USE OF PERSONAL COMPUTER FOR QUALITY TEACHING IN CIVIL ENGINEERING

*Dr. M. M. Bhosale, **G.N. Ronghe

SYNOPSIS

At present class room teaching is adopted in Engineering without consideration about assimilation by students. Pace of learning of each student is different especially when variety of subjects are considered. Ideally it should be possible to teach at the pace of individual student. To achieve this, extensive use of computer is suggested to make good deficiency arising out of insufficient number of teachers. Paper outlines drawbacks of the existing teaching methodology and how cheaper effective solution can be obtained by use of personal computers.

Introduction :

Present methods of teaching for engineers in general and civil engineers in particular are identical with those adopted for arts, commerce and such faculties. For a number of years, need was felt to change pattern of education atleast for engineers to bring more and more professional contents. Necessity has forced trying out different alternatives available in view of lack of experienced dedicated teachers in different subjects. Main reason being the peaks and valleys associated with our developing process. Country is now passing from partly industrial stage to partly information society stage. More and more knowledge is to be imparted in restricted time available that too effectively. It was felt that Audio-visual methods including Video tapes may be able to supplement existing teacher oriented facilities. However, for our country where expert teacher himself is not upto the mark, expectation that students should attempt studies on his own, has failed due to lack of orientation and commitment. Hence dis-embodied and non-interactive teaching does not serve and purpose in our circumstances. Moreover, methodology does not encourage study of engineering approach to solve problem. Looking at an engineering problem as a problem of mathematics is common mistake made by students. Relevance of engineering

*Prof. Dept. of App. Mech., V.R.C.E., **Lecturer Dept of App. Mech., V.R.C.E. Nagpur

takes second place to arithmetical accuracy. Change in attitude needs thorough understanding of subjects and continuous questioning on value based system. This can be achieved only if students are motivated to learning at the pace and time most convenient to them. In short, release from class room teaching to some extent is necessary for emboding engineering spirit of problem solution utilising mathematics as a tool rather than master. For sufficient opportunities to each and every student to meet these requirements through employment of sufficient number of properly qualified experienced teachers is practically impossible at reasonable cost. Hence an interactive tool which stores considerable information and permits duplication is necessary as a teaching aid to satisfy above requirements.

1. Existing Scenerio :

Present day teaching is of pedagogical nature and of teacher orientation. There is no recognition of the fact that no teacher can deliver good teaching to all students in different types of subjects like descriptive, mathematical and engineering. It is not possible to adopt syllabus changes as frequently as it becomes obselete. There is restriction to change of content as well as method of teaching in view of the paradox that experienced teachers are available only after they have been teaching for sometime. This tends to stabilise habits, mannerism, illustrative examples so much so that students consider it a game to predict content of the subject or its nature. It generates dis-respect to the teachers and to a great extent to the subjects taught. This has been experienced atleast by faculty wanting to adopt Audio-visual methods. Failure of audio visual methods or lack of its wide use can be attributed to two causes - firstly inadequate training to teachers for preparing materials for audio-visual use and secondly, lack factors get more pronounced when student is exposed for first time to teaching of non- interactive and non-human type. Effect of these is to make it impossible to increase scope of existing subjects or introduce additional important practical subjects without increasing duration of course. It is a paradox that various subjects which can not be covered are most commonly practiced in field or on job location, e.g. contract laws, financial control, labour laws and such other important aspects.

2. National Stake in Engineering Education :

Aim of our plan and development efforts has been to improve quality of life of masses. In all aspects of quality improvement, engineers in general and civil engineers in particular play in important role. On an average at current rate of expenditure and value of Rupees, every civil engineer undertakes development work, including maintenance of assets created, to the tune of Rs. 40 crores in his life time. By increasing input on education of every engineer marginally it should be possible to save 10% of the development cost. Alternatively one time investment on education which is estimated to be about Rs. 40,000/- per student to Rs. 60,000/- per student will give

return of 4 crores of Rupees in estimated life span of 30 years. The amortised cost of Rs. 20,000/- over a period of 30 years will be about Rs. 6 lacs. Considering this economic aspect, apart from other benefits, it is worthwhile to give more input to engineering education. As outlined above, more input is required for making teaching student oriented rather than teacher oriented. This additional input will enable education of engineering students to be made more scientific and effective.

Another aspect of technical education is basis of selection which at present is being done in totally adhoc pattern based on marks obtained in competitive or public examination. This has done more damage than good for technical education. Due to lack of suitable jobs in different fields there is considerable allurement for becoming an engineer which assures better chances of employment with good standard of living and reasonable promotions. These allurements have induced number of talented students to come for engineering even though they might not have aptitude for engineering. After 12th, general aptitude of student is to consider that engineering is nothing but mathematics. Though this is partly true, role of mathematics in engineering has to be tuned to a great extent by common sense and practical aspects. Most common example being effort spent by students for evaluating certain results upto to 3 or 4 places of decimal even though from practical consideration it does not make difference whether result is rounded to nearest hundred. Such attitude shows total inaptitude for engineering, results in wasting time and talent causing national loss. Keeping in view good of nation in mind, it is worthwhile to have an aptitude test conductd for applicants in engineering. With present development in psychology, it is possible to decide aptitude test which indicates whether candidate is fit material for engineering or not. Naturally, investment required for aptitude test and its values will be considerable. However, with present day development in data processing, questionnaire reduced to objective type can be processed by computers thereby reducing time and money. Once again this additional expenditure is justified keeping in view high stake of nation involved in every engineering student.

3. Categorizing of Students :

From experience of past 30 years it has been observed that broadly speaking students can be divided in following categories :

1) Those having aptitude for theoretical subjects requiring high degree of abstract thinking, utilizing basic sciences. Such type of students can be called as R & D engineers.

2) Those having aptitude in evaluating numerical data and alternative solutions of engineering problem using available theory and its results. These can be termed as design engineers.

3) Those having more aptitude for descriptive subjects wherein logic

is applied continuously with reasons without mathematical parts except some statistics. Such type of students can be called as managers.

4) Those who are in a position to conceive pattern of demand and supply of engineers units in future. Such students will be partly engineers, partly managers with understanding of design engineer.

Each of these categories is necessary for proper development of the country. However, educational input for development of each category will be different and hence it may appear that some student doing very good in one group of subjects is a total failure in others. Unfortunately, good engineer has to have a reasonable minimum content of each of the categories, since at no stage of life, an engineer is employed to work in isolation from other categories.

Once again, additional investment required for this complete individual education in the interest of the country is worth having in view of the stake of nation. Here again personal computers and their use will help to large extent meeting existing demand for additional input in educational system.

4. Assessing speed of Learning in Different Categories of Students :

Assessment of speed of learning is quite possible with the aid of digital computer. This can be achieved by interactive software which will take care of explaining basic concepts, assumptions, theories & fundamental methods. There after computer evaluation towards speed of learning of particular candidate may be set aside by conducting various types of Test such as :

- Objective type Questions
- Multiple choice Questions
- Thought type Questions
- Miscellaneous Questions

One important fact is that the learning not only depends on grasping power but also speed of reading. It should be possible to answer about 30 objective questions of type listed above in 30 minutes.

Questions may be framed in simplest language and candidate is expected to find solutions on basis of his knowledge. A small number of questions call for simple logical reasoning but not any derivations. One great advantage in evaluation by objective questions is that candidate's capability in writing and his fluency in expression do not influence his answering capability. However, this as well as other capabilities also need evaluation, such as over all comprehension, organisation of thoughts and priorities, methods of approaches to solutions and accuracy of solutions. Evaluation procedures may have to take these aspects into consideration and then set up mixed type of question.

5. Catering for Individual Students :

Once category and speed of

learning of a student is assessed it is possible to teach student as per his aptitude & capacity. There can be two types of degrees given by University. One as standard Degree such as B.E. and another superior degree such as B.E. (Hons.). For standard degree subject contents & subjects can be of core type and do not involve advanced topics. These subjects can be easily understood by an average student.

Extra subjects or extra topics in the same subject which require additional efforts & aptitude can be obtained if student so desires and in return they get superior degree. This is necessary to motivate intelligent students to learn more. It may also be added that Post Graduation is permitted only after aquiring superior degree.

This method of awarding degrees will enable system to make changes in curriculum suitable to different category of students. This will provide challenge to students of higher IQ.

6. Changes required in Examination System :

Present examination & evaluation system has innumarable drawbacks and does not judge initiative & understanding of subjects. This needs to be toned up and time required reduced so that continuing assessment is possible to adopt corrective measures.

It is preferable to have questionaries in two parts; one containing objective questions and other qualitative questions & some times even descriptive questions may have to be included based on subjects in which a candidate is tested and purpose for which he is tested. Length of objective question paper should be limited to 1 hour or half an hour. Answering long objective questions can become monotonous & tedious. After half an hour of answering, the candidate is likely to lose his concentration. On other hand, qualitative questions keep mind of the student active and alert for a longer period. For such examinations personal computer can be conveniently used for examining and valuation. A large Question Bank can be created & questioning from this question bank randomly shot at students in quick succession. This reduces efforts for setting up a good question papers.

Need of Computers in Learning :

Even if we consider an ideal case in which students are categorised and grouped appropriately and best teacher provided, still it is not possible to teach students at their own speed of learning. This happens because students capabilities of learning are very sensitive to environment which is dynamic in nature. A small tussel at home, result of exam, puncture in his cycle can be few of the many reasons of reducing the attentiveness of the student in the class. Similarly there can be reasons which elevate the students to make them faster.

Ideal speed can be achived and the best teacher is capable of doing so through interaction with the students either verbaly or through expressions.

Even at this ideal speed which happens to be average speed some students get bored due to slow speed & some remain under cared. It is impossible to have individual attention even if students are grouped according to their capabilities. This individual attention is possible in self learning interactive "Computer Aided Learning" CAL + software.

8. Constitution of an Ideal CAL Software :

1. Computer which interacts with student should confirm background knowledge/concepts required for learning topics.

2. If required learner should be in position to refresh his memory by revising certain important topics through same package.

3. Computer should explain Aim & Scope of topic along with visual field applications explained with help of sketches, barcharts for comparision, numerical &/or statistical data, photographs & software animation.

4. Programme will ask for level upto which topic is to be studied Viz Elementary, Intermediate and Advance (in depth). Facility of skiping Elementary & Intermediate levels of studies while learning at higher level should be provided if so desired.

5. Software will also ask for speed at which topics are to be covered. viz Slow, Normal & Fast. At Slow speed more No. of problems or detail explanation will be provided for every point under discussion.

6. Topics can be divided in two categories. i.e. Analytical & Informative. These two can be dealt differently.

7. In informative topics, information will be given in stages & questions will be asked frequently to assess whether displayed information is being understood in rightway. In case topic is not understood, capsule of more details in simpler way is given to student. Once the point is assimilated next point is considered. After completing the topic, some questions which connect various points are asked; in case answered rightly the topic is completed. Otherwise further explanation is given. While covering such topics appropriate figures, photographs etc. are given.

8. When the topic is analytical, questions may be numerical and progressively difficult. First few problems are solved & solution of remaining problems are to be given only in case asked.

9. After completion of topic, questions will be posed to enable the student to know if he has understood the subject.

10. At each stage of discussion, a list of questions can be provided on

demand to clarify if there is any doubt.

11. To make package interesting even to revise the subject, illustrations should be different for different runs of package.

12. Software can be made more effective by creating Artificial Intelligence in the programme so that doubts/questions in the language of student are understood by the computer and answers can be evaluated even if they are in the language of students. Of course this will be next generation of CAL package.

13. CAL package can be made very much interesting to the students by including some games on the topics.

9. Role of a Teacher in Computer Aided Learning Method :

When teaching & examination both are done by computers, teacher is not idle. He should continuously improve the package & communicate with students to remove whatever difficiencies are still left in the students. His primary objective then becomes that of getting the practice jobs done from students. He has to act as an element to emphasise the relationship of the subject and practical application.

It is felt that todays teacher has to be practising Engineer who is adopting the technology taught in the field. A teacher has to first get himself convinced that technology he is teaching is useful & is practised on fields and only then any student will appreciate & be interested in the topics being tought. When teacher starts with misconcept that what ever is tought is not used then he can not naturally know and convince students about relevance of the topics.

10. Conclusion :

Class-room teaching, being the only feasible method till this date for mass education, is practised by all institutions. This existing teaching system suffers from following draw-backs.

i) This method is teacher oriented.

ii) It can not ensure attention to each individual student.

iii) It can not be made available to students as per his pace of learning.

iv) It can not be made reusable for individual student as many times as required.

New technique viz Computer Aided Learning (CAL) over-comes these draw-backs.

i) CAL method is student Oriented.

ii) It is available to user student as per his requirements regading pace, grasp and frequency, and above all as and when he seeks it.

iii) It provides dynamic visualisation.

iv) It is flexible in providing numerical examples.

v) It is cost effective and intercative.

vi) Assesment topic wise is possible.

vii) It is possible to teach an individual student through Computer Aided Learning packages and Using similar software students can be examined.

viii) Aptitude Test softwares will guide students to select the subjects & topics. The suitable changes in examination pattern will permit choosing subjects of interest.

ix) Learning through computers can be used initially as a supplement to class-room teaching rather than substitute.

x) Once the teacher is partially relieved of day to day class room teaching, his expertise can be better utilised in orienting students to real life Engineering problems.

* * *