

Title of the Practice

Creative Thinking Skill Approach through Problem-Based Learning: Pedagogy and Practice in the Engineering Classroom

Objective of the Practice

Project-Based Learning (PBL) is “a teaching and learning model that focuses on the central concepts and principles of a discipline, involves students in problem-solving and other meaningful tasks, allows students to work autonomously to construct their own learning, and culminates in realistic, student-generated products” (Thomas, et al., 1999).

Presently the focus in Engineering Education is on teaching basics of technology (from text books). Only a few institutions/ universities can offer their student knowledge pertinent to the needs of industry as a part of the curriculum. There is a real challenge as how to impart knowledge which will have a perfect blend of learning the basics, testing their applicability so as to produce globally acceptable Engineers.

- The prime objective of the practice is to give students an opportunity for active learning.
- To design and offer effective mini projects in order to accomplish the course outcomes.
- Aiming for an overall transformation in the quality of teaching learning process.

The Context

In the regular practice of teaching-learning, the teacher is compelled for tutelage, which is to be avoided in problem based learning. Ample amount of time is required to be spared for designing the activities and providing all the necessary resources to students. The facilitator has to mediate only when prompted for and the urge for providing them direct solutions has to be controlled on the faculty's part. It is essential that the students get to brainstorm and find their path to the solution. The problem has to be designed such that, students get introduced with new contexts/ learn to use a tool/ get introduced to a methodology (preferably hands-on) while on the path of achieving their final target solution.

To start with there was a necessity of training the trainers. The trainers were trained with following objectives in consideration.

- To increase teachers' understanding of how facts are distinguished, ideas based on facts are generated, and appropriately defined learning issues are generated by learners going through a PBL case.
- To increase teachers' understanding of how students utilize resources to generate “learning needs” that are relevant to the case and their group's ideas.
- To increase teachers' awareness of how students, gauge their limit of understanding from a PBL case.
- To increase participant understanding of the inquiry-based, student-centric learning approach utilized in the problem-based learning program.

The Practice

A faculty from SIT registered for the online course offered by University of Aalborg University “An introductory course on PBL in Higher Education”. After the online training an FDP was arranged targeting the above referred. The faculty of SIT then started practicing PBL for various courses for different levels

PBL activities are being conducted throughout the semester in all technical courses. Few activities were planned to introduce students to new concepts allied with the course structure of the semester, and based upon the basic sciences knowledge they acquired either from high-school or engineering diploma courses.

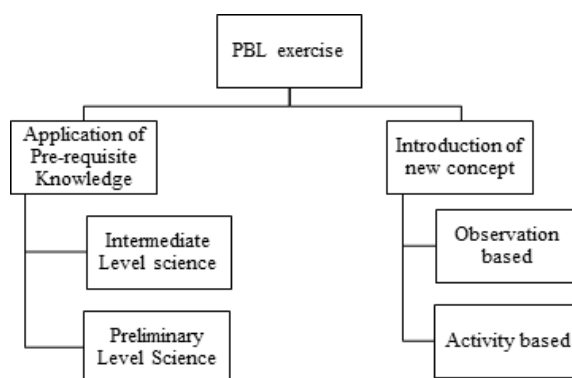


Figure1: PBL activity division

Dossier: Offering Complete course by Project Based Learning: Across disciplines

In the even semester, some courses were offered by core engineering departments in complete/partial project based learning pattern. The main objective was to emphasize concept building and understanding of the core fundamentals by the learning by doing methodology. The main challenge was that the entire pedagogy had to be designed to equip them for the conventional end semester examination along with the objectives mentioned above. In these courses, the faculties conducted weekly meetings and briefed students about key concepts associated with the subject and applications in-tune with the branch. The students were divided in to a group of 4 to 5. They came up with ideas where their knowledge can be applied for planning and managing. The initial part of the course was started in the conventional manner and then using the lab sessions the software simulations problem-based learning was introduced gradually. It helped the students in the lab as well as better understanding of theoretical concepts. It was then followed by assigning them projects that were carefully designed based on their learning of the core fundamentals, the practical learnings in the labs (hardware and simulations in lab sessions). Along with the regular hardware based labs they also learnt the simulation of the circuits using simulation software’s like LT spice, Easy EDA and KiCad (links for these software’s already given to them on the google classroom). Use of these software’s was also a big takeaway for them. Students submitted the project reports and exhibited the models they prepared for. They were evaluated on the basis of the theme of the mini project, activities carried out throughout the semester as a group towards completion of the project, demonstration and exhibition of their model and PowerPoint presentation. Students wrote reflection sheets to describe their experience of leaning through PBL.

Project Titles Group 1 to group 5

Group No	Title of the Projects	Group Name
Group 1	Cultural Heritage and its preservation methods and techniques: Case studies	Simple Minds
Group 2	Energy Conservation through floating solar panels : Case study	The Visionaries
Group 3	Reconstruction of an old structure and converting it to a Green structure	
Group 4	Study of spurs and dykes for flood water protection : case studies	Braincell
Group 5	Understanding Precast construction	Creative Construction

Fig. 2 Sample projects given to students

Evaluation scheme for PBL I (2 Credit)

Internal evaluation

- 1) Project selection report - 10 Marks
- 2) Focusing on subject knowledge - 10 Marks

External evaluation

- 1) Final report - 15 Marks
- 2) Presentation/ Oral exam - 15 Marks

Every subject teacher follows the project-based learning pedagogy for their subject and its evaluation done by the industry expert Ms. Mrinal Lokhande from Integrated Decision and Systems (India) PVT. Ltd. (IDEAS-A SAS Company), Pune

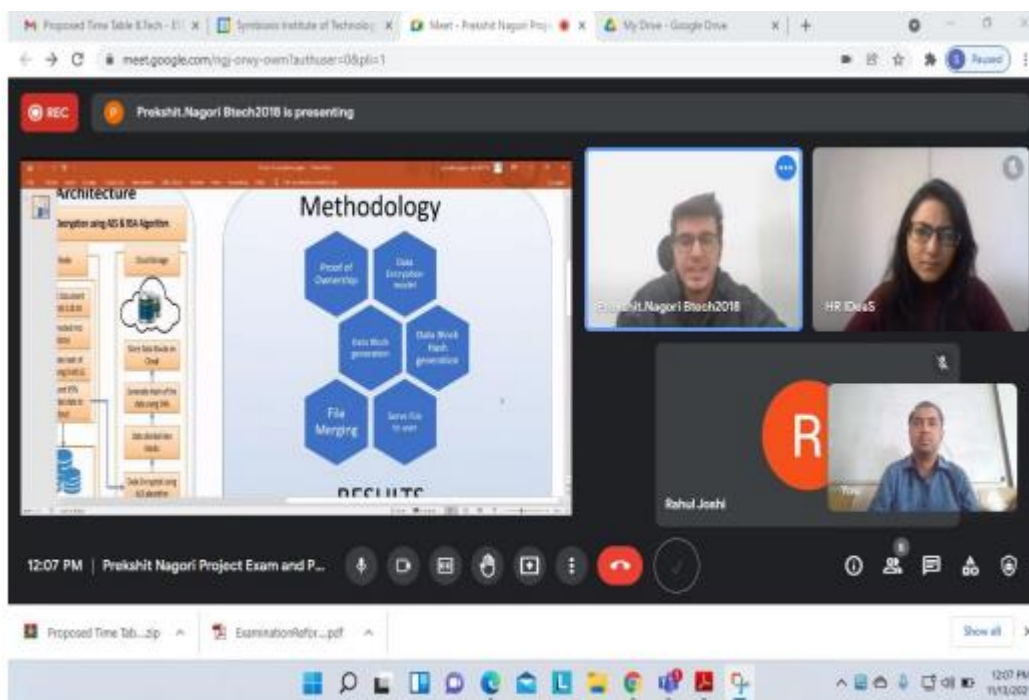


Fig.3: - Project Based Learning Evaluation of Student.

First Name	PRN	Final presentation [CO4]	Final report [CO3]	Focusing on the subject knowledge [CO2]	Project selection report [CO1]	Total
bilal.mohammed	19070125049	4	7	5	5	21
dharamveer.singh	20070125508	10	11	7	8	36
dsouza.pascoal	20070125504	8	8	7	7	30
krishna.vinil	19070125098	10	11	7	8	36
mohit.anand	19070125050	13	13	9	9	44
mohit.sambyal	19070125051	11	11	8	7	37
nachiket.malpure	19070125047	10	10	7	7	34
naved.patel	19070125057	11	10	7	7	35
niranjan.kodachakk	19070125044	10	11	8	7	36
ojeshwar.sharma	19070125055	11	12	8	7	38
omkar.more	19070125053	8	8	7	6	29
Patel.Yash	20070125506	9	10	7	7	33
pranav.rathi	19070125068	9	8	7	7	31
pranesh.shirke	19070125079	12	12	8	8	40
pranjal.tiwari	19070125061	12	13	8	9	42
pranshu.mishra	19070125062	10	11	7	7	35
prathamesh.shinde	19070125063	10	11	7	7	35
prathamesh.sonar	19070125087	7	7	5	5	24
pratyaksha.pandey	19070125064	8	9	6	6	29
priyanshu.agarwal	19070125065	9	8	7	6	30
protishee.das	19070125066	9	9	6	7	31
raj.patel	19070125067	12	12	8	8	40

Fig. 4 Sample mark list

Evidence of Success

Dossier:

Students used to muse after reading the problem statements and later get into action mode due to the intriguing tasks assigned. Key learnings and take-away from the experience were that, it acted as a team building exercise. A very good connect could be developed between teachers and students and the students could apply their basic knowledge of physics, chemistry, mathematics, and geometry to solve the problem. The entire course was executed such that the students get to do hands-on for addressing problem statements having application to different areas. It focused on smart infrastructure and effective engineered solutions. The evaluation was done on the basis of a project exhibition wherein students displayed working models of the technology chosen for application. The students learnt to make the model from scratch, learning from mistakes and retrying to reach success. In the process, they brainstormed with the faculty to ascertain that their concept is efficient for application in engineering perspective.

Problems Encountered and Resources required:

The prime requirement of this pedagogy is to have a supporting assessment pattern. This could be starting the course with a diagnostic assessment which shall help to set the bar. There can be formative assessment through the semester, ending with summative assessment. In such a way, the students would be able to focus more on the quality of their project and learn the key concepts while completing the task at hand.

Whilst delivering the entire course using the project based learning methodology, the most crucial part was to align it with the regular end-semester exams assessment. This was overcome by taking students into confidence and discussing and jotting down the key points that they learnt throughout the process. They were provided with standard notes for reference, thereby enabling them to read different terminologies. It was easier for them to compile the information, since they had experienced it through their project.

Notes

Dossier:

Students were asked to submit a report of their work after completion of the activity. For enhancing their report writing skills, they were not forced for immediate submission by the provision of an indulgent deadline. This way, they brainstormed and submitted a rather well drafted report. The final successful outcome in the activities was not expected from the students; however, their thought process and involvement were judged.

Students were inspired to take up projects of innovative nature, in-line with the course outcome. They actively participated in the activities and kept enquiring about their technical concerns at every possible stage. They determinedly worked on their project by learning all the necessary course outcomes while finding their way to the desired solution.