

Engineering Education

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Abstract: Engineering education plays an important role in the development of the country, industrial production technology as well as science. It should provide analytical ability, experience, creativity, communication skill, ethics business and management ability and lifelong learning. It should have more focus on cultivation on practical and innovation ability as well as the cultivating way is important in engineering education. Engineering education is teaching mixture of mathematics, design principles, science fundamentals, state of art and emerging technologies that are applicable to industrial process and research oriented careers.

Keywords: Analytical Ability, Creativity, Lifelong Learning Innovation Ability, Emerging Technology.

I. INTRODUCTION

When we think of engineering education, suddenly comes to in mind is different courses, laboratories, assignments, submission, internal examinations and examination conducted by university. As students often focus on inevitable deadlines and big picture of how all these pieces are connected and shaping the way we think and take forward the problems. Engineering faculties around the world are perpetually reviewing and transforming their curricula based on emerging trends, feedback from concerned industries, accreditation bodies like the Accreditation Board for engineering and Technology like AICTE, meanwhile technical societies like IEEE, ISTE and many more to ensure that their graduates are prepared for an ever changing world. Like everything else COVID-19 has had a drastic effect on engineering education, as temporary stay at home orders the forced professors to quickly change and adapt the vibrant learning culture to achieve impressive outcomes because it is essential to meet the needs of the new students and communities to serve with agility and innovation. Although some changes will revert back once in person classes resume, many innovative techniques for delivering content have emerged that will likely to evolve for years to come. Breakthrough is essential to meet the needs of the new students and communities to serve with agility and innovation. Breakthrough create a vibrant learning culture to achieve impressive outcomes. With the help of stakeholder continuous input, focused planning and in person traditional activities which depend on human connections can be transformed into meaningful virtual experiences. The advances in information and communication technology (ICT) offers incredible promise for improving teaching and learning process.

II. STUDY CONTEXT

2.1 Engineering Education Scenario in India

For the development of technical education in India Indian Institute of Technology, Indian Institutes of Management and Indian Institutes of Science were established. These institutions were aimed to produce competent and hard core intelligent engineers and scientists that would change the outlook of India in global prospect. Earlier India was known for holy places, yoga and meditation, but now renowned for intelligent engineers. In India the technical education starts from basic like craftsman to the post-graduation level, in which each level has its significance. All India Council of Technical education (AICTE) approves engineering colleges in India.

2.2 Brief History of Technical education in India

Education is considered as the main tool for social change. Technical education is important component of education system, where people are trained in skilled and semi-skilled activities. Technical education is also considered as primary and essential input for the overall development of society and the nation. At the end of World War II, India became independent, Government of India has focused for the study growth of the technical education upto to the end of THIRD Five Year Plan(1961-1966) . Both the world war was required so many number of engineers and technicians in India. The

Central advisory Board of Education appointed a Technical Education Commission to promote scheme for expansion of the technical education in India with the establishment of the All India Council for technical Education (AICTE) by the resolution of Government of India.

III. GROWTH OF ENGINEERING EDUCATION IN INDIA

At the time of independence there were only few number of engineering colleges. Indian Institute of technology (IITs) impel by the recommendations made by the Sarkar committee, and five IITs were established like Kharagpur, Bombay, Madras, Kanpur and Delhi. Later on sixth IIT was established in Guwahati to meet regional aspirations. Thomas college of Engineering and subsequently the university Roorkee was made seventh IIT in 2001. Six more IIT were started in Bhubaneswar, Gandhinagar, Hyderabad, Patna, Jodhpur and Roper in 2008 and two more in Indore and Mandi in 2009. After IIT, the next tier institution is National Institute of Technology, there are 30 NIITs with liberal funding from Central Government and autonomous structure.

3.1 Privatization of Engineering Education

In the early 1980's, there were about one hundred engineering colleges with intake capacity 25,000 students per year. Government institutions were insufficient to cater the demands of the industry during successive Five Year Plans and particularly with the implementation of the policy of liberalization and globalization. This forced the Government to allow and facilitate the private to setup technical institutions on self-financing basis, hence there has been a mushrooming engineering institutions. This mushrooming growth was opposed by academic community, as that time, as they thought this would decrease the standard of engineering education. Today India produces more than 1.5 million engineers from around 3500 engineering colleges annually. The quality of education in few of these colleges is very unbalanced, these colleges are failing in providing basic facilities required for engineering education and as well good qualified teachers. But few of the colleges have excelled and are as good as or even better than many of the government colleges today. In spite of this varying standards of college India has benefited from this growth. India's glorious heights in Indian industry has touched in past decades. Deemed universities have also mushroomed, with a consideration that they would bring depth and variation in education system.

3.2 Professional Development of Engineering Teachers

Teacher Education has confirmed the positive correlation between effective professional development and improved teacher practice, in order to improve the student performance[3]. The current emphasis of professional teacher preparation programmes in subjects like Science, Technology and the internships, which we require new strategies and efforts to understand and explain the nature of professional development for teachers of engineering both as a context for teaching and learning in other subjects and unique discipline[2]. One of the most important aspect for effective professional development in the literature is the quality improvement of teachers content knowledge[5], which indicates a positive correlation between content focus in professional development and increased teacher knowledge, improved pedagogy and moderate enhancement in students achievement[6][7]. Research shows that practicing strategies for success in engineering is highly effective in developing teachers context knowledge. The Professional Development of engineering teachers should support the evolution of their pedagogical skills by building a learning community and analysing how engineering design and problem solving offer a context for teaching standards of learning Sciences, Mathematics, Language, Arts and all across other subjects.

The professional teacher preparation programme should also empower the teachers to appropriate curriculum instructional materials and assessment methods. Researchers have claimed that "to establish a firm foundation for improved student outcomes, teachers must integrate their knowledge about curriculum, and how to teach it effectively and how to assess whether students have learned it".[8]. In today's context engineering education should not be limit just to transfer the knowledge. Today context engineering education should be more than just a transfer of knowledge. The 21st century skills such as creativity, innovation, communication, critical thinking, interpersonal skills, collaboration and team work should also be incorporated in the curriculum and pedagogy are mentioned in "Washington Accord", "ABET" or other Accreditation Bodies/Authorities. [9]

Professional development programmes for engineering educators must be flexible enough to meet the needs of teachers, students, employers, academic authorities and government bodies. Engineering teacher preparation should be designed and imparted in such way that teachers would be encouraged to ask themselves that by which concepts can be learned through a specific activity, what students are actually learning and which concepts can be learned through a specific activity, what students are actually learning and which aspects of the activity are most effective in learning, what opportunities to connect and reinforce learning from the content areas. Following characteristics are required for effective professional development:

1. It should be reform oriented such as grounded in inquiry, problem solving and experimentation
2. It must engage students, teachers, parents, employers, educational authorities as well as a wider community through collective and collaborative participation.
3. It should involve the participants in active, in depth learning activities.
4. It should be based on well-defined image of effective classroom learning and teaching.
5. Focus should be both on content and pedagogy and based on global culture context.
6. Should have the mechanism of continuous improvement, evaluation and follow up.

3.4 Setbacks and Challenges

The quantitative growth and of engineering education in India has increased the opportunities for engineering graduates and has contributed to nations growth. Due to lack of maintaining quality has become the victim of this growth phenomenon. Lack of maintaining standards in institutions and failure to monitor the same by regulatory bodies is the main factor responsible for Today's scenario in the country.

Undergraduate Engineering Education: Self-financing private engineering colleges are providing more than 85% engineering graduates in India. National Association of Software and Services Companies (NASSCOM), survey found that less than 25% of the graduates are employable. The factors lead to poor quality of education are:

1. Shortage of qualified knowledgeable faculty
2. Inadequate physical infrastructure and funds
3. Lack of autonomy.
4. Rigid and outdated curriculum
5. Poor quality of Training
6. Lack of R&D Activities
7. Poor learning quality
8. Ineffective collaboration with industry

3.5 Current Needs

1. The students of engineering colleges of each state should be given apprenticeship and on the job training opportunities and this will widen the availability of trained human resources to the industries of the region, as well as placement opportunities of the students in the industries and service sector. This will enhance the research potential of the industries.
2. Because of Globalization industries produce standardized, calibrated and quality products, institutes can help industries of the region in providing easy access to this.
3. Institutions should focus in changing labour markets and students' interests.
4. Private institutions are far more adaptable and non-formal provision is better in responding to the students' demand. Therefore, combination of public and non-public provision for higher education and training provides an optimal solution would meet the changing needs of economy and society.
5. The unified education and training system are best suited to respond to changes in the competitive, global job markets.
6. Our education system is designed for those who wish to pursue higher studies in universities or technical institutions, making no allowance for those who do not have the aptitude for the higher studies. Students either drop in higher secondary school or enroll in degree colleges for want of anything better to do, this results in large amount of unemployable graduates.

It is important for India to understand what it takes to achieve excellence and how to retain it for decades together.

Mashelkar[4] identified following Criteria:

1. Totally uncompromising supremacy of teaching and research
2. From the frontiers thrust not only on working repeatedly but creating new frontiers, implies to lead not just to follow.
3. A determined emphasis on selecting the very best or both in faculty and students on a universal scale, meanwhile promoting talented and proficient faculty will be detained. Everlasting commitment to true institutional liberty in all matters, with no political interference.
4. The National Board of Accreditation (NBA) is entrusted with the task of periodically evaluating technical institutions and programs based on norms and standards for the accreditation of Engineering Colleges laid down by the All India Council of Technical Education.

Commented [D1]:

IV. EDUCATION IMPLICATIONS

Even though some reputed higher education institutes make substantial progress in preparing engineering students as industry ready professional graduates, still we need to go a long way because of global nature of engineering organizations, technology infiltrations, multidisciplinary of the problems, diversity in worlds cultures etc. The higher education system and accreditation agencies along with their constituent bodies must collaborate with industries to share the best practices, to update their academic/research programmes and equip with contemporary latest technology tools, to be the part of active global players in the world market. To implement this following points to remember

1. Offering different types of courses as breadth electives, thin specializations, micro credit courses in various technical, skills related or interdisciplinary subjects to the students during 04 years.
2. Encourage and reward faculty members to carry out a globally relevant research, which are compatible with the needs of a globalized world.
3. Incorporate student exchange programme as a part of internship/on-the-job work experience international academic experience.
4. Integration of latest technology, tools and new pedagogy of deep learning into the curriculum.
5. Partner with other universities(worldwide), centers of excellence, professional bodies and global industries through sponsoring workshops, seminars, expert talks and collaborative projects.
6. Establish a global standard in relation to accreditation and quality assurance, introduce standardized evaluation system for measuring students learning outcomes and teacher's professional competencies.
7. Adopt flexibility yet objectivity in introducing new courses, programmes, placement/career development workshops/hands on experiences, strengthen the international networks and be a part of international ranking system.

V. CONCLUSION

There is an urgent need to address the problems ailing the technical education, India will miss the opportunity to utilize its demographic dividend of a young work force which it has. For ensuring standards as per global norms and monitoring mechanism for the same, dedicated attitude is required. In this context, India becoming a permanent member of Washington Accord is significant step. In India education needs to be more skill oriented-both in terms of life-skills as well as live hood skills. India has man power to substantially meet the needs of a world hungry for skilled workers provided its educational system can convert those numbers into a skilled work-force with needed diversity of skills. Hence we need to promote partnership between NGOs, private sector and public sector, along with increasing scope of apprenticeship training in service sector, informal sector and tech sector.

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