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Transformation in the Teaching-Learning Process of Engineering Education

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Abstract
Due to lack of direct industry interaction, the current system does not prepare future engineers for innovative entrepreneurship and self-employment, as engineering colleges focuses on Score-Based Education rather than moving towards practical approach. Engineering colleges need to set Short-term and Long-term goals for Teachers as well as Students. Teachers achieving short term goals like having attention to their teaching, interactive classrooms etc. A long term goal of teacher is to transform a student into independent source for the society, reaching academic visions, effective course design. Students achieving short term goals learn within the class and try it in laboratory. Long term goals performing well in examinations and solve real time problems in the society. This develops the transformation in teaching learning process. The main motivation behind writing this research paper is, firstly the problems faced by the students to get the job in industry secondly problems faced by the faculties to provide innovative teaching modes for the millennial learners. The main objective is to improve the Teaching Learning Process through invocative teaching mechanisms such as creating Dynamic Classrooms, Power of Technology, and Collaborative Learning. Thus to bring the transformation in engineering education we implemented student and teacher level transformation to produce more competent engineers for the society.

Keywords: Outcome Based Education, Collaborative Learning, Dynamic Classroom, Virtual Laboratories, Course Design, Effective Assessment.

I INTRODUCTION

Since two decades, four thousand Indian engineering colleges cretifing students as graduates without any proper knowledge. For quality education, IUCEE (Indo Universal Collaboration for Engineering Education) has identified the challenging issues faced by the engineering education system and took initiative to transform the engineering education system in India. In this IUCEE has selected more than 200 colleges to train the faculty through faculty development programs throughout the academia as International Engineering Educator Certification Program (IIEECP). From 2007 to now, the education system has been changing innovatively with implemented systematic approaches. IUCEE has identified the primary objectives of the education system, i.e, teaching approaches of a teacher and learning methods of a student. To train the engineering faculty, this program has

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chosenexperiencedinternational academicand industry experts. Following are the key learning areas of IIEECP, which are helpful for faculty to develop their Program Objectives for their courses provided by NBA.

Table1: key learning areas of IIEECP which are helpful for faculty to develop their Program Objectives for their courses provided by NBA.

PO1	To apply the theoretical components of teaching and learning to a specific course and practice them.
PO2	To implement effective teaching strategies for students meeting their learning needs and learning styles (millennial learners).
PO3	To manage student motivation and attention span, thereby impacting personal teaching style and professional confidence.
PO4	To better plan course content and delivery resulting from a better understanding of course design principles.
PO5	To formulate course objectives based on understanding and applying Blooms Taxonomy, and relate these to program outcomes.
PO6	To create a dynamic classroom using a variety of active learning strategies learned and practiced.
PO7	To improve the quality of tests and quizzes substantially based on a deeper awareness of effective assessment principles and practices.
PO8	To create rubrics for refining evaluation process based on an improved understanding of the pedagogical process.
PO9	To implement collaborative learning in order to develop real-world professional skills and to build interpersonal team skills of students.
PO10	To plan for and practice harnessing technology for more effective teaching with techniques such as the flipped classroom and blended teaching.

II RELATED WORK

Prior to the IIEECP program teaching-learning process in engineering education, teaching faculty had followed the most common teaching methods like Lecture based approach using chalk and board, focus more on examinations than knowledge of concepts for students in classrooms[1]. Attention span of any teenager is 15-20 minsmins, students get bored if classroom involves 40mins of lecture. General teaching methods that make classroom that makes students inactive are Lecture method, demonstration method.

Lecture method: In this method faculty tries to give exact information to the students with explanation and making them takenotes. The complete lecture is being dealt with definition, explanations and work process with textbook examples. In such a case, faculty is having 95% of their voice and 5% of students voice is heard within 40 mins of the classroom. Some teachersalso take textbooks to their classrooms and try to explain by reading.

*Demonstration method:*Lately, this method is also being implemented in classrooms. In this method, faculty allow the student to interact through their demos but only a few students are able to interact. Some students understand the concept well in this method but they fail to recollect the concept later.

A. Methodology

Student- centric Learning: Creation of dedicated course website using Canvas

Canvas is a software with allows students to get information from the concern faculty. Faculty can post the video as well as audio

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topics of the subjects. So that subject can hear whenever needed, Unitwise questions are uploaded into the canvas, Faculty can drop the assignment into the canvas by keeping the due date. Assignment submission automatically closes by the due time,the assignment can be given in the canvas itself and canvas is helpful to conduct quiz.
This helps students to make themselves as self-learners and develop their personality independently.

Improvement of collaborative learning through IIEECP program
Collaborative learning is a process of making students interacts with others to gain knowledge. Collaborative learning enhances student innovative ideas.Major challenging collaborative learning outcomes are through defined clear and effective objectives of the course like well-planned student teamwork for Problem based learning, computer-supported collaborative learning and also Integration across course boundaries. Following are the Collaborative Learning Strategies:

- Formation of effective groups
- Developing team skills and help students to work in teams
- Assess of technological use of student collaborative work
- Dealing with the conflicts within teams

Table 2: Learning strategies Lecture-based Learning, Problem-based Learning, and Team Learning

Lecture-based Learning	Problem-based Learning	Team Learning
In this lecture based learning students role is to attend class, take notes and read the same content for the end-of-unit exam.	Student's role is to identify suitable issues of learning; perform independently, non-class study; participate in group debates.	Student role is to do independent studies like out-of-class; assist with team debates; support team solutions in the classroom.
Students only take a subject that relates to exams.	Learners are likely to benefit from authentic solutions for the identified problems in groups which encourage the study of "learning issues" that are determine individuality and information to the application.	Learners benefit most from pre-knowledge of the data in teams and obtain instant feedback about their teams through problem-solving discussions.
The subject expert will set learning objectives, choose content; identify learning resources; and prepare well-structured demonstration with the relevant syllabus.	The role of an instructor in the learning process constructs instances to enable students to address appropriate learning problems; facilitatesconversations in tiny groups,and provides students with feedback and support as necessary.	The instructor's role in the learning process sets goals for learning; chooses material and resources; addresses questionsand prepares applications that promote meaningful group conversation.
Experts from the subject act as instructor to give content to learners with respected case examples.	Expert role as a consultant: support students, upon request, in their independent studies.	Expert role as an instructor: provide learners with content, including the possibility of using ideas for resolving situations.
Desired outcomes for lecture-based learning is acquiring of Content and its conceptual understanding	OutcomesforProblem-based Learning are students have capable to understand and identify critical problems and work effectively in groups.	Outcomes for team-based learning implement collaborative learning and work on problems.

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Engineering education System can be transformed when:

1. Engineering education isfor self and for the Society enhancement.
2. Engineering colleges should inculcate professional master degree programs to practice engineering.
3. ABET should provide accreditation for all engineering programs.
4. All engineering colleges must follow the outcome-based education approach.
5. Project-based engineering should be initiated from the first year itself.
6. Colleges should appoint well-qualified faculty for better growth of engineering students.

PROPOSED WORK

Problem Statement:

Engineering colleges lack proper inculcation of technical education without involving the emerging the industrial technology and not encouraging and initiating a culture of innovative entrepreneurship within the engineering education which leads to forming the gap between the industry and academia and not generating the self-employment capability.

Implementing Student-centric learning activities like creating coursecanvas, exploiting the power of technology in the teaching-learning process [2], collaborative learning [3], Critical thinking, and teamwork [4] among students.

B Adapted Methodology:

Implemented canvas, power of technology, collaborative learning (project work)

An easy way to get connected with Classwork: Creation of canvas and its usage

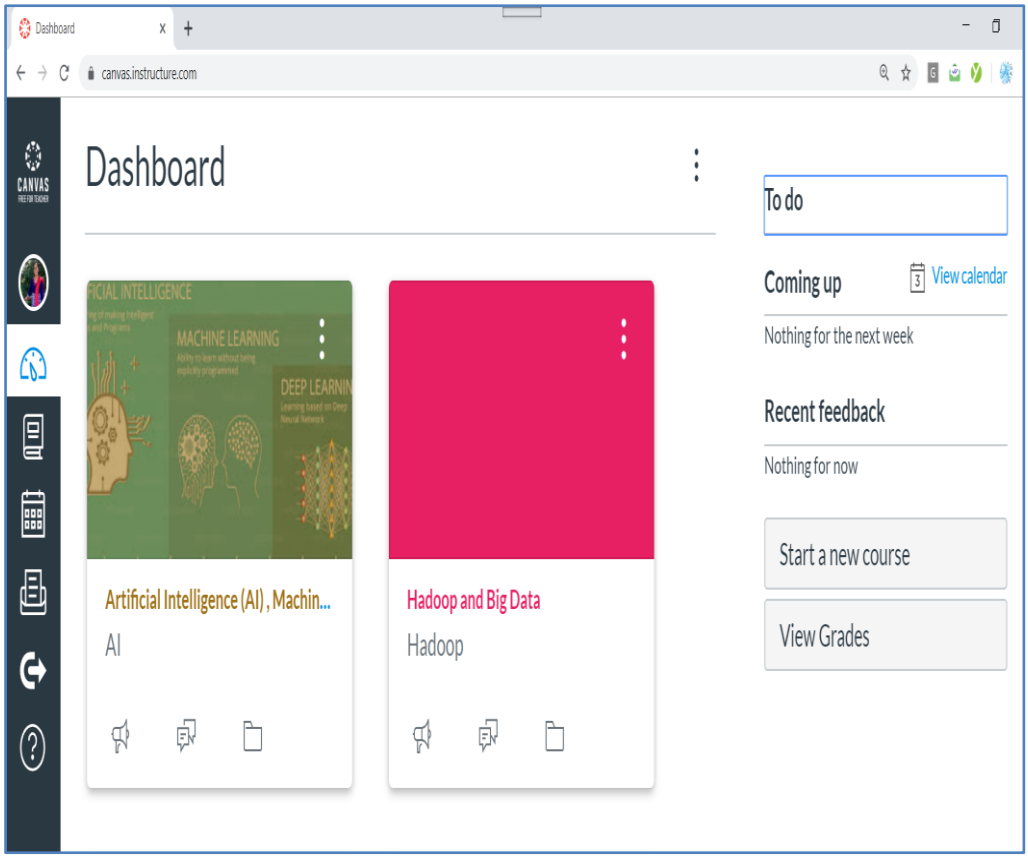

Fig.1: Canvas for Related Subjects

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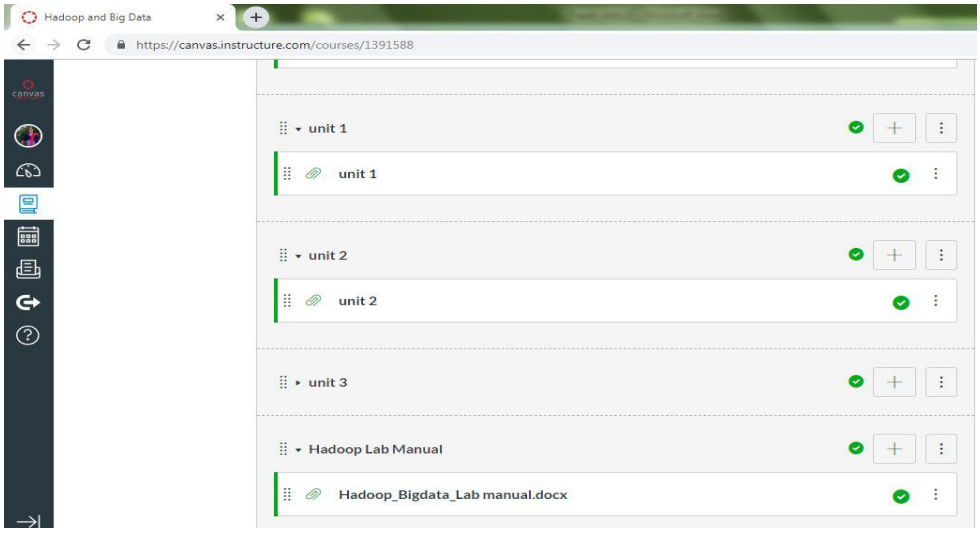

Fig.2: Unit wise concepts as well as Lab manual

Teacher uploads the concepts in canvas. It helps the student to view the class when he/she is absent or if they want to listen to the class repeatedly. Helps the Students to avoid coming to class with an empty minds.

Implementation of Collaborative Learning:

Introduced Massive Online Open Courses (MOOCs) for students

MOOCs is a learning approach for students. It delivers the content with a clear explanation. Online courses encourage students to develop self-study. If the students attend MOOCs classes before the class, they can easily understand the concept raise doubts and real times issues during class so that others will also get involved and try to pose more questions and resolve them easily. By this class can be more interactive and easy to complete the course by involving real-time problems.

Introduced Flipped Classrooms

Based on the flipped classrooms, the interaction- time among student to student and student to teacher is improved. Students inculcating different usage of tools and techniques will develop their skills practically. Students are forced to involve the subject discussions and ask them to compare with real-time applications.

In the process of Collaborative learning, Faculty use brain-based learning to make students involve completely within the class by activating their prior knowledge and encourage them.

Implementation of Harnessing the power of technology:

Fig. 3: Physics virtual labs for Students

Power of technology allows students to make use of virtual labs in an interesting way. It's a practical way of Learning.This process transforms students to think innovatively within the class.

IV CONCLUSION

Outcome Based Education at engineering institution plays an important role as it defines the outcomes, by considering it as important growth step for student's career. This has ensured the quality of education by implementing the effective Teaching-Learning process at Engineering Education.. In this

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paper, we focus the transformational teaching-learning methods in engineering education and also identified the drawbacks of traditional Learning. Implemented Teaching- Learning process involves Collaborative learning, Dynamic Classroom, Virtual Laboratories, Course Design, and Effective Assessment.

FUTURE SCOPE

Moodle- Open-Source learning platform is free open source software designed to help the educators, can be the future scope of this work.

CONFLICT OF INTEREST: Nil

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