

Pedagogical Approaches on Students Learning Engagement in Science

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Abstract—This study investigated the relationship between pedagogical approaches employed by the teacher and student learning engagement in science, addressing the critical need for enhanced student involvement in science education. Engaging students effectively was vital for improving their understanding and retention of scientific concepts; however, many students reported feeling disconnected from their science classes. Quantitative research design was employed in this study, which then utilized purposive sampling from three program participants at Bukidnon State University: The Bachelor of Science in Education (BSE) majoring in Science, the Bachelor of Science in Environmental Sciences, and the Bachelor of Science in Biology. Data were collected through two research-patterned instruments assessing pedagogical strategies and student engagement, employing a 4-point scale for responses. Descriptive and correlational analyses were conducted to explore the implementation of teaching methods and their impact on student engagement levels. Results revealed that teachers exhibited a strong commitment to effective pedagogical practices with the overall mean of 3.69, while students demonstrated high levels of engagement across behavioral (3.48), affective (3.58), and cognitive (3.45) dimensions. A significant positive correlation was found between pedagogical approaches and student engagement ($r = .707, p < .001$), indicating that diverse and effective teaching strategies fostered higher student participation and emotional investment in their learning. These findings underscored the importance of innovative teaching methods in enhancing student engagement, suggesting that tailored pedagogical practices could lead to improved academic outcomes and foster a lasting appreciation for scientific inquiry among students.

Keywords— Pedagogical Approaches, Student Engagement, Behavioral Engagement, Affective Engagement and Cognitive Engagement.

I. INTRODUCTION

This document In recent years, the significance of student learning engagement in science education has garnered substantial attention among educators and researchers. Engaging students in the learning process is crucial for enhancing their understanding and retention of scientific concepts. Research indicates that when students are actively involved in their learning, they are more likely to develop a positive attitude towards science, which can lead to sustained interest and improved academic performance. However, many students struggle with engagement in science classes, often resulting in a lack of interest and lower achievement levels. This study addresses the pressing issue of students' learning engagement in science, focusing on how various pedagogical

approaches employed by teachers can influence this engagement.

Student learning engagement is a multifaceted construct that encompasses behavioral, Affective, and cognitive. Behavioral engagement refers to students' participation in academic activities, such as attending classes, completing assignments, and participating in discussions. Affective engagement involves students' feelings towards their learning experiences, including their interest and motivation. Cognitive engagement relates to the mental effort students invest in understanding complex concepts and problem-solving. Research has shown that high levels of engagement across these dimensions are associated with better academic outcomes, particularly in subjects like science that require critical thinking and application of knowledge. Despite its importance, many students report feeling disconnected from their science education. Factors contributing to this disengagement may include traditional teaching methods that prioritize rote memorization over critical thinking and inquiry-based learning. As a result, educators are increasingly called upon to explore alternative pedagogical approaches that can foster higher levels of student engagement.

Pedagogical approaches encompass a variety of teaching methods and strategies that educators utilize to facilitate learning, significantly influencing students' motivation and interest in science. The effectiveness of these approaches is crucial in nurturing student engagement across different dimensions. Ben-Eliyahu et al. (2018) assert that effective pedagogical strategies enhance behavioral, affective, and cognitive engagement by fostering a supportive learning environment that promotes active participation and emotional investment in educational activities. For instance, hands-on activities and inquiry-based learning not only stimulate cognitive processes but also promote positive emotional responses, thereby enhancing affective engagement among students (Holmes et al., 2021). These approaches allow students to take ownership of their learning while engaging them at multiple levels.

Moreover, the findings from De Grandi et al. (2019) emphasize that teachers' beliefs about engagement significantly influence their pedagogical strategies. When educators adopt methods that prioritize student-centered learning—such as collaborative projects or problem-based learning—they can effectively increase both behavioral and cognitive engagement. This aligns with Schmidt et al. (2018), who argue for a person-in-context approach that considers

how individual learning activities resonate with students' interests and choices, further enhancing their overall engagement in science.

Additionally, the integration of various teaching methods tailored to local contexts can yield significant benefits for student engagement. Holmes et al. (2021) highlight the importance of linking K-12 STEM pedagogy to local contexts, suggesting that contextualized learning experiences can foster deeper connections between students' lives and scientific concepts. This not only enhances cognitive engagement but also positively impacts affective dimensions by making science more relevant and relatable.

The primary objective of this research is to determine if there is a significant relationship between the pedagogical approaches employed by teachers and the level of student engagement in science learning. Exploring this relationship aims to provide insights that can inform teaching practices and enhance student outcomes in science education. This research will be conducted during the first semester of the school year 2024-2025 at Bukidnon State University and is intended for college students particularly the Bachelor of Science in Education (BSE) majoring in Science, Bachelor of Science in Environmental Sciences, and Bachelor of Science in Biology. The findings are expected to contribute valuable knowledge to the field of educational pedagogy, particularly in enhancing student engagement in science through effective teaching strategies.

Understanding how different pedagogical approaches can influence student engagement is vital for improving educational outcomes in science education. Examining this relationship within the context of Bukidnon State University aims to provide valuable insights into effective teaching practices that can enhance student interest and participation in science courses. Additionally, this research seeks to strengthen social connections among peers through collaborative learning experiences. Ultimately, enhancing student engagement through innovative pedagogical strategies may lead not only to improved academic performance but also to a lifelong appreciation for scientific inquiry among learners.

The insights gained from this research are expected to directly benefit the courses offered within these programs by providing actionable recommendations for educators. Identifying effective teaching strategies that foster student engagement can significantly enhance instructional practices across various disciplines, ultimately resulting in improved academic performance. Furthermore, fostering greater engagement in science courses can cultivate a deeper appreciation for scientific inquiry among students, encouraging them to pursue careers in science-related fields. This aligns with BukSU's commitment to community engagement and sustainable development, as engaged students are more likely to contribute positively to their communities through their knowledge and skills.

Objectives of the Study

1. What are the pedagogical approaches being implemented by the teachers in teaching science?

1.1 What types of teaching strategies do teachers employ in their science instruction?

1.2 How do teacher-student interactions manifest during science lessons?

1.3 What assessment strategies do teachers utilize to evaluate student learning in science education?

2. What is the level of students' engagement in learning Science?

2.1 What is the level of behavioral engagement among students in learning science?

2.2 How emotionally engaged are students in their learning experiences in science?

2.3 To what degree do students demonstrate cognitive engagement when learning science concepts?

3. Is there a significant relationship between the pedagogical approaches employed by teachers on the level of student engagement in science learning?

II. MATERIALS AND METHODS

A. Respondents

Participants in this study included students from three specific programs: Bachelor of Science in Education (BSE) majoring in Science, Bachelor of Science in Environmental Sciences, and Bachelor of Science in Biology. These groups were chosen because they represented a range of science-related disciplines and were likely to experience different pedagogical approaches in their coursework. Purposive sampling was used to select participants across all levels within these programs. This method ensured that the selected students possessed relevant experiences and insights related to their specific fields of study, allowing for a more focused exploration of how various pedagogical approaches impacted student engagement in science learning (Etikan et al., 2016).

B. Research Design

This study employed a quantitative research design that was both descriptive and correlational to investigate the relationship between pedagogical approaches and student learning engagement in science learning. The descriptive aspect aimed to provide a comprehensive overview of the pedagogical approaches implemented by teachers and the level of student engagement among students. By collecting numerical data, this part of the research sought to present measurable insights into current teaching methods and student participation in science courses.

The correlational aspect was utilized to explore the significant relationship between the pedagogical approaches employed by teachers and the level of student engagement in science learning. This component aimed to determine how different teaching methods relate to students' interest and participation in science classes while recognizing that correlation does not imply direct causation. Employing both descriptive and correlational designs aimed to provide valuable insights into how various pedagogical strategies affect student engagement in science education.

C. Instrument

Two research-patterned instruments were utilized for data collection. The first instrument was based on the work of Dumilao et al. (2021), which focused on various pedagogical approaches used by teachers. The second instrument was adapted from Hart et al. (2011), which assessed student engagement in learning science. Both instruments employed a 4-point scale rating system to gauge participants' levels of agreement with various statements regarding teaching methods and engagement. The scale was as follows: 1 indicated "Strongly Disagree," 2 indicated "Disagree," 3 indicated "Agree," and 4 indicated "Strongly Agree."

D. Statistical Analysis

Data were collected to address three research questions. The first question sought to identify the pedagogical approaches implemented by teachers when teaching science. The second question aimed to determine the level of students' engagement in learning science. Descriptive statistics, specifically the mean, were used to summarize the data for these questions. The third question investigated whether there was a significant relationship between the pedagogical approaches employed by teachers and the level of student learning engagement in science learning. To analyze this relationship, Pearson's correlation coefficient was utilized, allowing for an assessment of the strength and direction of the relationship between these two variables.

III. RESULTS AND DISCUSSION

Summary of Teacher's Pedagogical Approach

Table 1. presents the summary of the level of pedagogical approaches among educators, encompassing three key sub-variables: Types of Teaching Strategies, Teacher-Student Interaction, and Assessment Strategies. As indicated in the table, Types of Teaching Strategies received the highest mean score of 3.74, categorized as "Strongly Agree," reflecting a very high level of implementation. This is closely followed by Teacher-Student Interaction, which achieved a mean of 3.69, also rated as "Strongly Agree," indicating a similarly high level of engagement in this area. Assessment Strategies recorded a mean score of 3.64, maintaining the "Strongly Agree" rating and demonstrating a very high level of assessment practices among teachers. The overall mean for pedagogical approaches is 3.69, reinforcing the idea that educators exhibit a strong commitment to effective pedagogical practices.

TABLE 1. Summary of Teacher's Pedagogical Approach in the aspect of Types of Teaching Strategies, Teacher-Student Interaction and Assessment Strategies.

Indicators	Mean	Descriptive Rating	Qualitative Interpretation
Types of Teaching Strategies	3.74	Strongly Agree	Very Highly Effective
Teacher-Student Interaction	3.69	Strongly Agree	Very Highly Effective
Assessment Strategies	3.64	Strongly Agree	Very Highly Effective
Overall Mean	3.69	Strongly Agree	Very Highly Effective

Range	Descriptive Meaning	Qualitative Interpretation
3.25-4.00	Strongly Agree	Very Highly Effective
2.50-3.24	Agree	Highly Effective
1.75-2.49	Disagree	Low Effective
1.0-1.74	Strongly Disagree	Very Low Effective

The results indicated that teachers implement a variety of pedagogical approaches in science education, utilizing diverse teaching strategies, interactive dynamics, and assessment methods. Teachers often integrate technology, employ lectures, design relevant activities, and incorporate hands-on laboratory experiences to enhance student understanding and engagement. Teacher-student interactions are characterized by approachability, fostering an interactive learning environment, providing timely feedback, and encouraging student expression during discussions. Additionally, teachers utilize various assessment strategies, including hands-on lab experiments and performance-based assessments, to evaluate student learning effectively.

These findings underscore the significance of high levels of teacher engagement in pedagogical approaches, which can lead to improved student outcomes. Research indicates that effective teaching strategies are closely linked to students' engagement and motivation (Han, 2021). Furthermore, fostering positive teacher-student interactions is essential for creating an inclusive classroom atmosphere where students feel valued and motivated to participate actively in their learning. Roorda (2017) highlights that strong teacher-student relationships positively influence students' engagement and achievement. The focus on assessment strategies also highlights the critical role of formative assessments in guiding instruction and providing feedback that supports student learning, which has been shown to significantly impact student achievement. Chusni (2022) emphasizes the strategic implementation of assessment "for" and "as" learning in science education, underscoring how effective assessment practices can enhance both student understanding and engagement in the learning process.

Summary of Student Engagement

Table 2. presents the summary of student engagement across three key dimensions: Behavioral Engagement, Affective Engagement, and Cognitive Engagement. As indicated in the table, Behavioral Engagement received a mean score of 3.48, categorized as "Strongly Agree," reflecting a very high level of active participation among students. This is closely followed by Affective Engagement, which achieved a mean of 3.58, also rated as "Strongly Agree," indicating that students experience strong emotional connections to their learning environment. Cognitive Engagement recorded a mean score of 3.45, maintaining the "Strongly Agree" rating and demonstrating a very high level of investment in the learning process. The overall mean for student engagement is 3.50, reinforcing the idea that students exhibit a strong commitment to their learning experiences.

These findings highlighted the importance of fostering an engaging learning environment that addresses all dimensions of student engagement. According to Bryson (2014), understanding and developing student engagement is crucial for enhancing educational outcomes. The multidimensional

nature of engagement, as discussed by Ben-Eliyahu et al. (2018), emphasizes that effective teaching strategies must cater to behavioral, affective, and cognitive aspects to fully engage students in their learning processes.

TABLE 2. Summary of Student Engagement in the aspect of Behavioral Engagement, Affective Engagement and Cognitive Engagement.

Indicators	Mean	Descriptive Rating	Qualitative Interpretation
Behavioral Engagement	3.48	Strongly Agree	Very Highly Effective
Affective Engagement	3.58	Strongly Agree	Very Highly Effective
Cognitive Engagement	3.45	Strongly Agree	Very Highly Effective
Overall Mean	3.50	Strongly Agree	Very Highly Effective

Range	Descriptive Meaning	Qualitative Interpretation
3.25-4.00	Strongly Agree	Very Highly Effective
2.50-3.24	Agree	Highly Effective
1.75-2.49	Disagree	Low Effective
1.0-1.74	Strongly Disagree	Very Low Effective

Moreover, Sinatra et al. (2015) point out the challenges in defining and measuring student engagement in science, underscoring the need for educators to implement varied approaches that can foster engagement across different contexts.

Relationship of Pedagogical Approaches and Student learning Engagement in Science

Table 3. displays the results of the correlation analysis between pedagogical approaches and student learning engagement. The findings indicate a significant positive correlation, with a Pearson coefficient (r-value) of .707**. This suggests a strong relationship between effective pedagogical strategies and the level of student engagement in learning. The probability (p-value) is .000, which is less than the established significance level of 0.05, leading to the rejection of the null hypothesis.

TABLE 3. Correlation of Pedagogical Approaches and Student learning Engagement in Science

	Student Learning Engagement	Pearson Coefficient (r-value)	Probability (P-Value)
Pedagogical Approaches		.707**	.000

The analysis of the correlation between pedagogical approaches and student learning engagement reveals a significant positive relationship, with a Pearson coefficient (r-value) of .707 and a p-value of .000. This indicates that as the effectiveness of pedagogical strategies increases, so does student engagement in learning. The strong correlation suggests that educators who implement diverse and effective teaching methods are likely to foster higher levels of student participation, emotional involvement, and cognitive investment in their learning processes. This finding underscores the critical role that pedagogical approaches play in enhancing student engagement, which is essential for improving academic outcomes.

Supporting this study, De Grandi et al. (2019) emphasize that specific pedagogical strategies can significantly enhance students' engagement and motivation, aligning with the findings of this research. Similarly, Schmidt et al. (2018) highlight the importance of a person-in-context approach to student engagement, demonstrating that tailored learning activities can effectively increase student involvement in science education. Furthermore, O'Brien (2015) discusses how pedagogical tools designed to promote engagement and active learning in sciences can lead to improved student participation and understanding, reinforcing the idea that innovative teaching strategies are crucial for enhancing student motivation and participation in diverse educational contexts.

IV. CONCLUSIONS

From this study, teachers implemented a variety of pedagogical approaches in science education that encompass diverse teaching strategies, interactive dynamics, and assessment methods. In terms of teaching strategies, educators often integrate technology, utilize lectures, design relevant activities, and incorporate hands-on laboratory experiences to enhance student understanding and engagement. Teacher-student interactions are characterized by approachability, fostering an interactive learning environment, providing timely feedback, and encouraging student expression during discussions. Additionally, teachers employ various assessment strategies, including hands-on lab experiments, performance-based assessments, and open-ended questions to evaluate student learning effectively. Collectively, these approaches aim to create an inclusive and stimulating educational environment that promotes active participation and deepens students' understanding of scientific concepts.

The level of student engagement in learning science was found to be very high across behavioral, affective, and cognitive dimensions. Additionally, the strong positive correlation between pedagogical approaches and student engagement suggests that when teachers utilize diverse and engaging instructional methods, students are more likely to participate actively, develop emotional connections to the subject matter, and engage in deeper cognitive processes. This underscores the importance of effective teaching practices in enhancing student learning outcomes in science education.

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