

Project Based Learning for a Comprehensive Course

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Abstract : Project Based Learning helps students to gain a better understanding of the course. The students actively apply their understanding of the course content and ideas for any given problem. Project Based Learning prepares students to discuss their ideas, debate on the ideas of their peers and enables them to come up with new ideas. In this paper, an implementation of project based learning for the comprehensive course 'Programming with Java' is discussed. The methodology followed and outcome of implementing Project Based Learning is depicted.

IndexTerms - Project; Java; PO attainment; Survey; Assessment;

I. INTRODUCTION

In recent times Project Based learning is gaining popularity in engineering education. It mirrors the professional behavior of engineering discipline. Project Based Learning is a student centric methodology of learning. Project based learning is based on identifying a real-world problem and learning through developing solution to the problem. Project based learning enables students to learn the theoretical concepts well and enhances their creative and thinking skills. It equips them with technological and practical skills which would be a part of their lifelong learning process. Project based learning enables the students to learn a course by solving open ended problems. It enhances identifying skills in selecting complex problems, develop and design solutions to the problem along with management of time, organizing their work, collaborating with others and working in a team [1][2].

Self-study might be a huge responsibility from the student's end for a comprehensive course. Projects can be one of the ways of motivating students as a part of self-study. This paper discusses an approach which was followed for the comprehensive course Programming with Java. As a part of self-study, students were asked to identify real-world problems and implement the solution using Java. The assessment pattern had three reviews by the faculty which included rubrics for assessing the students. The rest of the paper is organized as follows. Project Based Learning is discussed in Section II. Section III discusses the proposed methodology. Section IV gives the outcome on Project Based Learning. Student Survey is discussed in Section V followed by conclusion in Section VI.

II. PROJECT BASED LEARNING

Project based learning inculcates in-depth understanding of the concepts and improves the level of students creativity. The real world problem given draws students attention and drives them to apply higher level of thinking. The characteristics of Project Based Learning are i) Is organized around a problem or a challenge without a predefined solution. ii) To acquire essential content and skills. iii) Process need to be designed by the students which leads towards the solution. iv) Involves critical thinking, problem solving, teamwork and communication. v) Students attain knowledge of working independently and take decisions depending upon the situations. vi) It aids the faculty in designing structured review pattern to be followed. The faculty takes the role of facilitator. vii) Motivate the students to inspect the problem from a different standpoint by utilizing various resources and aggregating relevant data from the pool of data which they have collected [4][5].

The challenges in project based learning: From the students' perspective, prior learning experience may not help them. It requires effective time management because they need to prepare for other courses. It may increase their stress level. They need to over-come any issues faced with in team members and work in unity. Some students may not gain knowledge if they are not involved in the project. From the Faculty perspective, it would be a challenging task to approve the projects and give challenging projects to the students who are unable to find a problem. It consumes lot of preparation time. Faculty need to be aware of what and how to evaluate the student work. Sometimes faculty intervention is needed when there are issues in the team [3][6].

III. PROPOSED METHODOLOGY

The students were asked to do a project as part of the Self Study for the course Programming with Java. The self-study component was 30% of the 50 marks of Continuous Internal Evaluation(CIE). The Assessment Pattern is as shown below in Table 1. The theory marks were for 25 where in the students were given 3 tests and average of best two were considered for 20 marks and a quiz was given for 20 marks and reduced to 5 marks. The course had a lab component for 10 marks and the rest of 15 marks were assigned for self-study.

Table 1 Assessment Pattern

Component	Theory (50%)			Practical (20%)	Self-Study (30%)	Total Marks
	Test -1	Test -2	Quiz -1	Lab		
CIE Marks	10	10	5	10	15	50

The 15 marks of Self-Study were split up into 3 reviews. Project was evaluated in three reviews. Review 1 for 3 marks, Review 2 for 5 marks and Review 3 for 7 marks. The Project Group consisted of 2 students.

3.1 Assessment Pattern for Review 1

Students were given the task of identifying any real-world problem and presenting the same in Review 1 along with documentation for the same.

The faculty evaluated the student's performance based on the following parameters.

- Preliminary Study.
- Identification, formulation and Analysis of the Problem.
- Presentation and Documentation.

3.2 Assessment Pattern for Review 2

After the Review 1 approval by the faculty, the students continued their project work and were required to give a presentation on the analysis and design of the project. The students were evaluated based on the following parameters given below:

- High level Design.
- Detailed Design.
- Usage of modern tools and Partial Implementation.
- Presentation and Documentation.

3.3 Assessment Pattern for Review 3

The final assessment of the project work was done in Review 3 and the parameters used for the assessment is given below:

- Test cases.
- Design and Implementation of the Project.
- Engagement level of each team member.
- Presentation and Report writing.
- Completion of Project on time.

3.4 Panel Review

The Faculty shortlisted 12 batches of projects among the 43 batches present for the Panel Review. A Panel review was scheduled for selection of best project. The evaluation of the best project was done by experts from industry.

Among the 12 short listed projects, three best projects were selected by the expert from industry based on the following the parameters.

- Identification, formulation and Analysis of the Problem.
- High and Low Level Design.
- Usage of modern tools.
- Implementation of Object Oriented Concepts.
- Engagement level of each team member.
- Presentation and Communication Skills.

The feedback given by the industry expert was that he applauded the initiative taken by the faculty towards the right step in bridging the gap between industry and students. He appreciated the quality of projects and also the enthusiasm and passion of the students. He mentioned the tools used in the projects were inline with new trends. He selected three best projects out of 12 projects presented based on the research and code quality. The selected projects were Path animation using Dijkstra's Algorithm, Utility App and Transliteration API. He also suggested a bit more challenging projects could be taken up and continued across multiple semesters so that it would imbibe a sense product building in students.

IV. OUTCOME ON PROJECT BASED LEARNING

The students could gain in-depth knowledge on the topics covered in the class room as they incorporated the concepts in the project. Students were asked to use the object oriented concepts discussed in the class to be implemented in their project work so that it improves their practical skills and they could explore the problems faced and come out with the solutions.

The topics in the syllabus such as encapsulation, inheritance, polymorphism, packages, generics, multithreading, exceptions and usage of files were incorporated in designing and developing the project.

The student learned modern tools such as Eclipse, NetBeans, Java Swing, JavaFX, etc. which was not included as part of the course. Since students were working in team they could enhance their leadership skills, contribute to the team and collaborate with others. Project based learning helped the students to improve their presentation and communication skills as there were periodic reviews. It helped them to learn time management efficiently as every review had a timeline and it was well informed to the students at the beginning of the semester. The students had to submit a report on the work done for every review where in they were able to learn how to effectively document the project work.

Few of the topics of the project were Transliteration API, No Q BMSCE, Faculty Activity Updater, Online Examination, Shortest Path with Animation, Student Information System, Image Steganography, Utility App, Advance Calculator, e-Wallet and Utility Box.

Having Project Based Learning as a part of the Comprehensive course enabled to attain wider Program outcomes like PO3 – Design and Development of Solutions, PO5 – Modern tool usage, PO9 – Individual and team work, PO10 – Communication and PO12 – Lifelong learning. Figure 1 shows the PO attainment, where it can be observed the attainment all the PO’s were above 8.

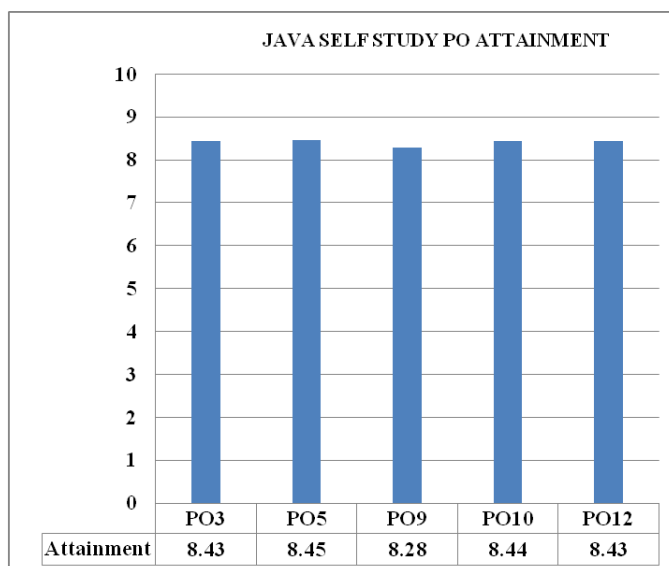


Fig. 1 Java Self Study PO Attainment

V. STUDENT SURVEY

Student survey was done at the end of the semester to know the response of the students on project based learning for the comprehensive course. The Project based learning was implemented for the Fifth Semester Information Science and Engineering students as part of the Self-Study.

The Figure 2 shown below represents the feedback from the students for the parameters like learning of modern tools and technology, their understanding level of the subject and enhancement of their skills on design and implementation. The results depict that 83% of students found they could enhance their skills by including project based learning as part of their course. Very few students felt including project as a part of the course was difficult to manage.

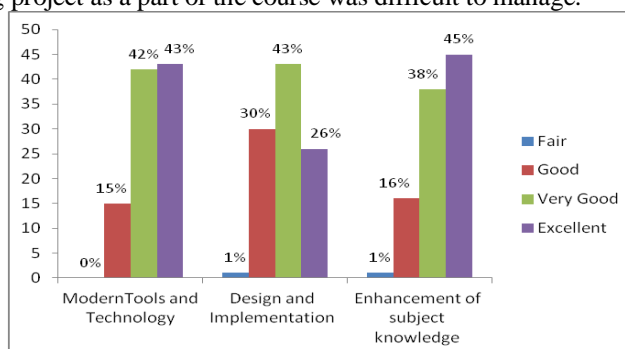


Fig. 2 Student Feedback Responses - 1

The Figure 3 shown below represents the feedback from the students for the parameters like enhancement of presentation skills and effective time work. The results depict that 79% of students found they could enhance their presentation skills by including project based learning as part of their course. 20% of students felt working in a team was not very comfortable. The faculty intervention was needed to solve the group conflicts during the process of implementation of the project. It is observed that Project based learning for the course aided the students to enhance their subject knowledge.

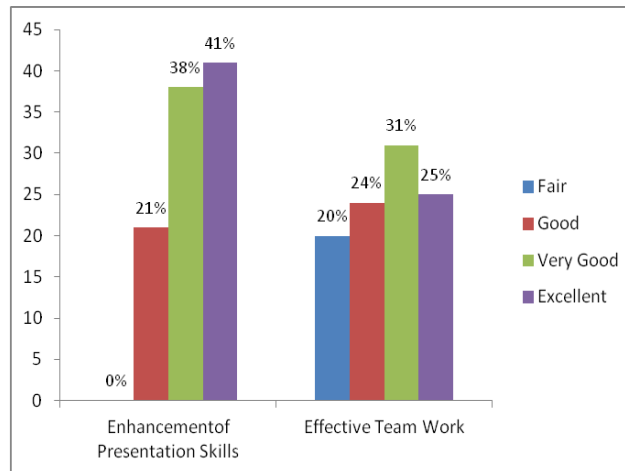


Fig. 3 Student Feedback Responses - 2

VI. CONCLUSION

Project Based learning is gaining popularity in engineering education. Inclusion of project based learning for the course Programming with Java can be considered to be one of the best methodology as it is a course which involves programming and students gain in depth knowledge of the subject by having hands on experience. The feedback from the students indicates that, they could enhance their subject knowledge. Results also shows with the inclusion of Project Based Learning to the comprehensive course Programming with Java aided to spread the POs and enhance the PO attainment.

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