

Global crisis in engineering education

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ABSTRACT: Irrespective of the region, technical education is facing new challenges of advancement and obsolescence. Particularly in engineering education, due to the lack of dynamic leadership for planning, designing and administration, we foresee set backs in the process of classroom education and, hence, the system is facing a crisis around the world.

INTRODUCTION

Engineering education is an ever expanding subject. Every day more and more advancement takes place in science and technology. As more advancement takes place, more obsolescence follows. This is a phenomenon that is prevalent in education as a whole. However, in engineering education, the foundations of various engineering courses themselves change and, hence, it changes the whole structure of engineering education. As a matter of fact, the structure of engineering education itself changes every ten years.

SCIENTIFIC ADVANCEMENTS

It is understood that the knowledge profile of an engineer becomes completely obsolete within three years if he/she is not in touch with the developments in the respective field. If he/she is a computer science graduate, his/her knowledge profile gets grounded to zero if he/she is not in touch with the developments in computers and the information technology field. It is also understood that the technology and innovations, we see today, are one third of what we would expect to see in the next five years. Our capability and capacity are not adequate for facing the new inventions and innovations. The developments in IT and computers have made the existing system obsolete and redundant.

Faster development in computers and related services sent a shock wave in the sectors where computers were involved. These sectors could not accommodate the speed in development and, hence, recession was the result. The education sector as a whole is one sector where the computers and related services are widely used and, hence, the shock wave has penetrated here very seriously. Consequential developments in computers and allied services have transformed the shock wave into a Tsunami.

The effect of the Tsunami in the education sector is that all our teachers have become obsolete; the teachers who are not in touch with the developments have become redundant irrespective of their age and experience. The educational system and the universities that govern the educational system are headed by people who provide very weak leadership in accepting the challenges in the technology of education.

Administrators of education and policy makers continue to play with the age old technologies and are not willing to accept the changes in technology of education due to the inventions and innovations. Academic seniors are not in tune with the current technologies; some are not ready to accept the new technologies. Unfortunately, our educational system is such that degrees and diplomas are awarded to aspirants through a system called the university. And, such universities are headed by the so-called educational stalwarts. Such stalwarts normally are not willing to adopt the changes themselves. They have limited capacity to accept the new inventions and innovations in the educational methodologies. Faster progress in education and educational methodologies depend upon the vice-chancellors/rectors

and vice-rectors. However innovative these younger teachers are, the whole progress in education is limited to the point where the academic leaders stay.

DEVELOPMENT OF AN ENGINEER

To make an engineer, the educational system provides 20 percent of the sum total requirement through the engineering institutions. Remaining 80 percent is to be absorbed by the student through various mechanisms outside the institution. Pace of learning has been increasing every year. Pace of developments and advancements also increase every year.

A few decades earlier, equipping with 80 percent of knowledge took place after the individual's regular classroom education. Individual had breathing time to concentrate on regular education from institutions.

TWENTY PERCENT EDUCATION

The number of disciplines has increased. Interdependence of subjects from various disciplines has come to stay. This has necessitated the adoption of credit systems in the institutions. Credit systems provided the necessary flexibility for an individual to mix the desired proportion of subjects from various sources.

Formal and non-formal education offer credits. On-line courses also provide credits. Lectures through video-conferencing also provide credits.

Since classroom education has gone through several changes, we are unable to demarcate the thin boundary that exists from formal classroom education to that of distance education.

As the boundary line fades, there is a social phenomenon that creeps in. It is a fact that education in the classroom does not confine itself to the syllabus and the subjects being taught. Two components are added to make it livelier:

1. The teacher adds relevant case studies from the market that are useful for professional development.
2. The teacher adds relevant cases that are useful for life.

The degree of involvement of the above two components makes the teacher come closer to the taught. The students get lessons for life that help in building up character. The degree of mixing of the two components distinguishes one teacher from another.

A student with complete professional knowledge but without the character will be detrimental to society. Hence, classroom education has to be carefully designed and carefully nurtured by experienced teachers. Our educational system is expanding faster; engineering education in particular is expanding faster than the speed at which it is being redesigned. Society has varied demands in the service sector since the quality of life has gone up many fold. More quality and more services in different sectors of life demand trained personnel in each of those sectors. Due to this complex phenomenon, new fields of engineering emerge. Emerging of new engineering precedes the availability of teachers in the new field.

Every three years new gadgets and new technologies emerge, making the existing gadgets obsolete and the existing engineering discipline outdated. A teacher was confined in his/her teaching to *the chalk and talk* method. Now with the emergence of new gadgets, conventional classroom education has gone through sweeping changes.

New gadgets such as models, working models, video clips, on-line video clips, guest speeches, on-site real time work related video clips and such other components constitute classroom teaching. However, the teacher cannot be dispensed with under any circumstance. On the contrary, the teacher has to streamline the various components and his/her individuality of character building into the teaching and make the classroom teaching lively, homely and effective.

The teacher has an additional responsibility to be equipped with new technologies and new gadgets in his/her teaching process with changing times. He/she should be well versed in the subject, well versed in the delivery of the same and well versed in using the opt-technologies and gadgets to deliver the same. In other words, the teacher should be master in the field of engineering that he is teaching. Also, he should be master in the classroom engineering.

CLASSROOM ENGINEERING

Classroom teaching is an art. A person who is well versed in the field of engineering should also have additional knowledge in delivering the same to the student. When a teacher delivers the subject, he/she should ensure that his/her teaching have been received in full by all. It should be absorbed by the students in full. It should be digested by the students in full. It should be in a retrievable form, for the students when it is demanded. This is only fifty percent of his/her job. He/she should be able to deliver character building components that are useful in life and that are useful in his/her profession.

When the teacher is able to cover 100 percent, he/she has mastered the *Classroom Engineering*. *Classroom Engineering* comprises the student, the teacher, gadgets, the room environment, related subjects of the day for demonstration, the degree of obsolescence in the gadgets, the degree of obsolescence in syllabus and such other things that contribute to effective understanding of the subject by the student.

In the components described above, one could identify the quantum variations in each component as follows:

Component-Student; all students are not the same from their basic intelligence; they are not same from their understanding level. They are not same with respect to the time and environment.

Component-Teacher; all teachers are not the same from the point of their teaching. Every teacher has a unique model of teaching and, hence, the teaching process differs from teacher to teacher.

Component Gadgets; as technology is advancing, we get newer gadgets, simpler gadgets, effective mechanisms and more adaptive gadgets to facilitate the teaching process. The state-of-the-art equipment for today becomes outdated tomorrow. Hence obsolescence is engulfing the classroom's gadgets. The related subject for demonstration changes with changed environment and day. This is highly dependent on social engineering.

As explained earlier, classroom engineering deals with transferring subject knowledge to the student efficiently and effectively to enhance the student's professional skills. It must also offer knowledge to enhance his/her character and to improve his/her life skills for honest living.

EIGHTY PERCENT EDUCATION

This component of education is done outside the classroom educational system. This component deals with skill development in the field of engineering, skill development in human relations and skill development in self-understanding. The above three sub-systems do not have fixed boundaries, studying and understanding, and absorbing and implementing varies from student to student; from country to country and from the working environment and from the people with whom the student associates in the learning process.

CONCLUSIONS

Scientific advancements made through research blossoms into advanced gadgets for development purposes. In the field of education, particularly in engineering education, the advancements and Internet tools have been making *sea-changes* every day and, hence, put the education system at the crossroads.

This new phenomenon invites young, dynamic and technologically sound administrators to lead the administration of technical education, be it the university, be in the governmental policy making bodies, to respond to the crisis in global engineering education system in order to keep it in the development track that is sensitive to dynamic changes.