ENGINEERING EDUCATION FOR KNOWLEDGE SOCIETY

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Abstract

Engineering educators today must teach academic disciplines which encompass a greater range and depth of technology than ever before. Engineering graduates, on the other hand, are expected to combine detailed understanding of a subspecialty with the flexibility to adapt to new technologies, interdisciplinary challenges and a changing marketplace. A solution to this apparent dilemma can be found by considering a new paradigm for engineering education, which places specific engineering disciplines within the context of information technology. This paper outlines the current scenario and reviews the possible solutions.

1. Introduction

The scale of current economic and social change, the rapid transition to a knowledge-based society and demographic pressures are all challenges which demand a new approach to engineering education and training. Present education is under process of radical change in response to various factors like development in information technology, communication, bio technology,, globalization etc. Linked with this, new areas of study are emerging in higher education in order to meet the vocational and professional needs of students. In this century, a new society is emerging where knowledge is the primary production resource instead of capital and labour. Efficient utilization of existing knowledge can create comprehensive wealth for the nation in the form of better health, education, and infrastructure etc. for improving the quality of life.

Today's engineer must be able to see beyond technical issues to the social implications of technology, adapt to the rapid fluctuations of the consumer market and new technologies, solve interdisciplinary challenges, and combine a depth of knowledge of a subspecialty with the breadth of understanding required for real-world engineering.

In recent years, even as these demands have increased, engineering education has actually become more fragmented and more constricting with the continued expansion of technology. Alice Agogino states that we are

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producing engineers who are "narrowly focused and not prepared for the competitive pressures in industry today".

Information technology is another area that holds immense possibilities. Virtual classrooms and virtual universities may serve the needs of continuing education and further education at least for those who can afford to have computer facilities. Computers and use of CD-ROM for carrying lessons have already become popular, and will bring about revolutionary changes if we could tap their educational potential imaginatively. Development in the past meant, by and large, economic development. Today we recognize three aspects of development: social development, political development, and economic development. The computer revolution has brought about a paradigm shift in teaching the effects of which are visible in both the teachers and the taught. Worldwide, the educational scenario has experienced a movement from blackboards and classrooms to the WWW. With the emergence of computers, connectivity and convergence, the way people learn has also changed and more and more people prefer to learn on-line. UNESCO report has highlighted the fact that 6,150,000 people have worldwide enrolled to learn on- line in 1999.

2. Globalization of Engineering Education

The higher education environment has changed significantly since independence in our country. This century, however, will see engineering education radically redefined in response to information technology. The pressure on institutions will come from outside the educational community. The workplace has already adjusted to benefit from the productivity gains, which are the rewards of exploiting information technology. The job market is increasingly demanding computer-literate workers. The use of educational technology in the field of engineering education system is increasing; however, the rate of improvement falls far short of the requirement. While the number of computers in the colleges continues to increase, there is not much evidence that their introduction is having a significant effect on curricula or how teachers teach. This needs to change quickly if the engineering graduates are to be responsive to the challenges of the global economy. All these changes due to globalization will have following basic implications on engineering education in our country.

- Tackling rapid obsolescence in engineering knowledge / techniques / technologies.
- Design education in multidimensional societal and global framework.
- Problem solving in fuzzy environment.
- Processing information and discarding what is irrelevant.
- Evaluating solutions for local relevance and eco-friendliness.
- Understanding biological systems and their interface with engineering.
- Exploring financial resource generation from sources other

than state support.

- Need for stricter quality assurance in market-controlled growth of engineering education.

Internationally trained professionals are able to address cross-border and global problems from an international and inter-disciplinary perspective, and to work with people from different national and cultural backgrounds. Internationalization of technical education must involve active participation by stakeholders from the government, private sector, community, and voluntary organizations. The tendency to commercialize education is increasing more or less everywhere. The globalization of the economy is acting as a powerful catalyst in this process of transformation whereby a sector traditionally regarded as a public service is turning into an increasingly attractive market for major national and foreign corporations. Although the international trade in education services is not a new phenomenon, it is today assuming new forms and undergoing a rapid expansion. The quest for new sources of funding and new investors is already pushing a number of university institutions down the slippery slope of commercialization, with all the negative consequences this may have.

3. Lifelong learning

Lifelong learning is about acquiring and updating all kinds of abilities, interests, knowledge and qualifications from the pre-school years to post-retirement. It promotes the development of knowledge and competences that will enable people to adapt to the knowledge-based society and actively participate in all spheres of social and economic life, taking more control of his or her future.

Learning opportunities should be available to all on an ongoing basis. In practice this should mean that people have individual learning pathways, suitable to their needs and interests at all stages of their lives. The content of learning, the way learning is accessed, and where it takes place may vary depending on the learner and their learning requirements. Lifelong learning is also about providing "second chances" to update basic skills and also offering learning opportunities at more advanced levels. All this means that formal systems need to become much more open and flexible, so that such opportunities can truly be tailored to the needs of the learner.

Effective teaching in higher education matters greatly and although styles, forms and techniques of teaching may alter over time and between locations and disciplines, there is no reason to believe that this will not continue for long to be the case. Effective teaching and learning process forms the bedrock of a dynamic culture and society. Only career-long, continuous professional development and systematic updating in the discipline and in pedagogy can equip teachers and others who support learning, with the expertise and understanding to support student learning. Given the half-life of knowledge, the changing profile of students, the demands of lifelong learning and the potential of information technology, there are compelling reasons why the knowledge of teaching-learning process is more important.

4. Teacher Training

The traditional role for college and university faculty includes a balance of teaching, research, and public service among their activities. However, conventional wisdom has become, increasingly, that the one role for faculty that counts is research, which brings grants, results and publications. This view has brought greater attention to the graduate study and research endeavors of our nation's colleges of engineering. Unfortunately, this has also brought lesser attention to undergraduate study in these institutions. Teaching and research are both important. But the relative weight has shifted over time. It is time for us to reaffirm that education, which is teaching in all forms is the primary task and that our society will judge us in the long run on how well we do it (Edward W. Ernst, 1995). Perhaps the change in relative weight between teaching and research has gone too far and, rather than strengthening education, the significantly greater attention now accorded to faculty research activities has eroded the quality of the undergraduate program. There seems to be much agreement that the culprit is the reward system that recognizes research and publications as the primary, often only criteria for promotion, tenure, and salary increase. In addition, it should contribute to the knowledge and understanding of the discipline. Research, grants, and publications can do this well, but are there other endeavors that meet this requirement? Do the writing of textbooks and other tutorial material, or practice oriented efforts by engineering faculty meet these requirements? Each of these can also be done in a way, which subverts these goals, just as research, grants, and publications can fail to meet these same goals. In addition to or as part of contributing to the knowledge and understanding of the discipline, each faculty member should become an expert about some part of the discipline. The faculty member has a responsibility to maintain this expertise current and contemporary. Even more important, the topic and scope should be such that it has value for others.

Engineering faculty serve as role models for undergraduate students and their endeavors beyond teaching, greatly influence the students of engineering as a career. For a faculty as a whole, these endeavors should reflect the broad range of engineering such as research, engineering design, engineering in industry, social service etc., Although it may be unrealistic to expect many faculty to include experience in all these facets of engineering among their backgrounds, the goal of providing a broad picture of engineering can be realized if the faculty includes persons whose endeavors beyond teaching differ from one another and cover, in this way, the diversity of engineering.

We cannot underestimate the challenge of training teachers to incorporate the computers into their classes. Most educators have no idea where to begin or what to do. Many teachers have never used a computer and cannot afford to purchase their own. History is full of good intentioned examples of technology being bestowed upon institutions with inadequate teacher support. There is a great deal of very high quality educational content already available at little or no cost; yet few teachers have the desire, know-how, energy, or time to incorporate it into their lessons.

Without a focused effort on teacher preparation, technology will have little effect on education. Until teachers use computers themselves, they will have a very hard time imaging what students might do with one on their desk.

5. Conclusion

The application of new technology to education and training is gaining ground. One notices shifts in employment towards informa-tion workers, away from traditional 'unskilled' and 'semi-skilled' jobs. The impact of competition, technological change and micro-economic reform on employment, increasing part-time, casual and contract work leads to the need for people to change jobs more often in a work life. There is growing disparity in income and wealth and increasing cultural diversity. As the Internet and its technology evolves and becomes an influential part of the everyday life, its incorporation into the educational system becomes essential. It is therefore very important that the Internet and its technology become integrated into every classroom in order to prepare the students of tomorrow for their future. Many outcomes will result with gradual replacement of the traditional classroom setting with a technologically advanced one.

The last few years have seen a number of changes in the higher education sector, which have exerted pressure upon the traditional role of universities in particular in the technological developments. Universities need to keep up with technological advances because at the end of the day modern universities have to cater to the requirements of the global market. The more students the more government funding the university gets. However students want the latest resources and equipment so the university that has these will get the students to enroll in them. The challenge facing our education and training system is to create a learning culture that keeps pace with these changes and equips people with the knowledge, skills, ideas and values needed for lifelong learning. Our education system must create students who use information effectively and constantly keep abreast of the technological advances.

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