Improving the collaboration between academic and industrial organisations in engineering and technology education

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ABSTRACT: Engineering and technology education today has reached a crossroads. On the one hand, this is because of the need to keep the curriculum and syllabus of the subject at educational institutions up-to-date and, on the other hand, the pace of development of information technology makes this difficult to achieve. Information technology affects both the development of various institutions' teaching methodology, as well as the actual contents of the curriculum and syllabus. Another reason for the difficulties facing engineering and technology education is that the nature of the student input is entirely different from that planned for. Today's students are influenced by the impact of information technology on their daily lives. The same impact is there on the quality of teachers. The educational content and standard of teachers, as well as the nature of students as input to education; the administration and management of the educational system; and the degree of influence of IT, should be analysed critically so as to design a flawless, adaptive, time-sensitive and modern educational system, thus, removing engineering and technology education from the crossroads it is at.

INTRODUCTION

Although engineering and technology education has advanced over the years, the actual rate of advancement is not commensurate with the advancements that have been achieved in the products and services of technology and engineering [1-6]. Therefore, the gap that exists between the two, as well as the digital divide that makes the gap even wider, is the subject dealt with in this paper. At the heart of the stresses between educational provision in technology and engineering, and the rate of change of the technology itself, are the practitioners and users within the present system who can either influence the need for change or create the change themselves.

ENGINEERING AND TECHNOLOGY EDUCATION AT THE CROSSROADS

Technical Education and the Rate of Change of Technology

Engineering and technology education is perceived to be at the crossroads between technical awareness in educational institutions and the rate of change of technological and engineering products and services. In this regard, it is necessary first to state the key groups who constitute higher technical education. These groups are: the policy makers for education, the managers of technical education, the academic administrators, as well as the students, parents and other stakeholders who are active users of the services of the institutions. Last but not least, there are the industries which participate in the processes of technical education.

Collaborations between Academia and Industry

Apart from the key groups that make up higher education, there is a range of collaborations between academic institutions and industrial organisations. These collaborations fall into six main areas as shown below:

- Participation of subject-related industries in the academic process;
- Participation of any industry or organisation in the academic process;
- Participation of industries and organisations at local levels (within 15 km radius);
- Participation of industries at country level;
- Participation of industries and organisations at an international level;
- Participation of R&D institutions in the academic processes, including the promotion of research.

From the point of view of industry, they face technical problems and technological issues. Mostly, the technical problems are solved within the industry itself. However, issues of a technological nature may require research and development (R&D) work, leading to a consequent solution. Industries very typically need the support of academic institutions in solving problems such as these.

Support Sought by Industry from Academia

To source the right solutions to their technical problems, industries essentially need the academic institutions' support and in some cases this involves R&D. This requirement for support is evident across a number of areas in industry; for example:

- There are few industries with R&D facilities that can take up problems in-house. Industry personnel involved in the R&D would love to involve senior academic faculties and research staff in sourcing solutions they look for from the academic institutions.
- There are industries that will wish to minimise risk and, hence, will depend fully on the help provided by academia for getting solutions.
- There are only a few industries which are fully self-contained and, hence, do not need to have any involvement with academic faculties or students.
- From the research and training point of view, certain industries do not encourage either the students visiting or training or the research from the associated academic faculty.
- On the whole, industries look for collaborations with academic institutions only for gaining knowledge on the R&D side and a wish to promote their business.

INDUSTRY PERSPECTIVE

Importance of Student Visits and Placements

Where industries are subject-related, the involvement of, and interaction between, both industry and academia is vital to the educational process. It is highly essential that students be exposed to the developments in the subject-related industries. In cases where the industries are not subject-related, general industrial visits and training alone would enhance the confidence of students in these peripheral areas.

Today, there is a tendency on the part of academics to not adequately encourage students to apply for an industrial visit or training place. Teachers place an emphasis on class-room teaching as the main thrust of their efforts to carry out the syllabus.

Only 20 Percent of Engineering Knowledge is Gained through Classroom Teaching

It is an agreed norm that only about 20% of what an engineer should learn is taught through classroom teaching and the remaining 80% of knowledge needed for the full development of an engineer is acquired outside the syllabus or classroom. Readers will be fully aware that 20% of the knowledge is described in texts required by the curriculum and syllabus.

The other 80% of the knowledge is not fully available in the written form and has to be acquired by other means, e.g. practical experience or industrial placements. It should be pointed out that a decade ago, a student's time would be allocated to various industrial apprenticeships or training schemes to learn about the 80% of engineering not in texts. An individual student could take time on other activities, after completing their engineering course. However, these days, given the pace of advancement of technology, this is now decreasingly possible.

SYLLABUS

Some Subjects are Rapidly Outdated

A careful analysis would reveal that a syllabus designed for students is invariably revised once every ten years and, in some cases, the revision interval is every seven years. According to a few leading academicians, the syllabus for general engineering disciplines becomes outdated in three years and some are outdated in one and a half years, particularly if the subject is computer science and information technology.

On average, a student takes four years to complete an engineering course, whereas the syllabus remains in vogue for at least seven years. Invariably, the student comes out of an academic institution having been taught with an outdated syllabus. This is true, even if he or she achieves First Class Honours with Distinction, and even if the institution is rated highly in the area. In order to bridge the gap regarding this discrepancy in the learning system, the student is forced to learn part of the 80% component while he or she is studying the course.

An interesting outcome of the above analysis is that industry may not show an interest in employing students because of their backwardness caused by the outdated course. The consequent effect is that prospective students may lose interest in taking on an engineering education.

RESPONSE OF POLICY MAKERS

Resistance to Change

The people who serve in institutional policy making teams and the administrators who manage the technical and engineering education field should be alerted to the situation as it stands. Careful analysis indicates that the policy makers who are longstanding employees and entrenched in their positions, are not prepared for the required revision of and upgrading of the relevant policies. Equally, administrators of technical and engineering education do not have up-to-date technological expertise and, hence, are not in a position to introduce changes needed to meet the technology gap.

Obsolete Decision-making

The advancements in technology are making the policy makers and administrators of technical and engineering education obsolete in the decision making process. As a consequence, students receive an education that is outdated. With the impact and widespread use of information technology and the Internet, the digital divide between the technology to be learnt and the learners of technology has widened. As long as the teachers continue teaching in the conventional way, there is bound to be an even greater technological divide in the educational system.

IMPACT ON STUDENTS

Risk of Low Interest and Poor Intake

The present situation may result in students showing less interest in studying the subject and, hence, could result in poor intakes for engineering and technology education. That is the risk. Every day, the influence of information technology on people’s lives and on services is increasing and, hence, the dependence by people on technology is increasing every day. The more that the population depends on new technologies for its living, the more it will need the services of skilled and trained manpower.

Perhaps today, there is indeed a lack of interest by students in engineering and technology education. But, this situation will change and the demand for engineering and technology courses will multiply manyfold in the near future.

Bridging the Divide: Continuing Education and Technology

In order to bridge the technology divide, it is vital that use is made in the teaching and learning process of the existing technology and software applications. Educators need to use on-line forums for inculcating the specialised knowledge that exists in cutting edge technologies. This is true also for those who have passed their programmes of study and are in the profession, keeping in mind that education does not end upon acquiring a degree or diploma.

Continuing education (CE) gains credibility where short courses on specialised and skilled subjects are offered on a stand-alone credit course, as these enable the learner to acquire more credits in the related disciplines. These also enable him or her to receive a diploma or degree. Globalisation of such credit courses would enable the international universities to enter this global education market and offer courses of importance in the related discipline and, by this way, can contribute to bridging the gap in the technology divide.

CONCLUSIONS

From looking at the present problems generated by the speed of technological change and the requirement for key interventions to bridge the digital gap, it was found that regular academic institutions should without delay adopt the latest in technologies into their curricula and syllabi and, thus, help to reduce the digital divide. They must introduce innovations into the teaching methodologies, as these would enable the student to learn about current developments in technology that would, then, equip him or her for the challenges raised by industry needs.

Once the digital gap is reduced, acceptability of students and graduates by industry would increase. It would be a benefit if industry earmarked, say, about 10% of their profit for a continuing education programme for their own workforce; thereby, connecting with the academic institutions that are offering the continuing education programmes. This would accelerate the process of bridging the gap between the academic world and industry.

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