Curriculum Design & Enhancement

Chitralkha Potnis
Academics Manager
Canadian Institute of Management &
Technology
Chitra@cimtcollege.com

Ajit Potnis
Project Engineer
T I Automotive
APotnis@ca.tiauto.com

Abstract

Educational systems are viewed as a coherent system comprising elements such as students, faculty, and methods of imparting education. An engineer is a problem solver. Careful planning to inculcate particular structure of thinking, mental organization and intellectual ability in a prospective engineer is essential.

Engineering is a highly creative profession. Engineers should be able to deal with economic, human, social factors in their profession.

The “crux” of all educational processes is the ‘CURRICULUM’. Curriculum is planned to fulfill a particular objective within specified time and should change the attitude, knowledge and skill levels of the student.

Curriculum design should be considered very carefully. It is essential to know that course duration, course pattern (regular, part-time), entrance qualification, teaching and evaluating system impose limitations on the design. This dynamic process will require continuous evaluation and modification to meet the changing needs of society. Curriculum’s success depends on how well it is implemented. It is imperative that the institute has the necessary facilities for implementing the curriculum and the faculty effectively teaches the course. A continuous evaluation by peers and experts is necessary on a continuous basis to maintain the relevance of the curriculum to the needs in the field.

1 Introduction

Engineering education is undoubtedly an area of vital importance in national reconstruction and development. Right type of education is the key to the

development of a country and its future prosperity. Excellence in technical education is a commendable objective and requires careful and elaborate analysis. Any educational system, especially in the area of technology or engineering is viewed as a coherent system comprising of various elements such as students, faculty, and methods of imparting education, which makes the product more acceptable to industry and society in general.

An engineer is basically a problem solver. A particular structure of thinking, mental organization and intellectual ability is required for the same. Careful planning to inculcate these abilities in a prospective engineer is essential.

An engineer is neither a theoretician nor a technician, but an individual with a unique problem solving ability backed by both practical and theoretical knowledge. Practical knowledge cannot be imparted in the classroom. The theory learnt in the classroom will enable the engineer to solve the problems encountered in real life using a multidisciplinary approach. Engineering is a highly creative profession. Engineers and technicians should be highly trained with the requisite technical knowledge and peripheral skills required to execute their role professionally. They should be able to deal with the economic, human, social factors that impact the professional problems that they deal with.

In engineering education programs, the learner shall be trained for specific jobs. Also, the learner shall be able to deal with the situation arising out of future changes in technology. Thus the student shall be taught the necessary skills and other techniques to perform the jobs and also equipped with fundamental concepts and principles related to his branch of engineering.

The “crux” of all educational processes is the ‘CURRICULUM’. The education imparted should

serve the purpose of bringing the desirable changes so far as knowledge, attitude and skills which determine the quality of performance are concerned. Curriculum is planned to fulfill a particular objective within specified time. Curriculum while dealing with the details of the relevant discipline cannot ignore peripheral topics. Achieving the right balance is key to producing a graduate who will be able to be multi-faceted.

Curriculum design should be considered very carefully as it is essential to know the constraints which impose limitations on the design. They are identified as duration of course, course pattern (regular, part-time, etc), entrance qualification, teaching and evaluating system.

Curriculum design and development is a dynamic process and will require continuous evaluation and modification to meet the changing needs of society. Curriculum evaluation is aimed at assessing whether the objectives for which the curriculum was designed, have been achieved. The success of curriculum depends on how well it is implemented. Thus it is imperative to verify whether the curriculum is relevant to the work, whether it is within the student learning ability, whether the institute has the necessary facilities for implementing the curriculum and whether the faculty had effectively taught the course.

2 Steps in curriculum design

2.1 Step 1: Diagnosis of need

As societal mores and demographics change, the needs change. New needs lead to technological developments to meet those needs. Every time a new technology is developed, it creates a need for people who are familiar with the technology to develop the technology further, develop practical applications of the technology and also to troubleshoot them. Technology is also used in teaching. In today's age, obsolescence is a constant occurrence. A clear foresight is needed to determine what the educational needs will be a few years hence. Curricula need to be designed keeping in mind the projected needs of the society.

2.2 Step 2: Formulation of goal

Once the need has been identified, the next step should be to finalize a goal. Curriculum goals should be centered with today's changing technology. Obviously the goal should be to develop the skills necessary required for the technical environment. The curriculum has to be designed so as to help the student understand

the relationship of engineering principles learned in class and their application in industry. The course needs to develop in the student the ability and desire to continue to learn the newly developing technologies in the industrial world. Developing the process of creative thinking is the crux.

2.3 Step 3: Selection of content

The content selected should be based on goals and objectives of the curriculum and the experience needed by the learner to gain a deep knowledge about the subject.

Due to the ever changing technology, the correct selection of content is very crucial. Both learner and teacher should work together to achieve the desired goals. There is a serious need to remain current by replacing content that may be obsolete to meet the latest developments in technology. This may not be always possible due to the rapid rate of obsolescence in certain engineering fields. In such cases, the concerned teachers need to append additional content to the prescribed curriculum so that the student's knowledge level is not too outdated at the time of graduating. It is also in the institution's interest to do this as this reputation spreads in the industry, and makes their graduates more employable.

The quality of the content and the imparting and mode of teaching needs to be contemporary. In today's electronic age it would be out of place to not to use the latest presentation and teaching tools. It is well known that audio visual aids amplify the quality of transmission. It is not possible for every institution to have working models demonstrating the various principles of science. However, it is easily possible to have audio visuals which demonstrate these. The curriculum cannot be superficial, and at the same time cannot be too overwhelming. The scope needs to indicate the extent and depth of what to cover.

Experts from industries can be called upon in selecting and designing the contents.

2.4 Step 4: Organization of content

Any curriculum content needs to be properly selected and organized. Solid theoretical principles make the foundation strong. There needs to be continuous re-introduction of the main ideas of a topic as you proceed to the next topic or level. This is the spiral approach to teaching, which helps imprint the basics of any subject on the students' minds.

2.5 Step 5: Selection and organization of learning experiences

In addition to textbooks, real life cases should also be presented and discussed. These cases should be related to the topics being taught, and should be pertinent, and current.

Discussions on various problems occurring in the technological front and sharing of experiences help prepare the students for their future as a part of the technologically trained workforce. This makes the learner more confident and will help him visualize and solve future situations arising in industries.

Organizing thoughts and sharing correct experiences with learners supported with appropriate examples will facilitate understanding the concepts. Professors, who are not pure academicians, are of great value in this area. Introducing industry experts to share their valuable experiences to learners on continuous

basis will definitely be helpful in overall development in the standard of engineering education.

2.6 Step 6: Curriculum evaluation model.

Curriculum evaluation is vital in gauging the success of quality engineering education system. The curriculum should be reviewed on a continuous basis by professors teaching the same subjects in different universities, as well as by experts in the field. This would ensure that the topics being taught are current and relevant.

Evaluation of any process has to be based on the evaluation of the product, in this case the students. Exams should be conducted so as to gauge the level and understanding of the student not only against the topics taught, but also against contemporaries from other institutes and universities.

Figure 1. Turtle diagram

3 Evaluation Model

The evaluation model has to take into account the input, the process and the outcome. An evaluation model can be developed using a turtle diagram as shown in Figure 1.

The diagram would visually depict the inputs, the process and outputs, and their interactions, and would be unique to each program and each institute.

3.1 Inputs

All the inputs to the process of developing the curriculum should be listed. Examples could be learners' interest, aptitude, intellectual competence and abilities, availability of competent staff and faculty, availability of resources such as library and internet. The curriculum will have to be tailored based upon the availability of these variety of inputs.

3.2 Process

The process for the topic being discussed is the curriculum design, and not the teaching itself. The turtle diagram in this case should not be confused with one for the teaching process, as this will change the inputs. Therefore, we can have student's feedback and the admission criteria (academic level of admitted students) as the inputs for the process of curriculum design, but the students themselves are not inputs.

3.3 Output

Some of the outputs could be academic performance & personality development of students, extent of employability of the student as per their qualifications

and status, and employers' satisfaction with the performance of students. The average and the highest and lowest salaries offered to past graduates is also a useful input for curriculum design. Businesses that employ graduates offer salaries depending upon how well the graduates' skill sets fit into their needs. The better the fit, the higher the salaries that employers are willing to offer. In some cases, the career graph of alumnus can be used as a tool for curriculum design. This can be used to gauge how adaptable the curriculum made the graduates. These outputs should be used as feedback for the development and upgrading of the curriculum.

However, for the sake of the curriculum design as a process, the output will be a best-in-class curriculum, which would be not only contemporary, but would be the benchmark for similar courses nationally or internationally.

Apart from regular evaluation method authors would like to suggest few other ideas of evaluation other than normal evaluation method.

- 3.3.1 Employability
- 3.3.2 Co-curricular and extracurricular activities
- 3.3.3 Partnership with industry
- 3.3.4 Promoting teaching and learning activities
- 3.3.5 Counseling and guidance to students
- 3.3.6 Continuous updating of syllabus

A good curriculum evaluation system surely lends a distinctive cachet to the educational program.

4 References

- [1] Proceedings of the XIX National Convention of Indian Society for Technical Education - 1989