

Enhancing Student Engagement and Skills Development Through Activity-Based Learning: A Case Study of Classroom Transformation in the Digital Age

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Abstract— The 21st-century students more depend on technology tools and accessories because of online classes and drastic improvements in emerging technologies. To motivate students to attend the classes and learn the courses by activity-based approach. JIGSAW Pedagogy, flipped classroom, Project-Based learning and demonstration activity planned for the module teaching. The one-minute paper activity was conducted to take the reflections from the students. The goal of this research is to converting a traditional classroom into an activity-based classroom with the goals of motivating students to attend regularly and fostering the development of technical skills, communication, presentation, and teamwork. The research question Is student's attendance increased after implementing activity based leaning? Is student's skills improved? Module wise activity planned before starting of the semester. As per lesson plan time slot is given for each activity.

85%. After the module reflection collected from the students to know is students understanding the topic clearly or not. The student's reflection shows that majority of the students are able to give presentation on stage without any hesitation. After implementation of activity in the module student's attendance increased but not able to achieve 90 % - 100%. The internal assessment conducted for the activity in Moodle tool the students' performance is increased compared to pre-test. Students technical knowledge enhanced on materials and their applications.

Keywords— Active learning methodologies, collaborative learning, project-based learning.

I. INTRODUCTION

To achieve higher order skill in students the activity based learning pedagogy should be implemented in the course. (P et al., 2022)The research observed that students initially showed reluctance to participate in the collaborative learning activity.

However, over time, their interest in the activity increased significantly. This suggests that the teaching methodology had a positive impact on student engagement. Jigsaw learning activity had a positive impact on student engagement, task completion, and learning outcomes. However, there are opportunities for future research to delve deeper into the methodology's long-term effects, provide

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The method followed to implement activity based learning is team activity and presentation by students. Gradually students interest towards course increased and overall class attendance is increased up to 80 % -

quantitative data, compare it to other strategies, and analyze student feedback more comprehensively.

(Pusawalea, 2020) The Jigsaw activity also helped develop important soft skills in students, including teamwork, leadership, and responsibility for their own and their peers' learning. The student feedback or testimonials about their experiences with the Jigsaw activity to provide a more comprehensive perspective on its impact on learning and soft skill development.

(Jamila, 2020) The paper extols the efficiency and lifelong learning benefits of the flipped classroom based on PowerPoint presentations (FCPPP), emphasizing its positive impact on soft skills essential in the digital age. It notes improved public speaking, self-confidence, presentation techniques, information literacy, self-learning, and knowledge enhancement. Positive student feedback and dynamic session engagement are highlighted, along with claims of enhanced academic achievement supported by statistical analysis.

(Komives, 2018) The flipped classroom activity has increased student learning, as evidenced by improved preliminary quiz grades and enhanced student engagement during class periods. By shortening lectures to 10-15 minutes and incorporating online quiz problems, the strategy has effectively motivated students to engage with the material more deeply than traditional in-class lectures. Additionally, the strategy has provided more class time for collaborative problem-solving, facilitating skill development in problem-solving and communication among students.

(Dabir et al., 2022) The paper emphasizes that with proper training, facilitators can manage the facilitation aspect of PBL effectively. It also acknowledges the importance of crafting clear and intriguing problem statements to maintain student interest. The paper underscores that both teachers and students benefited from PBL, with teachers expressing a desire to incorporate it into regular classroom sessions, and students reporting improved problem-solving skills, a deeper understanding of logical thought processes, and increased interest in learning.

(Thakur et al., 2021) The paper emphasizes the pressing social issues of poverty, hunger, and gender inequality in a densely populated country and acknowledges the detrimental impact of environmental exploitation and materialistic desires on society. It underscores the pivotal role of education as a catalyst for achieving Sustainable Development Goals by fostering logical thinking, questioning, and problem-solving skills to address deeply-rooted

social problems. The paper rightly advocates for quality education that promotes holistic development and contributes to a nation's social and economic progress. Furthermore, it highlights Problem-Based Learning (PBL) as a promising approach to integrate science, technology, and education, offering learners a deeper understanding of social, economic, and environmental challenges.

(Agavekar et al., 2023) This paper advocates the implementation of active learning techniques, specifically the Muddiest Point Technique and One Minute Paper, in three distinct Mechanical Engineering courses. The study reports that these methods improved students' overall understanding of course content and allowed them to communicate conceptual difficulties effectively. The active learning strategies were found to promote higher-order thinking skills, enhance engagement, generate interest in course content, and facilitate timely addressing of doubts by instructors. The use of digital tools like Padlet and Google Forms as well as traditional paper-based approaches demonstrates versatility in applying these techniques. Moreover, the paper underscores the benefits of such strategies in building a repository of key course-related points and suggests that these techniques prevent the accumulation of unanswered questions, leading to better conceptual clarity.

(Senthil, 2020) This paper addresses a significant concern about the declining enrollment in engineering programs globally, with a specific focus on the sharp decline observed in India over the last two years. It advocates for the incorporation of state-of-the-art infrastructure and active, project-based learning methods to bridge the gap between educational institutions' goals and engineering aspirations. The case study on active learning methods provides empirical evidence that project-based learning and conference publications are effective in improving academic performance and student engagement. The paper highlights the role of activity-based learning methodologies (ALM) in enhancing students' competency and motivation for project-based learning, which can contribute to the sustainable growth of engineering enrollment. The suggestions for awareness programs, multidisciplinary activities, and emotional learning methodologies provide practical insights for addressing this issue.

(Dass et al., 2021) This research highlights the importance of collaborative learning, especially in catering to the needs of Generation Z (Gen Z) engineering students who are accustomed to technology and interactive learning. It conducts an

action research study involving second-year electronics and communication engineering students, employing the Six Thinking Hats activity as a collaborative learning method. The paper effectively demonstrates the positive impact of collaborative learning on enhancing learning outcomes, with a correlation between collaborative learning and student performance. Additionally, the active participation of students in assessment parameters like presentations indicates the effectiveness of the approach. Overall, the study contributes to our understanding of how collaborative learning can benefit Gen Z students in engineering education. From the above literature by conducting assessment & taking a feedback from the students the activity based learning (ABL) will improve student's learnings.

II. METHODOLOGY

A. JIGSAW Pedagogy

After completion of module lecture for revision the JIGSAW pedagogy is being incorporated into Module 1 of the Engineering Material course, which focuses on structural steels. This pedagogical approach is strategically applied to foster cooperative learning among students. Before conducting of activity pretest was conducted to categorized students into teams. After the test (N=60) students are divided into 15 teams which contains A, B, C, D group of students. Module 1 divided into smaller topics and given to each teams. Main two groups are made one is home group and another group is expert group. The given topic will represent in poster by home group and the presentation this poster will be given by expert group. Due to this activity student have learnt and understood the topic clearly.

B. Flipped classroom

This activity in implemented module 2 of the course to achieve higher order thinking skills. The topic name is super alloys were students needs understand basic formulation of this material and chemical treatment analysis. The notes of the module are uploaded in the Moodle tool were students informed read the topic clearly and come to class.

Submitted for grading	Grade	Edit	Tuesday, 5 September 2023, 9:13 PM	EM_assignment.pdf	5 September 2023, 9:13 PM	Comments (0)
Submitted for grading	Grade	Edit	Wednesday, 6 September 2023, 12:10 PM	Kaagaz_20230906_120928523754 (1).pdf	6 September 2023, 12:10 PM	Comments (0)
No submission	Grade	Edit				
Submitted for grading	Grade	Edit	Wednesday, 6 September 2023, 12:08 PM	DocScanner Sep 6, 2023 12:04 PM.pdf	6 September 2023, 12:08 PM	Comments (0)
Submitted for grading	Grade	Edit	Wednesday, 6 September 2023, 12:19 PM	em.pdf	6 September 2023, 12:19 PM	Comments (0)
Submitted for grading	Grade	Edit	Wednesday, 6 September 2023, 9:22 PM	Em_assignment 0408	6 September 2023, 9:22 PM	Comments (0)

Fig.1 Flipped classroom activity

In the class timing students are asked to solve the questions related to module 2 and submit in the Moodle for assessment. Total 55 students are submitted the answer for the questions in the classroom out of 60 shown in figure 1.

C. Project Based Learning (PBL)

Students typically gain a more profound understanding of a subject when they engage in hands-on experiences. To enhance comprehension of this course and its practical applications, students are divided into two teams. Each team is assigned a problem statement, challenging them to develop a composite material capable of withstanding high temperatures and bearing a load of 20 kg. These teams collaboratively work on their projects, and through the Problem-Based Learning (PBL) approach, they acquire knowledge about the creation and testing of composite materials for diverse applications shown in figure.2.



Fig.2 Material Preparation – PBL

D. Laboratory experiment

In the materials lab, students are exposed to the study of material microstructures and compositions. During lab demonstrations, students gain insights into the significance of microstructure analysis and become familiar with various testing methods employed for evaluating materials.



Fig.3 Lab demonstration

E. One-minute paper

To know if students understood the topic clearly one-minute activity is conducted in every module. The question asked in the class was 1. What were the most important points you learned during the activity? 2. Which part of the concept discussed was unclear? 3. Did you find any differences in teaching methodology where need to change or continue the same methods. To record the things one-minute activity was conducted in google quiz form where students' roll numbers and other information were not taken. Through this approach, instructors are able to understand whether the instruction methods reach students or not. If students are given any topic that is unclear on the next day of class, the same topic revision will be done. Total 42 responses received out of 60.

III. RESULTS AND DISCUSSION

After the implementing of ABL post test was conducted where many students are able to score A, B grades compared to pretest shown in table.1. The assessment of activities is conducted in Moodle for all five modules.

Table.1 Pre Test and Post Test

Sl.No	Pre – Test (N-60)	Post – Test (N-60)
1	A- 9	A-26
2	B- 41	B – 34

3	C- 5	C-0
4	D- 5	D- 0

The feedback is collected from the students on pedagogy implementation shown in figure.4. The N=60 students given feedback 88% students for PBL, 74 % for Lab demonstration, 76% for flipped classroom, 70% students for JISAW pedagogy implementation.

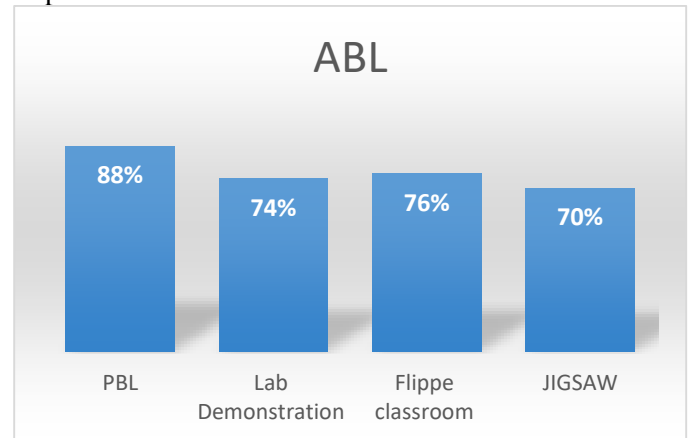


Fig. 4 Activity feedback

Overall, PBL received the highest level of positive feedback, followed by Flipped Classroom, Lab Demonstration, and Jigsaw Pedagogy. This information will help in assessing the effectiveness of these pedagogical methods in classrooms.

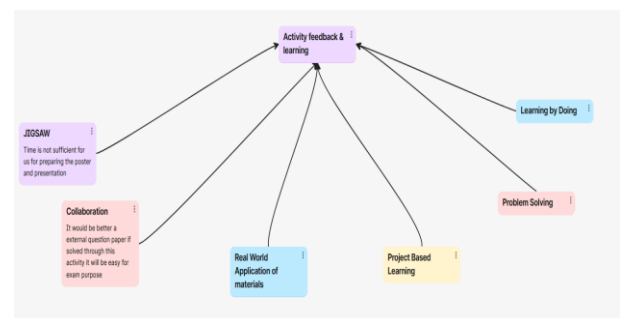


Fig. 5 Students Learnings

The student's feedback taken shown in figure.5 what are they learnt during the activities. Students have given a very prompt feedback 1. Time is not sufficient for us for preparing the poster and presentation 2. It would be better an external question paper if solved through this activity it will be easy for exam purpose.

A. Is student's attendance increased after implementing activity based leaning?

The student's attendance was around 70% in module 1 instruction class, after activity implementation attendance was reached to 80% to 85%. There is a little bit improve of attendance in the classrooms. If

all courses are implemented ABL then (Senthil, 2020) students attendance will increase in the classrooms.

B. Is student's skills improved?

The student's communication skill, team work, technical skills were improved due to ABL pedagogies. The students are shown very interested to work in a team. ABL pedagogies enhances students learning outcomes and other soft skills.

IV. CONCLUSION

the transformation of traditional classrooms into Activity-Based Learning (ABL) environments, incorporating methodologies such as Problem-Based Learning (PBL), Flipped Classroom, Lab Demonstrations, and Jigsaw Pedagogy, has proven highly effective in enhancing student engagement, performance, and skill development. The positive feedback from students, improved grades, and increased attendance rates underscore the success of these pedagogical innovations. Future work should focus on addressing time constraints and refining assessment methods, including the integration of external question papers, to further enhance exam preparedness. Additionally, continuous exploration of ABL's potential for fostering holistic student development, including soft skills, remains a promising avenue for educational improvement in the digital age.

For future work, it will be beneficial to explore ways to address students' concerns about time constraints and integrate external question papers to better prepare students for exams while continuing to harness the advantages of ABL in enhancing overall learning outcomes and soft skills development.

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