

Computer Aided Learning In Engineering Education

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Abstract

Engineering is the process of utilizing knowledge and principles to design, build and analyse objects. This paper discusses the role of computer aided learning in engineering education. In recent years positive results were seen in the engineering education for the use of computer aided learning which included multimedia instructional format such as video lecture, simulation, animations for training the students. Computer aided learning also helped the instructors in enhancing the efficiency of the teaching process and students by providing them individual learning environment. Virtual laboratories generated by computer can design the object virtually where the objects can be analysed, designed, developed and build virtually and tested in advanced on the computer which can improve the quality and performance of the product. Engineering education should facilitate in developing a new models and computer based training is the best tool for this purpose.

Keywords: - *Computer aided learning, Engineering education, Video lectures, multimedia instructional format, and simulations.*

Introduction

Engineering is a broad field encompassing many different branches, it is using the existing information, knowledge to design new technologies and ways to make everyday life more efficient. The goal of engineering education is to provide problem solving techniques, design new products which exhibits better performance than the existing, develop new method than teaching contemporary basic science and engineering information to the students.

Computer aided instruction is a computer technology which is widely used in teaching and learning process. CAI application includes animated notes, video lectures, facilitates analyses of problem, visualization of complex objects, auto evaluation of quiz and communication of students to student and student to instructor through computer.

Engineering education consists of theoretical knowledge followed with laboratory practices. Theoretical knowledge is understood and applied in laboratory to solve the problem, analyse the problem and design a better product that can make day-to-day human life better. Engineering students gain the theoretical knowledge and apply to implement a product or solve a problem in labs. Hence in engineering education theory and practical go hand-in-hand computers can be used in virtual lab in modelling and visualizing the problem on computer and analysing the experimental results. Virtual lab can help the student's researchers to save lot of time, cost and deliver improved product. Hence the computer-aided education has tremendous importance on engineering education.

Objectives

The main goal of computer aided learning in the engineering education is to make the engineering education system transparent learning based and outcome based. Computer aided learning (CAL)

will contribute the quality of education system. Computer aided learning will ensure that current education system contributes in enhancement of the research. CAL will include all types of technology enhanced learning tools which will improve the learning process. CAL will provide better learning and teaching aid through audio, video lectures, animated learning materials, e-books which will be rich source of materials to the students and can make teaching learning process easy. Computer assisted instruction (CAI) to facilitate interaction instructional technique and monitors the learning that takes place. Finally the main objective of the computer aided learning to be an integral part of teacher's pedagogy and classroom processes and not a standalone activity.

History

In 1925 Pressey's multiple choice machine tested the user by providing interactive multiple choice questions to the user and evaluated the user based on the answers provided by user, Pressey's machine provided also provided feedback, generated result and recorded each attempt of user as data. Thus Pressey's machine made learning interactive and effective. In 1950 Crowder developed the computer assisted learning program for US Air force. This program provided instruction through text, tested user through online multiple choice questions tests, generated results and then branched on to the corrective information or new information with respect to the response of the user. Crowder's CAI was thought as an advanced CAI compared to Pressey's CAI since it provided corrective information for the user's response. In 1954 at the University of Pittsburgh, Psychologist B.F. Skinner made the user to access the auditory material listen to the passage as often as necessary. In 1980's Programmed Logic for Automatic Teaching Operation (PLATO) system was early CAI was initiated at the University of Illinois by Bitzer in the higher learning education. In 1985 PLATO generated new system which was boon to the society in which e-mail facility was made available i.e. the message were electronically passed from one computer to other across the world. Bitzer was one of the first to realize the importance of graphics and sounds in teaching methods and which had high positive impact on teaching and learning process. The Time Shared Interactive Computer Controlled Information Television (TICCIT) system.

Mitre Corporation and Brigham Young University in Utah developed a CAI project which was used to teach the mathematics and English courses to the students. This project help the students tremendously as sharing the resource was online, student's evaluation was online, interaction with the subject experts through e-mail made the system self-learning oriented. System also contributed in the developed of the research.

Instructional Modes of CAI

In the instructional mode of CAI the computer presents its lesson and instruction to the students allowing the students to directly interact with system's instruction and lessons. In CAI computer tests the students, guides the students in their learning, gives feedback and generates reports. Few Instructional mode of CAI are discussed below

1. Drill and Practice – This instructional mode provides the students the opportunity to practice the skills repeatedly that have been presented previously. In this mode only when the learner achieves mastery the computer will proceed further.
2. Gaming Mode – In this mode the learners are made to learn through small games making learning interesting and fun.
3. Tutorial Mode - In this mode the system presents the concepts and skills and gives opportunity for the student to practice concept repeatedly until the learner masters their skills. Tutorial mode may also include drill and practice, games, problem solving, simulations etc. to make the concept of the student clear, to make them to understand

- particular subject in depth and develop their learning and creative skills.
4. Simulation Mode – A simulation is a presentation or model of a real event, object or phenomenon where learners can see the results of their own actions. Simulation software provides realistic practice without involving any risk for example training a pilot through simulation pilot training software will give the trainer pilot the feel that he is actually navigating the plane by reducing the real life risks of plane crash.
 5. Discovery Mode – Discovery approach provides the information about problem specific to the course encouraging the learners to analyse, solve, compare, evaluate, infer, and explore the given information to solve the problem.
 6. Problem Solving Mode - this mode helps the learners to develop the problem solving skills.

Design of CAI

The main aim of the computer assisted education (CAE) is to make the students master their concepts and develop their skills to achieve their goals. CAE can also help the instructor by improved techniques of presenting notes, assignments, automatic updation of attendance. Computer assisted Education can also help head of the institute/department to keep a track of every instructor/students by observing the performance report generated by CAE for each instructor and student.

The system was developed in three phases

1. Registration Phase
2. Design Phase
3. Analysis Phase

Registration Phase – Registration phase allows the registration of all the new user to the system. Registration phase has following components

- Registration of Dean, Directors, and Management Officers - This Component allows the system to add details of deans, directors and management officers. This component have highest permission rights than other components. The user in the phase can view any detail of principals, head of department, students, parents and guests from their login. They can also view the performance analysis result and feedback report of instructor and heads.
- Registration of Principals/Head of the departments – This Components allows to add the details of Principals/Head of the departments in the system. Principals/Head of the departments will be having more permission rights than instructors, students, parents and guests. Head of department/ Principal can view any course for any student or instructors and can also view their performance measure online. Head of department can add remark or take constructive decision for particular student or instructor online.
- Registration for Instructor - This Components allows to add the details of instructor to the system. Instructor will have more permission right than students. Instructor can view any student details and their performance of the respective course.
- Registration for Students – This Components add the details of the students to the system. Students can view all the course details for which they have enrolled through their login.

- Registration for Parents - – Adding parents details to the system. Parents can view his/her ward detail with respect to performance and attendance. Parents can also communicate online to the respective instructor.
- Registration for Guests - Details of the guests are added to the system.

Design Phase – Design Phase will be designing the contents for the course, students, instructors and heads in the specific manner. Design phase consists of following components

- Design for course –Design for a course page will contain details for course starting with objectives, lesson plan, session plan, Multiple choice question, Notes, Short question and Answer for each session. Online video uploaded for each session taken by the faculty. Automatic updation of attendance for each session. Student forum for discussion and uploading notes by the students. Course at the end of the semester will have rich source of material and automatically generate performance reports for each faculty and student.
- Design for Students – Students can access all course details they have enrolled during the registration. Students can view all resource materials for all the courses. Students can create their forum and discuss about the subject with others students for the course. Students can participate in multiple choice questions and see immediate results. Students can see the performance report and attendance report in their login. Student can directly interact with the professor and clear their doubts. Students can submit their assignment in their login.
- Design of Head of the Department/Principal - This page consists profile details of instructors/ heads along with their publication details, extra activities, patents, research grants, guests lectures, Contribution in the growth of the department and institution. Performance reports with respect to all criteria. System maintains the details of constructive action taken by heads for poor performance or good performance for faculties.

Analysis Phase - This page consists profile details of instructors/ heads along with their publication details, extra activities, patents, research grants, guests lectures, Contribution in the growth of the department and institution. Performance reports with respect to all criteria. System maintains the details of constructive action taken by heads for poor performance or good performance for faculties.

Advantages of Computer Assisted Learning

CAI enhances the structure of classroom teaching – CAI teaching technique are interesting, fascinating and inspiring which can motivate the students to learn the subject enthusiastically. Resource, tutorial supported by CAI help the students in self-learning. CAI transform the teacher's explaining tool to the students self-learning activity which changes the function of instructional media. CAI can help in advanced teaching methodology by helping the teachers to use the tools like video lectures, projectors, animated tutorials which can make teaching more significant alluring and making the concepts palpable. Hence CAI is more effective and enhances the classroom activity than the traditional teaching learning process.

CAI is an interactive teaching tool - CAI is an interactive tool which allows the students to learn through simulation, games and drill and practice methods. CAI man-machine dialogue function is

the advantage which makes CAI interactive and interesting learning tool for students. These feature of CAI enhance the student's participation in learning and trigger their learning interest.

CAI tool enhances the research capabilities – CAI is a large repository of resources which includes animated lectures, audio-video lecture, e -books and vast resources are made available for a particular course. CAI also has the facility to interact with the eminent professor, research scholar to discover and understand the problem clearly. Numerous simulation tools supported by CAI allows research scholars to test their protocol with the existing one and analyze the result.

Limitations of Computer Assisted Learning

CAI lacks the rapport with the students – A quality of good teacher is to establish a strong rapport with their students to understand their students and establish a trusting relationship with their students. Since CAI lacks in establishing a rapport with its students it is unaware of background of the students, prior knowledge the student is having in the subject and time needed to be spent in teaching the basic fundamentals.

CAI can lead to ungoverned education system degrading the overall quality – CAI is designed with the fact that “teach less” and “learn more”. This can make students passive in participating in learning activity. Such design of classroom can degrade the initiative and enthusiasm of the students in learning new concepts. Hence research shows a better results in the combination of traditional class with CAI. Research has shown that combining technology with the standard classroom approach actually improves student performance.

High Cost for Implementation and Maintenance - building and maintaining a good CAI system is difficult and requires lot of time energy and cost.

Outcome of CAI

- Making the current education system transparent by capturing live video lecture and putting it online for future reference of the students.
- Marking the attendance automatically for the class and allowing the instructor to take the class for the full durations of 45 minutes.
- Calculating the performance of each instructor and student automatically thus reducing the manual work and making the system transparent to the head of the departments/principals.
- System reduces manual work to its maximal and make the education system transparent, learning and outcome based

Conclusion and Future Work

CAI is an effective and efficient teaching learning tools enhancing the field of education and research domain. CAI helps in engineering education by allowing the students to apply the principles in the virtual lab and develop a practical solution which can make human life better. Hence in future CAI will be developed for all kind of engineering problems CAI has also helped the instructor by allowing the instructor to place their animated engineering lecture, video lecture, automatic marking of attendance and automatic result generation for each students thus reducing

their manual work and making the teaching effective. Thus CAI has helped both students, instructor and heads of the departments in the following ways

- To boost the enthusiasm of learning and increasing the self-learning ability.
- Ability to analyse the problem
- Ability to Solve the problem
- Ability to deeply understand the course
- Ability to stimulate learning interest and broaden knowledge
- Contribution to the research.
- To make the system transparent and only contribute in enhancing the learning skills.
- Rich source of material for the particular course
- To monitor the quality of the lectures.
- To reduce manual work to the minimum extent.

Future Work of CAI

- Adding Virtual teaching software which will make the students a feel like a real teacher is taking a class.
- Making the entire engineering education system transparent.
- Adding all the interactive software tools, multimedia hardware to CAI to make it more interactive.
- Rich source of materials specific to the subject which can contribute for advance research.

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