

An initiative to the Project based learning at KGR CET: as a part of active learning methodologies

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Abstract: Designing problems for project based learning (PBL) courses in engineering education has always a challenging task; PBL is a model for teaching, problem-solving and is a highly operative technique for engineering pedagogy, which is to learn design by experimenting design as active percipients. This paper describes pedagogical issues involved in conducting the PBL Activity in Embedded System course, designing a problem in course, and analysis of students' solutions. It also presents the assessment of PBL in engineering education along with characteristics, Benefits, problems and differences between traditional and PBL approaches.

Key words: PBL, Outcomes, Engineering education.

1. INTRODUCTION:

Project-based learning is a well-known example of an active learning environment which focuses on learning through experiences. Essentially, project-based learning is an Active learning method where the students are involved for investigation of a problem that serves to organize and drive learning activities which culminate in a final product that addresses the problem. The result is that students develop deeper level of knowledge, problem-solving, and communication skills that help them both in academia and in future workplace.

Problem based learning can be approached as 'functional socio-cultural constructivism' (stauffacher et al.2006), Inquiry based learning (sporken-smith and kingham, 2009) is based on the investigation of real world problem and learning by doing. In these methods the best suitable method to implement as a starting step is learning by doing. In this Project based learning is mainly focus on the projects from main learning approach and are part of the curriculum.

2. PROBLEM BASED LEARNING:

i. Characteristics of PBL:

Students learn through problem solving where there is usually no single right answer. Some of the key characteristics of PBL are:

- Students must have the responsibility for their own learning.

- Self and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit.
- The activities carried out in PBL must be those valued in the real world.
- Engages students in complex, real-world issues and problems.
- Provides opportunities for students to learn and practice interpersonal skills.
- Student-centered. Students assume responsibility for their own learning and faculty act as facilitators. Instructors must avoid making students dependent on them for what they should learn and know.
- Self-directed learning. It develops research skills. Students need to learn how to get information when it is needed and will be current, as this is an essential skill for professional performance.

ii. Benefits of PBL:

Project-based learning gives students a more "integrated" understanding of the concepts and knowledge they learn, while also equipping them with practical skills they can apply throughout their lives. The interdisciplinary nature of project-based learning helps students make connections across different subjects, rather than perceiving, for example, math and science as discrete subjects with little in common.

- Student enthusiasm - students can't be dragged away from working on the project.
- Student autonomy - they seem to shine whenever they are given real responsibility and control.
- Realistic self assessment is very meaningful to students - especially when their performance is evaluated in terms of results or the reactions of the public.
- Students who are withdrawn or sullen begin to participate, slowly at first, then with great enthusiasm.

iii. Challenges in PBL:

- The students do substantial amount of question asking and group discussion supported by the facilitator to achieve the learning objectives of the course,
- The role of the facilitator is face-to-face in several aspects, not only managing the time but also facilitator should keep in mind that students should achieve maximum learning objectives and technical nodes of the course.
- The facilitator has to take care of each student such that every student in the group should participate, and they should learn the concepts in depth and at the same time each student has to move to the presentation level.
- The co-ordination between the groups to be maintained to achieve the learning objectives.

iv. Differences between traditional and PBL Methods:

Features	Traditional method	PBL
Syllabus	Content coverage is the main agenda	Depth of understanding of content is main agenda
Role of teacher	Teaches the content	Teacher should act as facilitator
Assessment	Test scores	Demonstrations by the students
Materials	Teacher prepares the class notes, exercise sheets.	Student should collect the material, teacher provides the video lectures.
Classroom context	Student works alone	Student works in groups
Student role	Carry out instruction given by teacher	Students define their own tasks

3. Implementation at KGR CET:

The latest trend in engineering education may be a hybrid approach. In the olden days, students are taught the basic knowledge and skills required in engineering. In the final years, PBL is favored to help integrate knowledge, teach people group skills, and apply the design process; PBL was introduced in this course using a common approach of dividing the class into 2 groups: one is a general traditional class room group (CG) and other group is experimental group (EG). The selection of students for the groups was random based on students' interest.

As the students went through the method of PBL and group work, improvement was seen in their knowledge and skill, and the differences between both the groups are tabulated based on the evaluations done. This paper highlights designing of problems, pedagogical issues while conducting the projects, solutions submitted by students and differences between both the groups.

USAGE METHOD OF PBL IN CLASSROOM:

Syllabus of embedded systems course:

The syllabus of embedded systems course can be categorized into :

1. Architecture and memory organization of microcontrollers & PSOC
2. Design examples based on microcontrollers
3. Software requirements for implementation of the project.
4. Design the microcontroller hardware systems
5. Implement and debug the microcontroller and PSOC programs under real world applications.
6. use and describe the implementation of a real-time operating system on an embedded computer system

7. organize and write design documents and project reports
8. Organize and make technical presentations that describe a design.

The experiments are made to include the following tasks in the practical Applications, which are classified as:

- To study the architectural details (register & memory organization) of Microcontrollers and PSOC
- To study the instruction set and addressing modes of Microcontrollers and PSOC.
- To practice the tools to be used for the implementation of project.

Technical nodes of the course:

T1: Recall the Architecture of Microprocessor

T2: Differences between microprocessor and microcontroller are identified

T3: Develop, understand and apply instruction set and addressing modes of microcontrollers to implement the programming part

T4: Understand the architectures of PSOC.

Conduct of course:

The existing class of 60 students was split into two groups: one is a general traditional class room group (CG) and other group is experimental group (EG), total 24 students were selected for EG. Group formation is based on the student interest to learn, as they have to spend extra time other than institution working hours if it is required for their project completion. Total duration of 16 weeks at the rate 6 hours per week allotted to course was divided into 4 lab sessions for PBL Activity and 2 classroom sessions.

The PBL course was planned as: first few sessions, students (both CG&EG) have to get the knowledge about Architectures, addressing modes and instruction set of Microcontroller, similarly about the architecture, addressing modes and instruction set of PSOC and then after EG has practiced programs of Microcontroller and PSOC. After completion of few sessions (i.e., in the middle of semester) students started implementing the following projects by the knowledge of Microcontrollers and PSOC. The total 24 EG students were divided into 6 batches each contains 4 members for projects implementations:

1. Temperature based fan speed control
2. Gesture controlled robotic wheel chair
3. Bore well rescue robot
4. Automatic door locking system with home automation
5. Smart blind stick using ultrasonic sensor
6. Smart blind stick with voice guidance system using PSOC-3.

Once Titles were confirmed students start with designing of block diagram, contains necessary modules required for the implementation. And then they have written the code for the project and tested with the help of simulation softwares (Proteus, Atmel studio, keil) with the help of circuit

diagram. After obtaining required simulation result (project output) they went to market place for the components required for completion of project, when all the components are ready they started implementing the project with the help of circuit diagram, in the next stages the tested result code for the project dumped the on to the kit and finally results were verified by the performance.

While doing all these activities in working hours and extra hours by EG students, CG students were engaged only in working hours with regular class work, writing assignments for the subject topics, and giving few presentations based on theoretical knowledge from the subject.

The PBL sessions, group discussions, seminars and project demonstrations by the EG were analyzed by the peer students and faculty of the department, based on their performance internal marks were assigned.

At the end both the CG and EG were compared, the EG students scored 60% more than the CG students and also EG students were improved their knowledge and skills (communication and presentation skills) compared to CG students.

RESULTS AND ANALYSIS:

At the end of the course results were analyzed based on both the group's performance, the CG performance was calculated by the test marks and classroom activities and EG performance was calculated by students performance in terms of their demonstrations, presentations and seminars and evaluation was done by their peer members and faculty. Achievement of learning objectives and technical nodes of both the groups were given below:

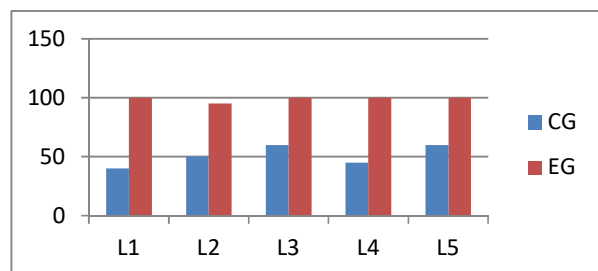


Fig: Achievement of learning objectives by both the groups

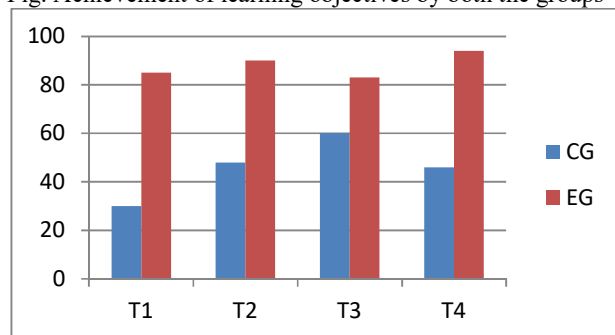


Fig: Achievement of technical nodes by both the groups

CONCLUSION:

The PBL based embedded system course was conducted, the pedagogy here involves designing the problems, which cover the scope of the subject and achieves the maximum learning objectives and technical nodes by experiment group. Demonstrations, presentations and seminars by the students were recorded for the knowledge construction. From the results and analysis we can say that EG performance was much better than the CG. However continuous monitoring for EG is required by the facilitator.

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