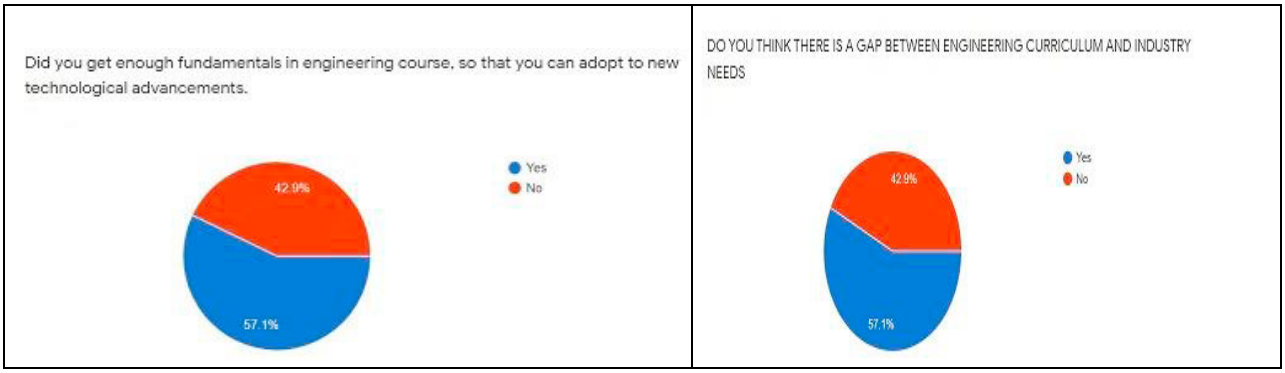
2. Related Work

It has been established from the research done by various assessment companies that the productivity of engineering education in India is very low and it is due to substandard engineering education. It is high time that we must bring in reforms in engineering education through disruption. To suggest the types of disruptions in engineering education, it is mandatory to gain deep understanding of the challenges that led to substandard engineering education. In this process we have surveyed various stake holders including alumni, faculty, and freelance professionals. Based on the feedback of the stakeholders we have identified four key attributes in any engineering graduate to sustain in industry. The four key attributes are**Skill, Performance, Adaptability and Communication**

2.1 Feedback of the stake holders

2.1.1 Alumni

When we have surveyed alumni on various parameters, they opined that most engineering graduates lack skill and thus unable to perform. Since technology is changing at a rapid pace, one should have strong fundamentals to adapt to the latest technological advancements. Many students lack strong engineering fundamentals and hence struggling to adapt new technologies. Some of the key observations from alumni are depicted in following figures.



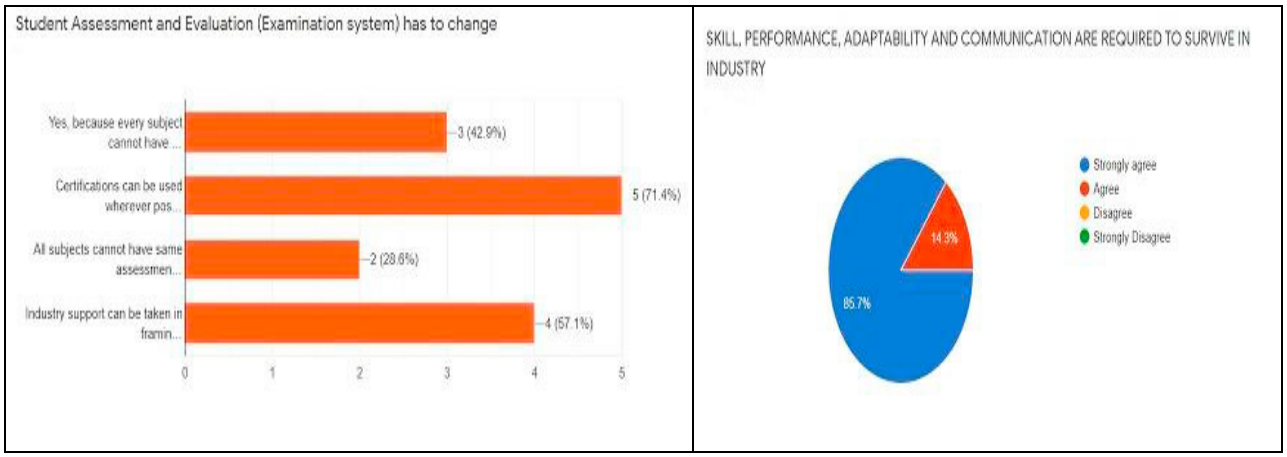


Table 1: Alumni Feedback

Some of the key points observed from alumni survey are

I. Graduates struggle to adapt to new technologies because of poor fundamentals in engineering.
II. Graduates are unable to apply the knowledge gained from the university education. It is the time to question reliability of the university examination system.
III. Communication and soft skills are two common problems found in graduates especially belonging to south India.

In the disruptions section, we have suggested solutions to address the issues of the graduates.

2.1.2 Faculty Survey

Faculty of various premier institutions in the region were surveyed and few key observations were drawn. Faculty involved in the survey agreed that the quality of the engineering education across the country is declined and they made few critical remarks listed below.

I. In few states, government policies have ruined the quality of education.
II. Teaching learning processes must evolve to engage students and address diverse learning styles.
III. Faculty must be paid as per norms and encourage youngsters with good academics to join teaching profession
IV. Assessment and evaluation has to change.

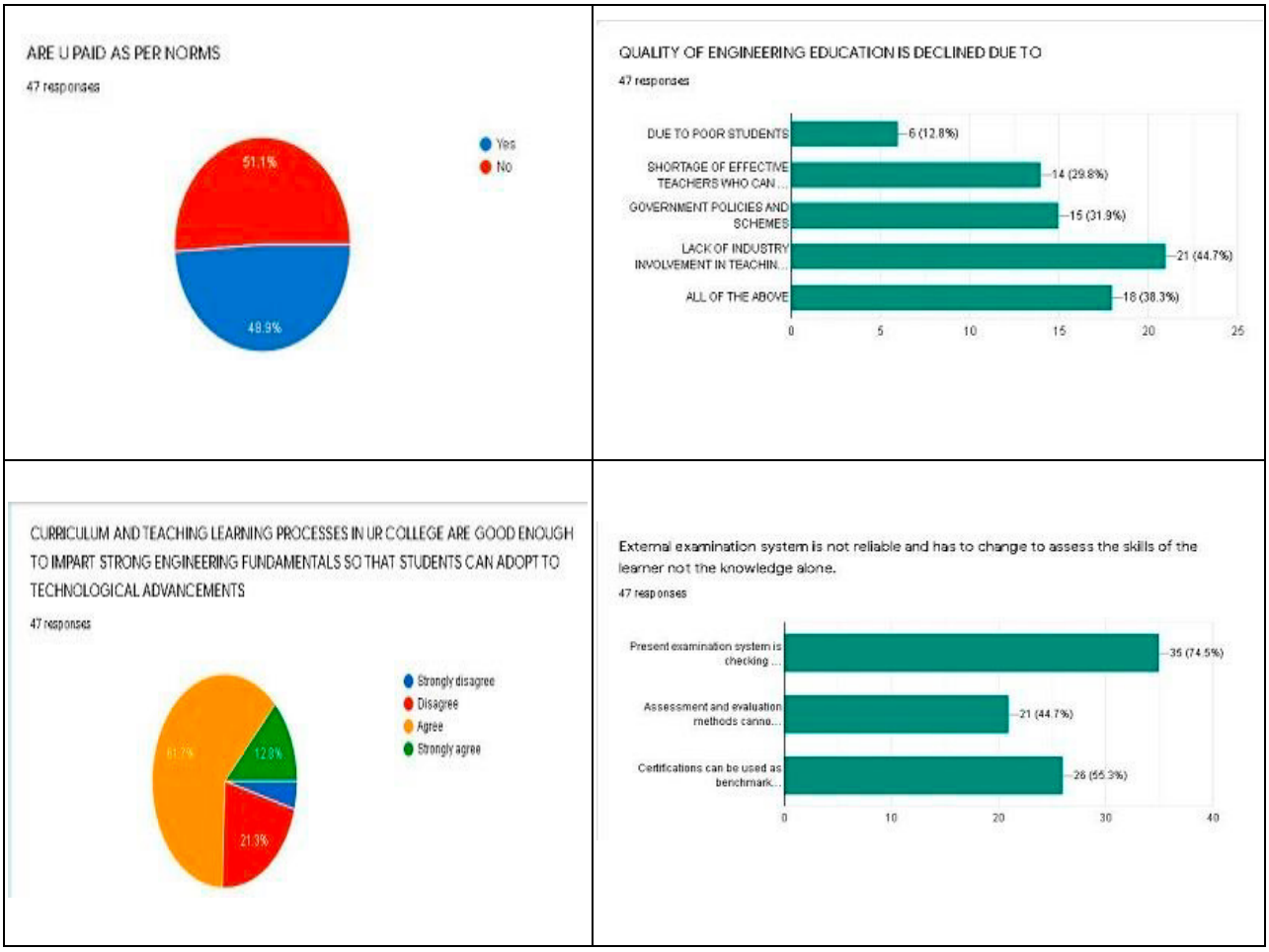


Table 2: Faculty Feedback

2.1.3 Freelance professionals

As part of our research, we interacted with few freelance professionals who did not had good academic track record and were not placed in campus drives but today they are serving industry by virtue of their skill and ability to adapt to advancements in the field.

Mr. Sreenivas Mallampati, BigData Architect , CEO Techybees has expressed his remarks on engineering productivity. As per his observation, engineering students lack problem solving ability, university curriculum is not in line with industry needs.

Mr. Amith Kumar, Former Microsoft Employee has expressed the need for change in assessment and evaluation methods. He recommended industry certifications to be used as benchmark for award of credits wherever possible.

3. Causative Factors for substandard engineering education and Disruption in the process

Based on the detailed surveys with various stake holders and after studying the engineering education system in various dimensions, we could able to identify the causative factors for substandard engineering education in India which are listed below.

3.1.1Faculty Competency:

Faculty are considered to be the torchbearers in this journey of transforming engineering education and bridge the gap between academic and industry. However more than 50% of the faculty do not have any industry background and hence they fail to bridge the industry institute gap. As an example we interacted with 34 faculty members of computer science engineering, who have handled Software Engineering course for about 86 times and they never discussed code repository which is a bare minimum requirement for any fresher. The faculty members told that code repository is not part of the syllabus and is not present in the prescribed text.

3.1.2 Curriculum:

Curriculum is the major setback for engineering education in India. There is need to revise curriculum every year and incorporate new courses which the industry demands. Technology is changing at a rapid pace and the curriculum is not revised accordingly. When country talks of bullet train, students are still learning steam engine. Multicore processors are used today, but computer science graduates are still learning single core processors. CPU are replaced with GPUs and TPUs but the curriculum remains un attended.

3.1.3 Teaching Learning Methods:

In our survey and analysis we found few interesting facts. more than 90% of faculty are using ICT in classroom and also following active learning strategies. However they fail to attract the students to come to the classroom. Many student do come to the class only for the sake of attendance. Hence it is required to create interest in the student and improve attendance.

3.14 Assessment and Evaluation Methods:

As part of our research we have reviewed examination papers of 10 universities under AICTE. The cognitive level of the questions was only Understanding level of Blooms taxonomy. It is a clear indication that we are assessing students on lower level cognitive skills and expecting them to perform at higher level cognitive skills like ability to apply, analyze, evaluate and create. Hence the examination system itself is not reliable. All courses cannot be assessed using same technique. Rubrics and assessment methods can vary from course to course.

4. Disruption in the process of Engineering Education

Based on the present situation of engineering education, surveys, opinions of various stake holders we propose strategic changes in various dimensions through disruption to improve quality of engineering education, increase the employability of the engineering graduates and thus increase productivity of engineering graduates.

4.1.1 Faculty Recruitment and Training:

Since faculty is the key for transformation of engineering education, disruption in faculty recruitment and training is needed. Faculty must have minimum industry background and faculty must be certified in teaching learning pedagogy.

4.1.2Teaching Learning Process:

Using ICT alone will not serve the purpose. every faculty must use LMS(Learning Management System) not only to share course related material but also create a collaborative platform to submit assignments, debate and discuss case studies.

4.1.3 Assessment and Evaluation

Assessment must be done by testing students abilities on higher order cognitive skills for which standard rubrics must be framed. Certifications must be used as benchmarks to award credit for all courses wherever possible. Laboratory courses must be conducted to facilitate experimentation with maximum test cases and incorporate ability to investigate and analyze the results. Lab courses and experiments must be in line with the industry needs.

4.1.4 Industry Involvement

Industry interaction is not sufficient rather industry involvement is mandatory since, industry is the main stake holder of the system. Industry involvement includes

i. Involvement in curriculum design
ii. Strengthen Teaching learning process by providing case studies, modern tools and materials
iii. Provide mentors who can collaborate with the students and faculty through LMS
iv. Support the institutions in identifying the curriculum gaps and facilitate in bridging the gaps.

Conclusion

We have done a multi-dimensional analysis by surveying different stake holders and identified the key attributes needed for a graduate to sustain in the industry. These key attributes include skill, performance, adoptability and communication (SPAC). Even though Outcome Based Education (OBE) has become an integral part of engineering education in India since 2015, it has failed to ensure SPAC. We opine that, there is an immediate need for disruption in the process engineering education.

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