

CASE STUDY: FUTURE CHALLENGES IN ENGINEERING EDUCATION IN PAKISTAN

Muhammad Mahmood Aslam Bhutta ¹, Muhammad Aftab Ahmad ², Syed Amjad Ahmad ³, Amanat Ali Bhatti ⁴, Shazia Hayat ²

¹ Department of Mechanical Engineering, University of Engineering & Technology, Lahore, Pakistan.

² School of Engineering & Technology, ICBS, Lahore, Pakistan.

³ Faculty of Mechanical Engineering, NFC Institute of Engineering and Fertilizer Research, Faisalabad, Pakistan.

⁴ Department of Petroleum Engineering, University of Engineering & Technology, Lahore, Pakistan.

*Corresponding Author: bhuttathermo@yahoo.com

ABSTRACT: *Training of engineers for the purposes of initiating, assisting and executing the technological for the development of a nation is obtained by engineering edification. . This paper present the elements identified keeping in view the current scenario of our Engineering Education system along with the problems being faced by this sector. The major problems in education system like lack of funding by Government, Professional training of teachers, and non-availability of latest equipment in Labs are discussed. Further, it explains the formidable challenges faced by engineers due to the gap between public sector universities and industries. It is concluded that with initiative of research projects, proper planning and improving the methodology of teaching can not only improve the ranking of the university but also resolve the problems of engineering education to greater extent*

Keywords: Engineering Education, Sustainability, Challenges, Global Profession

INTRODUCTION

Engineering and particularly engineering education is a solution to the challenges that we are facing today and is vital for building a more livable world. Engineers are the most paramount part of any country. They are the starters, performers, facilitators and achievers of technological development for a nation. Engineering compared to any other profession has a direct influence on nation's well-being. Engineering benefaction are globally visible, ranging from mechanical engineering, civil engineering, electrical & electronic engineering, aeronautical etc. Inevitably engineers can perform as changer not only for technical systems but also for many other social and economic systems. The unique identity of engineering education makes its distinctive in content and approach, thereby demanding special care and attention. Engineers are expected not only to solve technological problems, but also social and economic problems in sustainable ways. For this they must acquire themselves with modern engineering concepts, theoretical principles and their practical applications. The aspiration of stakeholders to achieve this has been met with a lot of challenges. For our inefficiencies to tackle these problems they have put us on a low level of technology. The difference that lies in developed, developing and underdeveloped countries is that the developed nations convert scientific ideas to technology while the developing and underdeveloped countries are yet unable to do so. The challenges alleviating the training of engineers are many, but a few of major ones are discusses below:

MAJOR CHALLENGES

For Pakistan to meet the future challenges we have to aware ourselves with many aspects of engineering education

INDUCTION OF THE SUSTAINABILITY CONCEPT

The framework of UNESCO says that "sustainable development is the result of a process in which ultimate decisions about ecology, equity and economy of all communities". Furthermore, it states "this vision of education

will help the resident of this world to understand it in a better way" [1]. For social progress and in order to attain the goal of sustainable development, higher education is mandatory. The issues of promotion of peace and understanding of the crisis across the planet as well as reduction in poverty can be strengthened in this manner [2,3]. The field of environmental engineering has also adopted the sustainable education for their curriculum. But the worry is about the students of other fields of engineering who are not directly linked to the sustainability concept. Almost all the engineering subjects are taught with minute global awareness with no reference to the practical world's technological, cultural and ethical issues[4,5,6].

These issues have made it important to include the sustainability to the teaching curriculum. For this purpose, we believe that engineering should take the leading role in this regard. Minor cases have been noted around the world that many engineering institutions have already added sustainable education to their curriculum. But majority of educational institutions have no programs for their students in this regard. This issue is to be taken into serious consideration, particularly by engineering institutions, on the basis of the assumption that engineering field should take leading role for sustainable education prevailing [7].

As stated by the World Federation of Engineering Organizations (WFEO), to meet the future challenges of society, engineering graduates must possess relevant knowledge and proper skills. Australian engineer, incoming WFEO president and former president of Engineers Australia Barry Grear (AO), questions, 'What aspirational role will engineers play in that radically transformed world? An ever-incrementing ecumenical population that perpetuates to shift to urban areas will require widespread adoption of sustainability. Demands for energy, clean water, clean air, safe waste disposal, and conveyance will drive environmental bulwark alongside infrastructure development [8].

TRAINING OF THE TRAINERS

It is essential for engineering educators to have knowledge about the requirements of a graduate engineer, so they begin responsible provision of the required knowledge and develop appropriate skills. So a range of incentive mechanisms should be considered by professional bodies and universities. Some of the incentives are:

Allocation of funds for educators to have knowledge in a new field , Provision of a budget, research assistance, for teachers to renew their existing courses, division of resources to do a desktop review of contemporary courses within engineering, encouragement through funding opportunities (e.g. minute grants) for university staff to explore research opportunities in this area[9].

FUNDING

The primary source of funding comes from the federal government and the budget allocation is only 2% of GDP, which is in contrast to the recommended budget for engineering education by UNESCO, which is 4%.this budget further gets diluted because major part of it is absorbed by primary and secondary schools and liberal arts and medical universities and a fraction of it is only dedicated for the engineering education. This is in contrast with other developing nations which spend twice more on technology. The lack in funding in the technology sector results in lack in research ;although over the past decade money has been poured into this sector, but majority of that money was spent on building universities and basic infrastructure and research centers ; but for research to happen these centers require annual funding for which the current budget allocations are not sufficient. Graduate research , doctoral and post DOC research requires money in the amount of millions which needs special allocations in the budget .Another important reason why universities lack in revenue is because these are not self-sufficient, the wholly depend upon federal funding and don't generate much revenue of their own . Although in the past decade initiatives have been taken by the government to encourage universities to generate their own revenue but these efforts have proved fruitful only up to a little extent. If universities are made wholly or partially self-sufficient the surplus budget can be allocate for research.

FACILITIES

Students are categorized mainly in three types: the verbalizers, the visualizers and the doers. Information is easily learned by verbalizers if it is spoken or in written form. Lectures, tutorials and handouts are beneficial for them. Information is easily learned by visualizers if it is presented in diagrammatic or pictorial form with the help of multimedia. If the lecturers present information by practical demonstration, doers will better understand it. Both the visualizers and doers are in trouble due to inadequate facilities. Greater strength of students in the class puts the verbalizers in difficulty. So the current pedagogical system is favorable only for the small proportion of students. The lack of multimedia equipment in classrooms and labs, especially causes a lapse in student's key concepts which they could have acquired with aid of multimedia. The power shortage in

the country combined with 6 months of summer makes classes and lectures unbearable for students .only few universities have backup systems and their own power plants the rest need funding to design their own power plants or a backup system

LABS

Most of the lab apparatus in our public sector universities is analogous or mechanical and the data obtained from the experiment is physically recorded and then mathematically analyzed which is in today's engineering education system is outdated. All the top engineering universities have DIGITIZED labs and data from experiments is digitally recorded and then computer analysis is done by the students, and the data and the results thus obtained are plotted and printed on the graph with the aid of computer. This is considered a standardized method of engineering.it ensures reliability of the results, plus it is more helpful as it familiarizes the students with on field methods.

BRAIN DRAIN

Emigration of highly trained professionals, Scholars, and Experts in engineering from universities to other countries is termed as brain drain and they play critical role in the socio-economic and technological advancement. Different types of brain drain are faced by our engineering education sector:

- Professionals who peregrinate to the industry, which provides them better accommodations.
- Engineering students who go abroad for higher education and then used to live and don't come back to their home country.
- Adroit professionals are indulged into other unrelated economic activities so they can't devote their full attention to their job.
- Another reason of this phenomenon is inadequate pay packages for lectures and lab engineers which drives them away from the profession of teaching and research to other jobs like executive positions. Most Engineers prefer to do MBA and opt for an executive office job which has less to do Engineering and more to do with decision making. This results in country losing valuable human resources in technology sector.
- Due to inadequate facilities for research at masters and PhD level most engineers prefer to opt for European and American universities for further education and many of them don't return to country after the completion of their education due to lack of incentive provided by the government.

SEMESTER SYSTEM

Semester system hasn't really kicked off in Pakistani universities. Though this system is very successful and has across the board acceptance in western universities. In Pakistan it has faced a lot of resistance since its adoption in the early 2000 and up till now university teachers and students haven't really implemented and exploited this system to a great extent. One of the prime reasons of its failure is its unpopularity among the senior professors. Most of them have studied according to annual system and they are

not very much comfortable with the concept of semesters. Teachers lack the capacity to structure their course according to the semester course. They normally pile up course and in the end have to arrange for extra classes in which a large chunk of course are covered just a week before examination. Initiatives have to be taken to familiarize teachers with the semester system so they can exploit this system to its proper strength. One of the benefits of semester system is the concept of Extra credit hours. It essentially allows students to customize their course and add a course of their liking to their degree by getting it approved by the advisor. Only a couple of universities in Pakistan are adopting this useful concept the rest encourage their students to follow the same curriculum set at the start of the year.

For example

A student of mechanical engineering is interested in Control system and artificial intelligence. He can take an extra course from mechatronic department on BIO mechanics, maybe an extra course in programming and a course in modeling and simulation. These extra courses will go into the degree. This way a student can customize his course while taking his Mechanical engineering courses at the same time.

A student interested in Astronomy as a hobby can take a just for fun course in astronomy.

International universities offer students the privilege of customizing their courses, they even provide them with the option to start an entirely new course in the university provided they have at least 15 to 20 students willing to take that course.

GENERAL METHODOLOGY OF TEACHING

The course structure and no of credit hours for different Engineering disciplines have been modeled on International standards and is set by the Higher education commission (HEC) of Pakistan and is adopted by all Public sector resources.)

DIFFERENCE BETWEEN THE SCOPE OF WORK OF AN ENGINEER AND A TECHNOLOGIST

In general, the distinction between an engineer and a technologist emanates primarily from differences in their inculcation. Conceptual development and design skills are connected with engineering programs, whereas technology programs are focused on the application of designs. The stability between theory and practice provides physical insight and understanding, equilibrium between the world of an engineer and the world of a technologist [10].

ENGINEERING BECOMING A GLOBAL PROFESSION

Engineers are not only serving in the country where they received their inculcation but they are also serving in other countries. Internationalization/globalization is the main force which is responsible for the mobility of the students. Each country differs in its laws, culture, standards related to education and in utilizing the engineering knowledge. Surely, this process of mobilization will be higher in the major tradeoff for unions for example European Union, the Asia Pacific area and the America. Instant worldwide communication is also playing a dynamic role for developing

universities. But in reality due to lack in teachers training, the teaching staff is not entirely familiar with the methodology. They lack the knowledge of how much emphasize should be given to design and how much on theory. Due to lack of coordination between lab and theory teachers and students often find themselves performing Experiments that they have no scientific background of or they sometimes memorize chunk of theory books without actually realizing the practical implications and applications of their knowledge.

ROLE OF INDUSTRY

In determination of research agenda, neither the industry leaders are concerned about it nor do they participate in the refining of engineering curricula. As a result of this, two sectors are operating at different positions. There is a visible gap between the industry and the education sector some of the courses taught a little application in the local industry, but are still taught keeping in line the international model. Steps need to be taken to make collaborations between the two sectors so engineering programs can be structured to suit the needs of the local industries. The research units of the multinational companies are located in their home countries and only assembling is being done in the host nation. Among other one reason is because they feel a gap between the technology and the human resources of the host country. If industries and universities are brought closer courses can be reconstructed to meet the needs of industry plus students can learn a lot about what they are expected to perform once they complete their education and step into Field work.

POLITICAL/GOVERNMENT ROLE

Generally, edification, including has not been given proper attention. So the biggest challenge for engineering educators is to convince the lawmakers that why they should give priority to engineers in allocating worldwide practice of engineering knowledge and engineering edification. It is a sham for the world engineering profession to identify this situation and to take steps to fix this orderly transition into the universal practice of engineering and the edification of engineering in particular.

CONCLUSION

For Pakistan to prosper further in the field of science and technology the challenges that are addressing engineering must be identified and adequate resources must be allocated to bring a positive outcome. Engineering graduates should implement their scientific concepts to solve real world problems. Their jobs involve innovative theoretical concepts such as designing of new products e.g. robots application in automotive industry. They must acquire themselves with modern theoretical, scientific and mathematical knowledge. Moreover universities and colleges have started 4- year and 2-year engineering technology programs preparing students for production works in growing industries. While graduates of 4-year engineering technology programs place and conserve products, making available a wide range of services e.g. implementation of design, testing, calibration and supervision of its operation

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