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The Impact of Project-Based Learning as an Innovative Pedagogical Approach in Assessing Student Engagement

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***Abstract*—** This descriptive study investigated the impact of Project-Based Learning (PjBL) on student engagement in four high schools in Prieto Diaz District, DepEd Sorsogon Province. The research focused on science teachers, selected through purposive sampling, to gather insights on PjBL's application, effectiveness, and challenges. Data were collected using a structured questionnaire, which covered the extent of PjBL utilization, its impact on student learning, effectiveness in engaging students, and the challenges teachers face in implementing PjBL. Statistical analysis using weighted means was employed to identify trends in teachers' perceptions and guide recommendations for enhancing PjBL implementation.

The findings revealed that PjBL was frequently used for activities such as experiments and presentations, and it is highly effective in assessing critical thinking, problem-solving, and real-world application skills. PjBL also significantly boosted student engagement by fostering collaboration, critical thinking, and independence. However, teachers faced challenges, including time constraints, difficulties in assessing diverse student abilities, and limited resources.

The study concluded that while PjBL has a strong positive impact on student engagement, there is a need for greater teacher support, professional development, and resource allocation. It recommended the development of learning session guides to further enhance PjBL implementation in high school science subjects. The findings suggest that with improved support and resources, PjBL can be a more effective tool for promoting deeper student learning and engagement in science education.

***Keywords*—** assessing student engagement, Project-Based Learning, (PjBL) application, PjBL implementation, PjBL utilization, science education.

I. INTRODUCTION

Science education has evolved fueled by the integration of technology and innovative teaching methods. Traditional passive learning methods are being replaced with more dynamic and interactive teaching approaches. Students are no longer seen as passive recipients of knowledge; instead, they are encouraged to take an active role in their learning through digital tools, interactive simulations, and collaborative real-world research projects. This shift encourages deeper engagement and enhances critical thinking among students, making them more curious, analytical, and better equipped to apply scientific concepts beyond the classroom.

In the age of digital transformation, technologies such as artificial intelligence, big data, and the metaverse are revolutionizing education at an astonishing rate, bringing both remarkable opportunities and unprecedented challenges. These advancements not only redefine how we teach and learn but also pose significant hurdles in developing talent that is capable of navigating a rapidly changing world. Cultivating students with higher-order thinking skills—skills that enable them to adapt to future societal changes and address complex real-world problems—has become a pivotal goal in education reform worldwide. This approach is essential for preparing students to succeed in an increasingly interconnected and technology-driven future (Ma & Yang, 2021).

The need to enhance student engagement and performance in science is increasingly evident, as global assessments continue to highlight significant disparities. In the 2018 Programme for International Student Assessment (PISA), 78% of students in OECD countries achieved Level 2 or higher in science, demonstrating the ability to recognize valid explanations for scientific phenomena and assess conclusions based on provided data. Notably, regions such as Beijing, Shanghai, Jiangsu, and Zhejiang (China) (97.9%), Macao (China)

(94.0%), Estonia (91.2%), and Singapore (91.0%) outperformed most participating countries.

The 2019 Trends in International Mathematics and Science Study (TIMSS) further reinforced these trends, with Singapore leading the rankings—48% of its eighth-grade students reached the Advanced International Benchmark. Other high-achieving countries included Chinese Taipei (29%), Japan (22%), and Korea (22%), while the majority of participating countries had fewer than 10% of students attaining this level of proficiency.

In the 2022 PISA results, the average science score across OECD countries was 485 points, with Singapore ranking the highest in science (561 points), mathematics (575 points), and reading (543 points). Other top performers in science included Canada, Estonia, Hong Kong (China), Japan, Korea, Macao (China), and Chinese Taipei. Finland also matched Canada's performance in science. Beyond these nine leading countries, 15 other education systems scored above the OECD average, with Australia (507 points) and Belgium (491 points) among them. However, some countries displayed uneven performance across subjects, such as Austria, Belgium, Latvia, and Slovenia, which performed above the OECD average in science and mathematics but not in reading. The United States, in contrast, scored well in science and reading but not in mathematics, while Germany performed above average in science but had mathematics and reading scores close to the OECD average.

International assessments have revealed concerning results regarding the Philippines' science literacy. In a study by Mullis et al. (2020), the country ranked second from the bottom out of 357 nations, with Filipino students demonstrating limited understanding of scientific concepts and a lack of foundational science knowledge. This was further highlighted in the 2018 PISA, where the Philippines participated for the first time and ranked lowest in reading comprehension, and second-lowest in both mathematics and science. These results underscored the urgent need for the Department of Education and teachers to address the existing gaps and issues in the teaching and learning process.

The transition to online distance learning during the COVID-19 pandemic worsened these challenges, putting essential skills at risk. In the 2022 PISA, only 23% of Filipino students reached Level 2 or higher in science (compared to the OECD average of 76%). At this level, students can recognize correct explanations for familiar scientific phenomena and assess whether conclusions are valid based on the provided data. However, the performance in the Philippines revealed a deeper issue: nearly no students achieved the highest proficiency levels (Level 5 or 6) in science, compared to the OECD average of 7%. These top-performing students are able to apply their scientific knowledge creatively and autonomously to a wide range of situations, including unfamiliar ones, which highlights a critical area of concern in the nation's educational system.

Despite the importance of science in shaping critical thinking, problem-solving, and future innovation, many students continue to face difficulties in understanding core concepts and applying scientific principles effectively. This persistent underperformance underscores the necessity for a reassessment of current teaching methods, focusing on strategies that can foster a deeper interest in the subject and enhance overall comprehension. The persistent issue of low academic achievement among students calls for a shift away from traditional teaching methods that merely focus on basic and fragmented knowledge through repetitive activities. A more effective learning strategy is required to promote holistic development and address the challenges faced by Filipino learners.

One promising approach is Project-Based Learning (PjBL) (Guo et al., 2020), a dynamic teaching method that encourages students to learn by engaging in real-world, personally meaningful projects. PjBL provides an authentic learning experience where students actively solve problems, make decisions, and tackle complex tasks (Alamri, 2021). In today's classrooms, technology plays a vital role in empowering teachers to cultivate more creative and interactive learning environments, offering access to innovative tools and resources. However, to fully harness the potential of these technological advancements, teachers must also adapt their teaching methodologies. By integrating digital technology with innovative approaches such as Project-Based Learning (PjBL), teachers can effectively address students' learning challenges, promoting deeper engagement and helping students achieve higher learning outcomes.

Project-Based Learning (PjBL) is an innovative and dynamic approach to teaching science education that promotes active, inquiry-based learning. This method allows students to collaboratively engage with real-world problems, fostering critical thinking and enabling

them to apply their knowledge to solve complex issues. The World Population Review (2021) reported that the United States, United Kingdom, Germany, Canada, and France are among the top-performing educational systems globally, and all of these countries effectively integrate PjBL into their academic frameworks. Despite its widespread adoption, the direct impact of PjBL on students' academic performance remains an area that warrants further investigation. Fortunately, from a research perspective, PjBL is closely linked to the behavioral changes exhibited by students who engage in this approach.

In the Philippines, Project-Based Learning (PjBL) is increasingly recognized as an effective pedagogical strategy that enhances students' critical thinking, creativity, and problem-solving abilities. The Department of Education (DepEd) has actively promoted its integration into K-12 education to cultivate holistic and engaged learners. However, students' perspectives and personal beliefs influence their receptivity to PjBL, as some still prefer traditional academic practices that provide foundational knowledge. While PjBL offers an exciting avenue for improving education, its success depends on students' willingness to embrace its benefits alongside conventional methods.

Science process skills—observation, communication, classification, measurement, inference, and prediction—are fundamental to scientific inquiry and critical thinking. Introduced as early as Grade 3, these skills form the foundation for analytical reasoning. Additionally, 21st-century competencies, known as the 4Cs—communication, collaboration, critical thinking, and creativity—are vital for addressing complex problems, working with others, and innovating solutions. However, the shift to remote learning during the pandemic disrupted hands-on interactions, limiting the development of collaboration and social skills crucial for personal and professional success. Le Thu (2020) emphasized that while digital and socio-emotional skills gained importance during the COVID-19 pandemic, resilience—an essential 21st-century skill—has yet to be fully integrated into the learning framework.

Teachers must adapt teaching strategies that nurture both digital and socio-emotional skills. PjBL has emerged as a promising approach, engaging students in real-world problems that require research, teamwork, and sustained inquiry. Unlike traditional short-term projects, PjBL fosters deep engagement by encouraging learners to connect classroom concepts to meaningful, real-life challenges. Krajcik and Czerniak (2018) explained that PjBL enhances scientific literacy by providing hands-on, inquiry-based experiences, helping students develop a deeper understanding of core scientific principles.

Beyond content mastery, PjBL fosters independence and accountability, as students take responsibility for managing their time, researching information, and collaborating with peers. This active learning approach equips students to make informed decisions and address societal challenges using scientific knowledge. While the K-12 curriculum in the Philippines is designed to be student-centered and aligns with PjBL principles, its full implementation remains limited. Traditional lectures still dominate instruction, yet incorporating PjBL can transform learning by engaging students in meaningful, long-term projects that develop both Science process skills and 21st-century competencies.

This study intends to explore the impact of Project-Based Learning (PjBL) as an innovative pedagogical approach to assess student engagement in the Prieto Diaz District of DepEd Sorsogon Province Division. With a growing need for 21st-century skills such as collaboration, critical thinking, and creativity, PjBL is seen as an effective way to actively engage students in real-world problems and foster these essential skills. This research will examine how PjBL influences student participation, motivation, and the development of science process skills.

This study was designed to evaluate the impact of project-based learning (PjBL) as an innovative pedagogical approach in assessing student engagement in the Prieto Diaz District, DepEd Sorsogon Province Division. Specifically, it sought to address the following research questions:

1. What is the extent of utilization of project-based learning as an innovative pedagogical approach in assessing student engagement?
2. What is the level of effectiveness of project-based learning as an innovative pedagogical approach in assessing student engagement?
3. What is the impact of project-based learning as an innovative pedagogical approach in assessing student engagement?
4. What are the difficulties experienced by teachers in the utilization of project-based learning as an

innovative pedagogical approach in assessing student engagement?
5. What learning session guides can be proposed to improve student learning engagement?

II. RESEARCH METHODOLOGY

This study employed a descriptive research design, commonly referred to as statistical research, to examine the impact of project-based learning as an innovative pedagogical approach on student engagement. The primary goal of descriptive research is to provide a detailed and accurate depiction of the data and characteristics associated with the population or phenomenon under investigation. This design is widely utilized across various fields and systematically observes and documents the variables and conditions influencing the subject of study (Aggarwal & Ranganathan, 2019). Specifically, it sought to uncover insights into the extent, effectiveness, and impact of project-based learning, as well as the challenges faced by teachers and strategies for improving student engagement.

To achieve these objectives, the study adopted a quantitative research approach, which involves the empirical collection and analysis of numerical data to uncover patterns, test hypotheses, and derive insights. This approach enabled the systematic measurement and statistical analysis of data related to teaching strategies, teacher experiences, and student engagement levels. Larson (2024) noted that quantitative research provides robust, evidence-based findings that can be generalized to broader populations, offering a comprehensive understanding of behaviors, trends, and outcomes. By employing statistical tools and structured methods, this approach ensures objective measurement and facilitates the identification of relationships, patterns, and factors influencing the successful implementation of project-based learning. This structured framework yields reliable and applicable results that enhance understanding and support improvements in educational practices.

The Respondents

This research applied the purposive sampling method which enabled the researcher to select individuals who have specific knowledge and experience relevant to the research questions. This non-random sampling technique targets participants based on predetermined criteria, ensuring that the sample is aligned with the study's objectives (Bisht, 2024). By focusing on science teachers in four high schools in Prieto Diaz District, the method allows for in-depth insights into the use of project-based learning (PjBL) in classrooms. This focused approach is more time-efficient and practical than a broader sampling method, as it ensures that only participants with the necessary expertise and experience are included.

In this case, the researcher collected data from science teachers in four high schools within the Prieto Diaz District of DepEd Sorsogon Province Division. This approach ensured that the sample consists of teachers who are directly involved in the implementation of project-based learning (PjBL) as an innovative pedagogical approach, thus providing insightful and pertinent information about its impact on student engagement. The breakdown is presented below.

Table A. *Respondents*

School	**n**
Prieto Diaz National High School	14
Manlabong National High School	3
San Rafael Integrated School	4
Calao National High School	4
Total	25

Research Instruments

The research instrument used in this study is a structured questionnaire designed to assess the impact of Project-Based Learning (PjBL) as an innovative pedagogical approach in engaging students. It consists of four parts, each targeting a different aspect of PjBL implementation and its effect on student engagement.

Part I focuses on the extent of utilization of PjBL in the classroom. Respondents are asked to rate the extent with which they use PjBL methods in various teaching activities, such as group projects, scientific model creation, community issue research, and student-led projects. The rating scale ranges from “Very High Extent” to “No Extent,” allowing the researcher to capture how often these methods are employed in teaching.

Part II evaluates the level of effectiveness of PjBL in assessing student engagement. Teachers rate how well PjBL helps them gauge student understanding, critical thinking, creativity, and real-world problem-solving abilities. The effectiveness is rated on a scale from "Highly Effective" to "Not Effective," providing insights into how teachers perceive PjBL's ability to engage and assess students.

Part III examines the impact of PjBL on student engagement. It focuses on how PjBL influences various aspects of student learning, such as understanding of content, collaboration, independence, critical thinking, and real-world application. Respondents assess the impact of PjBL on student engagement, from "Highly Evident" to "Not Evident."

Part IV addresses the difficulties encountered by teachers in utilizing PjBL. Teachers are asked to rate challenges they face in areas such as time management, assessment of group contributions, resource availability, and maintaining consistent student engagement. This section aims to identify the obstacles teachers encounter when implementing PjBL, with ratings ranging from "Highly Difficult" to "Not Difficult."

The research instrument helped the researcher to gather detailed insights into how PjBL is utilized in high school science classrooms, its perceived effectiveness, its impact on student engagement, and the challenges teachers face when using this innovative pedagogical approach. The data gathered from this instrument were crucial in evaluating the role of PjBL in enhancing student engagement in high school science education.

Data Gathering Procedure

The data gathering procedure for this study followed a systematic process to ensure the reliability and validity of the findings. It began with the development of research instruments, specifically designed to address the research questions. These instruments underwent rigorous evaluation and refinement with feedback from the thesis adviser to enhance their clarity, relevance, and effectiveness. To further ensure their validity, a pilot test was conducted with science teachers from the researcher's school. Their feedback was analyzed, and necessary revisions were made to improve the clarity of the questions and the overall reliability of the instrument.

Once the research instruments were finalized, formal approval was secured from the Schools Division Superintendent, signifying official authorization to conduct the study. Following this, the researcher sent formal letters to the school heads of the identified respondent schools, informing them of the study's objectives, scope, and the participation of teacher respondents. After obtaining the necessary permissions, the validated questionnaires were distributed to the selected teacher participants, ensuring confidentiality and voluntary participation.

A week after distribution, the researcher collected the completed questionnaire and conducted follow-up informal interviews with a select group of respondents. These interviews served to validate the responses from the questionnaire, clarify any ambiguous answers, and gain deeper insights into the teachers' experiences with Project-Based Learning (PjBL). This qualitative component provided richer context to the quantitative data, allowing for a more comprehensive analysis.

Following data collection, the researcher applied appropriate statistical tools to analyze the responses, ensuring the accuracy, reliability, and validity of the findings. The results of this analysis were then synthesized to draw meaningful conclusions regarding the extent of PjBL utilization, its effectiveness in assessing student engagement, and the challenges encountered by teachers in its implementation.

Statistical Treatment of Data

In this study, the weighted mean served as the primary statistical tool for analyzing data collected through a Likert scale-based research instrument. The Likert scale measured respondents' levels of agreement or disagreement regarding the utilization, effectiveness, impact, and challenges of Project-Based Learning (PjBL) in student engagement. Each section of the questionnaire captured respondents' perceptions, experiences, and evaluations of PjBL in their teaching practices. The weighted mean was chosen for its ability to provide a nuanced analysis by assigning greater significance to specific responses, enabling a clearer understanding of overall trends in the data (Alonazi et al., 2019).

The weighted mean was utilized to determine the frequency of PjBL implementation by teachers and assess the extent to which project-based learning was adopted as an innovative pedagogical approach for enhancing student engagement. Additionally, it measured teachers' perceptions of PjBL's effectiveness in fostering student engagement. Weighted mean was also used to provide insights into its overall impact on

student outcomes.Furthermore, frequency count and rank were used to identify the challenges teachers encountered in implementing PjBL, offering a comprehensive understanding of its practical application in the classroom.

III. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Table 1. *Extent of Utilization of Project-Based Learning as an Innovative Pedagogical Approach in Assessing Student Engagement*

Indicators	x̄	Description
Require students to conduct experiments and present findings	3.68	Great Extent
Let the students create documentary video presentations or multi-media presentations on relevant topics	3.56	Great Extent
Guide students in developing research questions and in conducting independent projects	3.44	Great Extent
Allow students to conduct group projects to research on local community issues and propose solutions	3.36	Moderate Extent
Let the students create models or prototypes to demonstrate scientific concepts	3.32	Moderate Extent
Facilitate students' engagement in case study analysis and propose innovative solutions	2.61	Moderate Extent
Encourage and assist students to collaborate on planning and hosting school /community events	2.57	Low Extent
Help students design marketing plans for hypothetical products	2.44	Low Extent
Average	3.12	Moderate Extent

Table 1.0 presents the extent of utilization of Project-Based Learning as an innovative pedagogical approach for assessing student engagement. The weighted weighted mean was calculated based on the frequency of use of project-based learning activities or strategies. The highest-rated indicators, such as "Require students to conduct experiments and present findings" with a weighted mean of 3.68 and "Let the students create documentary video presentations or multi-media presentations on relevant topics" with a weighted mean of 3.56, reflect a Great Extent of utilization. These activities suggest that hands-on, investigative tasks and multimedia projects are regularly used to engage students and assess their learning.

Project-Based Learning (PjBL) enhances students' ICT skills, as shown by Agatep & Villalobos (2020). Their study revealed an improvement in student performance from a "Fair" level in the pre-test to a "Very Good" level in the post-test. Statistical analyses, including weighted mean scores, frequency counts, standard deviations, t-tests, and variance tests, confirmed the significant effectiveness of PjBL in improving ICT topic performance. Additionally, "Guide students in developing research questions and in conducting independent projects" with a weighted mean of 3.44 also indicates significant use. These strategies are particularly valued for promoting creativity, critical thinking, and independent learning. The frequent use of these activities underscores their effectiveness in fostering student engagement, providing deep learning experiences, and enhancing vital skills like problem-solving and research.

Some indicators, such as "Allow students to conduct group projects to research on local community issues and propose solutions" with a weighted mean of 3.36 and "Let the students create models or prototypes to demonstrate scientific concepts" with a weighted mean of 3.32, reflect a Moderate Extent of utilization. While these activities are applied with moderate frequency, they primarily support collaboration, critical and creative thinking, and the practical application of knowledge. However, these activities are less commonly utilized compared to those rated at a Great Extent, potentially due to factors such as time constraints, resource limitations, or the complexity involved in their implementation. Another activity, "Facilitate students' engagement in case study analysis and propose innovative solutions" with a weighted mean of 2.61, shows a similar pattern of moderate use, highlighting its importance in real-world application but suggesting it may not always be fully utilized due to the depth of analysis required or limited classroom time.

Although the present study focuses on science subjects, its effectiveness has also been noted in other areas. Biazus and Mahtari (2022) conducted a quasi-experiment comparing project-based learning (PjBL) and direct instructional learning models and found that the PjBL model significantly enhanced the creative thinking skills of secondary school students. In particular, Parrado-Martínez and Sánchez-Andújar (2020) examined the impact of project-based learning on ninth-grade students' writing skills and discovered that cooperative work within the PjBL framework promoted students' critical thinking, communication, and collaboration skills, leading to significant improvements in middle school students' English writing abilities. Although the present study is on science subjects, the effectiveness has been noted also.

While most strategies were implemented frequently, indicators like "Encourage and assist students to collaborate on planning and hosting school/community events" with a weighted mean of 2.57, and "Help students design marketing plans for hypothetical products" with a weighted mean of 2.44 reflect a Low Extent of utilization. These activities are less commonly used, likely due to the extensive planning, resources, and time they require. While they offer valuable opportunities for real-world application and the development of teamwork and communication skills, these strategies appear to be less feasible within typical classroom settings. The lower utilization of these activities suggests that additional support, resources, or adjustments to the curriculum may be necessary to integrate them more effectively into teaching practices.

Related to this, Capilitan (2019) studied the impact of Project-Based Learning Modules on enhancing Citizenship Science Skills among ninth-grade learners, focusing on Philippine Ecology and Biodiversity. Students worked on real-world projects, such as studying conservation sites in the Philippines with organizations like Haribon Foundation and BirdLife. This approach is similar to designing marketing plans for hypothetical products or planning school/community events, as it promotes creativity, teamwork, and problem-solving. His study showed that 84.38% of students had significant score improvements, demonstrating that PjBL helps students develop essential skills like collaboration and critical thinking, which are valuable in both academics and real-life situations.

The analysis of the findings suggests that while Project-Based Learning (PjBL) is being effectively integrated, certain aspects require more emphasis to fully enhance student engagement and deepen its impact on learning. The overall average weighted mean score of 3.12, categorized as Moderate Extent, indicates that PjBL is utilized to a considerable degree, though there is room for further integration in some areas. The data reveals that hands-on activities, such as experiments and multimedia presentations, are frequently used, emphasizing practical learning experiences that promote student engagement and understanding.

Ruman (2024) highlighted that Project-Based Learning (PjBL) is a flexible approach that can be applied across subjects and grade levels, engaging learners of various abilities, including English language learners and students with special needs. PjBL activities must include an open-ended question or problem, an inquiry-based process, the development of new skills, the use of higher-level skills like critical thinking and collaboration, student voice and choice, opportunities for feedback, and a final public presentation of the research and results.

The findings reveal that teachers are already utilizing a diverse range of strategies. However, strategies like designing marketing plans and collaborating on community events are utilized less frequently, suggesting they may not be as consistently incorporated into teaching practices.

This discrepancy highlights the opportunity to expand the use of these strategies to fully realize PjBL's potential. To maximize its impact on student learning and engagement, a more consistent and widespread integration of PjBL across various activities is needed, with teachers possibly benefiting from additional support or resources to diversify their project-based approaches.

Table 2. *Level of Effectiveness of Project-Based Learning as an Innovative Pedagogical Approach in Assessing Student Engagement*

Indicators	$\bar{x}$	Description
Allow teachers to gauge students' critical thinking skills	4.24	Highly Effective
Determine the students' ability to apply knowledge in practical scenarios	4.16	Very Effective

Measure students' competencies in creativity and innovation	4.12	Very Effective
Quantify the depth of students' acquired inquiry skills	4.12	Very Effective
Provide insights into students' ability to solve real-world problems	4.04	Very Effective
Encourage students to engage in collaborative learning	3.88	Very Effective
Help towards accurate assessment of students' understanding of contents	3.84	Very Effective
Offer a reliable way to measure students' engagement during lessons	3.76	Very Effective
Average	4.02	Very Effective

Table 2 discloses the level of effectiveness of PjBL as an innovative pedagogical approach to assessing student engagement. The data indicates that project-based learning is generally regarded as a very effective method for assessing student engagement. The highest-rated indicator, "Allow teachers to gauge students' critical thinking skills," with a weighted mean of 4.24, is considered highly effective. This underscores PjBL's exceptional ability to develop critical thinking, which is an essential skill for academic and real-world success. Teachers recognize this as one of the most impactful aspects of the approach, showcasing its utility in promoting analytical and evaluative thinking among students.

Dacumos et al. (2023) emphasized that specialized high schools have increasingly prioritized research education to strengthen students' critical thinking and problem-solving skills. This focus aligns well with the principles of Project-Based Learning (PjBL), which encourages students to engage in real-world projects that develop these same skills. Kettler and Puryear (2018) further highlighted that the defining features of STEM high schools, compared to traditional schools, include research mentorships and apprenticeships with expert faculty, providing students with hands-on learning experiences that mirror the collaborative, inquiry-based processes found in PjBL.

All other indicators fall under the very effective category, underscoring project-based learning's overall success in promoting various aspects of student engagement. For instance, the indicator, "Determine the students' ability to apply knowledge in practical scenarios," with a weighted mean of 4.16, emphasizes project-based learning's strength in helping students connect academic content with real-world applications, making learning more relevant.

Furthermore, "Measure students' competencies in creativity and innovation," with a weighted mean of 4.12, reflects project-based learning's ability to assess creativity and innovation, encouraging students to think creatively and develop novel solutions. Similarly, the indicator "Quantify the depth of students' acquired inquiry skills," with a weighted mean of 4.12, shows that project-based learning is effective in gauging inquiry skills, which are essential for independent learning and exploration. Another indicator, "Provide insights into students' ability to solve real-world problems," with a weighted mean of 4.04, highlights project-based learning's focus on real-world problem-solving, which is highly valued by educators. Additionally, "Encourage students to engage in collaborative learning," with a weighted mean of 3.88, reflects the collaborative nature of project-based learning, which fosters teamwork and peer interaction, enhancing social learning and interpersonal skills.

As Weihong and Yinglong (2019) stressed, PjBL is an effective classroom activity that fosters students' core literacies and promotes the development of higher-order thinking skills. The true value of PjBL lies in its ability to enhance critical skills such as creative thinking, problem-solving, and integrated application by engaging students in real-world problems. Through collaborative group work and the exploration of real situations, students acquire core concepts and principles, with driving questions stimulating deep involvement in the investigative process.

While these indicators fall under the very effective category, two indicators received slightly lower ratings, indicating moderate effectiveness. "Help towards accurate assessment of students' understanding of contents," with a weighted mean of 3.84, suggests that project-based learning is a reliable method for assessing students' comprehension of academic material, though it may not fully capture every aspect of understanding. Similarly, "Offer a reliable way to measure students' engagement during lessons," with a weighted mean of 3.76, indicates that while project-based learning provides valuable insights into engagement, it may not always offer a comprehensive measure of student involvement during every lesson. Nevertheless, the data reveals that project-based learning is widely considered a highly effective approach for assessing student

engagement, with an overall weighted mean score of 4.02.

The data from Table 2.0 reveal that project-based learning is a highly effective approach for assessing various aspects of student engagement, with particular strengths in fostering critical thinking, creativity, problem-solving, and practical knowledge application. As confirmed by Krajcik and Czerniak (2018), project-based learning (PjBL) fosters the development of both learners' knowledge and skills. Additionally, Carrabba and Farmer (2018) observed significant differences in students' motivation levels before and after the implementation of PjBL compared to traditional direct instruction. Majority of indicators fall under the very effective category, affirming project-based learning's significant role in enhancing student engagement and providing weighted meaningful assessments of learning outcomes. Although some indicators reflect moderate effectiveness, the overall trend confirms that project-based learning is a valuable and impactful tool for both students and educators.

Table 3. *Impact of Project-Based Learning as an Innovative Pedagogical Approach in Assessing Student Engagement*

Indicators	**x̄**	**Description**
Students were encouraged to manifest their critical thinking skills and problem-solving skills	4.12	Very Evident
Increased students' ability to apply knowledge to real-world situations	4.00	Very Evident
Helped students to be more engaged during lessons	3.80	Very Evident
Improved students' collaboration and teamwork skills	3.76	Very Evident
Students were more likely to take ownership of their learning	3.76	Very Evident
Allowed teachers to better assess the engagement levels of the students	3.68	Very Evident
Students demonstrated a deeper understanding of the topics	3.68	Very Evident
Led to greater students' independence in completing tasks and projects	3.60	Very Evident
Average	3.80	Very Evident

Table 3 shows that the impact of project-based learning (PjBL) on student engagement is clearly demonstrated across various indicators, with all weighted mean scores falling within the Very Evident range. This suggests that PjBL significantly contributes to various aspects of student development.

The highest-rated indicator, "Students were encouraged to manifest their critical thinking skills and problem-solving skills," with a weighted mean of 4.12, underscores PjBL's crucial role in fostering higher-order thinking and equipping students with essential problem-solving abilities. This is followed closely by "Increased students' ability to apply knowledge to real-world situations," with a weighted mean of 4.00, demonstrating PjBL's effectiveness in enabling students to connect classroom learning to practical, real-world scenarios.

In recent decades, there has been a growing demand for educational methods that promote skill development, particularly in the teaching of science across all disciplines and educational levels (AL-Zboun, 2020). One such method is Project-Based Learning (PjBL), which has gained widespread popularity among educators across various subject areas. Chiu (2020) highlights that PjBL is a collaborative teaching approach where students engage with real-life issues and scenarios. This learning process involves a series of complex tasks that engage students through hands-on projects. In essence, students work on open-ended problems, decision-making, and investigative activities, all aimed at achieving specific goals while assessing their performance and progress. The projects themselves are designed around issues and needs identified by the students.

Additionally, the weighted mean score of 3.80 for "Helped students to be more engaged during lessons" indicates a very evident impact on student participation and attention in class. PjBL's interactive and hands-on approach significantly boosts student engagement, encouraging active involvement in learning activities. The indicator "Students were more likely to take ownership of their learning," with a weighted mean of 3.76, further supports this, reflecting how PjBL empowers students to take responsibility for their educational journey. This is consistent with the findings of Bhuyan et al. (2020), who discovered that prolonged exposure to project-based learning (PjBL) boosts both cognitive competencies, such as knowledge and skills, and non-cognitive competencies, including motivation and interest in learning science.

Indicators such as "Improved students' collaboration and teamwork skills," with a weighted mean of 3.76, and "Students demonstrated a deeper understanding of the topics," with a weighted mean of 3.68, also highlight the positive effects of PjBL. These results highlight the essential role of teamwork and collaboration in the PjBL framework, demonstrating its effectiveness in fostering a deeper and more comprehensive understanding of subject matter. In today's digital age, where students increasingly rely on technology for collaborative work, PjBL serves as a powerful tool for enhancing engagement, critical thinking, and real-world application of knowledge.

Project-based learning effectively integrates technology, including gadgets, the internet, social media, and other online platforms, to enrich the learning experience. The rise of fourth-generation mobile smart devices has significant implications for education in general, and for project-based learning in particular (Al-Mawlid, 2019). As students are accustomed to using digital devices and computers for their tasks, teachers also employ these technologies to monitor and assess student engagement. This approach not only aids students in their project work but also provides teachers with real-time insights into student progress and involvement. Electronic project-based learning is a powerful strategy for incorporating technology into education, leveraging modern communication tools to meet the needs of today's learners, including e-learning and smartphone usage (Munawaroh et al., 2022).

"Allowed teachers to better assess the engagement levels of the students," which also has a weighted mean of 3.68, highlights how PjBL facilitates teachers' ability to monitor and assess student engagement more effectively, ensuring that their teaching strategies align with student needs. "Led to greater students' independence in completing tasks and projects," with a weighted mean of 3.60, while still showing a very evident impact, indicates that PjBL encourages self-directed learning, fostering students' ability to manage their time and responsibilities effectively.

Project-based learning incorporates active learning strategies that engage students by encouraging them to reflect on what they are learning and doing. These strategies are designed to foster critical, creative, and technological thinking, empowering students to actively participate in their learning process. According to Hartikainen et al. (2019), such strategies are particularly effective in enhancing students' cognitive abilities, enabling them to approach challenges from multiple perspectives and develop a deeper understanding of the subject matter.

To conclude, the average impact weighted mean of 3.80 highlights the significant effectiveness of project-based learning (PjBL) in enhancing various aspects of student engagement, learning outcomes, and teacher-student interaction. The findings reinforce the idea that PjBL is a modern pedagogical approach rooted in self-directed learning. It is learner-centric, focusing on providing educational resources that connect students to learning objectives while considering their individual differences, abilities, and potential.

Table 4. *Difficulties Encountered by Teachers in the Utilization of Project-Based Learning as an Innovative Pedagogical Approach in Assessing Student Engagement*

Indicators	f	Rank
Time constraint in adopting PjBL activities	15	1.5
Difficulty in assessing individual contribution in group work or project	15	1.5
Issue on sustaining enthusiasm and consistency of students on their engagement to PjBL activities	14	3.5
Insufficiency in training about PjBL	14	3.5
Difficulty in assessing diverse students' abilities	12	5
Difficulty in aligning PjBL activities with the curriculum standards	9	6.5
Insufficiency of materials and resources needed in conducting PjBL activities	9	6.5
Complexity of the assessment process for PjBL activities	8	8

The data in Table 4 reveal the key challenges teachers face in implementing Project-Based Learning (PjBL), particularly in assessing student engagement. Among the identified difficulties, two indicators emerged as the most prevalent: time constraints in adopting PjBL activities and the difficulty in assessing individual contributions in group work or projects, each receiving a frequency of 15 and ranking 1.5. These findings highlight the challenges teachers face in managing the extensive time required to implement PjBL effectively

while ensuring fair assessment of individual contributions in collaborative projects. This underscores the need for targeted professional development programs that focus on time management strategies, streamlined assessment techniques, and best practices for evaluating student participation. Additionally, training sessions on efficient PjBL planning methods could help educators optimize instructional time while maintaining student engagement and assessment integrity.

Training programs and workshops are crucial for equipping faculty with the skills needed to implement Project-Based Learning (PjBL) effectively. These initiatives provide guidance on pedagogy, project design, and assessment strategies, helping faculty embrace PjBL. Professional development opportunities and faculty readiness play a key role in ensuring its successful implementation (Warr & West, 2020; Alrajeh, 2021).

Following closely, two challenges ranked 3.5, each with a frequency of 14: sustaining students' enthusiasm and consistency in engagement and insufficiency in training about PjBL. This suggests that while PjBL is designed to foster student motivation, maintaining long-term engagement remains a challenge, possibly due to fluctuating interest levels or external distractions. Additionally, the lack of adequate teacher training indicates that many educators may feel underprepared to implement PjBL strategies effectively, reinforcing the need for professional development programs.

Project-based learning is gradually influencing educational reform by introducing innovative teaching strategies designed to cultivate various skills and competencies while enhancing learners' motivation to engage with educational material, as noted by Shin and Hannam University (2018). Motivation is essential for achieving learning goals, as it enhances focus, engagement, and interaction with educational activities. It also directs students' intellectual efforts during the learning process, highlighting its importance in education. Consequently, fostering motivation has become a key focus in educational strategies (Seli, 2019; Schunk & DiBenedetto, 2020).

The difficulty in assessing diverse students' abilities ranked 5 with a frequency of 12, implying that teachers find it challenging to accommodate different learning styles, skill levels, and participation dynamics within a single PjBL framework. Meanwhile, two indicators—difficulty in aligning PjBL activities with curriculum standards and insufficiency of materials and resources—each had a frequency of 9, ranking 6.5. These figures suggest that while PjBL offers flexible learning opportunities, ensuring that activities meet curricular requirements and securing necessary resources are significant obstacles. Project-Based Learning (PjBL) demands thoughtful planning and alignment with learning objectives. Juandi et al., (2021) explained that this process involves selecting appropriate projects, defining clear learning outcomes, and organizing activities in a logical sequence to create a cohesive and effective learning experience.

A lack of sufficient resources can impede the successful execution of PjBL projects, diminishing the quality and depth of students' learning experiences. To address resource constraints, fostering collaboration and resource sharing among faculty members and institutions can be highly beneficial. Building partnerships with external organizations, utilizing digital resources, and sharing expertise across disciplines are effective strategies to mitigate resource limitations in PjBL, as highlighted by Thi Ngu et al. (2021).

Lastly, the complexity of the assessment process for PjBL activities was identified as the least frequent difficulty, with a frequency of 8 and ranking 8. This indicates that although assessment is challenging, it is perceived as a comparatively lesser concern than other factors such as time constraints and training deficiencies. This suggests that while teachers may find PjBL assessment intricate, their primary struggles lie in the foundational aspects of implementing and sustaining the approach effectively.

The findings highlighted key challenges in the implementation of project-based learning (PjBL), particularly time constraints, difficulties in assessing diverse student abilities, and resource insufficiency. Addressing these challenges through targeted support, professional training, and resource allocation is essential for the successful adoption of PjBL. Additionally, clearer frameworks and guidelines are needed to help teachers manage group work assessments and align PjBL activities with curriculum standards. Overall, these findings emphasize the importance of continuous professional development and institutional support to enhance the effectiveness of PjBL in educational settings.

IV. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

This descriptive study examined the impact of Project-Based Learning (PjBL) on student engagement, focusing on its utilization, effectiveness, and challenges faced by teachers in four high schools in Prieto Diaz District, DepEd Sorsogon Province. A purposive sampling method was employed, targeting science teachers to provide insights on PjBL's application in the classroom. Data were gathered using a structured questionnaire, covering four areas: extent of PjBL utilization, its effectiveness in assessing student engagement, its impact on student learning, and the challenges teachers face. The data were analyzed using weighted means to determine trends in teachers' perceptions. The study utilized a Likert scale format for the questionnaire to assess teachers' views on the frequency, effectiveness, and difficulties associated with PjBL. Statistical analysis, including weighted mean calculations, was conducted to ensure accuracy and reliability, and to guide conclusions and recommendations on enhancing PjBL implementation.

Findings

The statistical analysis of the data has generated the following findings:

1. The most frequently implemented activities include conducting experiments and presenting findings with a mean score of 3.68, creating documentary or multimedia presentations with a mean score of 3.56, and developing research questions and conducting independent projects with a mean score of 3.44. While these activities emphasize hands-on and inquiry-based learning, the overall average utilization of 3.12 suggests that some strategies are less frequently applied.
2. The most effective aspects of Project-Based Learning in assessing student engagement are developing critical thinking skills with a mean score of 4.24, applying knowledge in real-world situations with a mean score of 4.16, and fostering creativity and innovation with a mean score of 4.12. These results highlight PjBL's role in enhancing higher-order thinking and problem-solving. Overall, it was rated very effective, with an average score of 4.02.
3. The most significant impacts of Project-Based Learning on student engagement include improving critical thinking and problem-solving skills with a mean score of 4.12, increasing real-world knowledge application with a mean score of 4.00, and enhancing lesson engagement with a mean score of 3.80. These findings emphasize its role in promoting analytical thinking and active participation, with an overall impact rated as very evident at 3.80.
4. The main challenges teachers face in implementing Project-Based Learning are time constraints and difficulty in assessing individual contributions, both ranked 1.5. Other significant difficulties include maintaining student enthusiasm and limited training opportunities, both ranked 3.5. These findings highlight the need for time management strategies, better assessment methods, and professional development to support effective implementation.
5. The effectiveness of PjBL can be enhanced by developing learning session guides to increase student engagement and mastery of high school science lessons.

Conclusions:

Derived from the d findings, the following conclusions are formulated:

1. Project-Based Learning is being utilized to a moderate extent across various pedagogical activities, with certain practices, such as conducting experiments and creating presentations, being implemented more extensively than others.
2. Project-Based Learning is a highly effective pedagogical approach for assessing and enhancing student engagement, offering a well-rounded framework that emphasizes critical thinking, problem-solving, and real-world application.
3. PjBL has a notable impact that reflects the effectiveness of PjBL in fostering an engaging and dynamic learning environment.
4. There is a need for increased teacher support, comprehensive training, and better resource allocation to strengthen the implementation of PjBL.
5. Learning session guides to enhance student engagement in mastering lessons in high school science subjects are proposed.

Recommendations:

Based on the conclusions, the following recommendations are given:

1. Further efforts be exerted to enhance the integration of Project-based learning (PjBL) into different aspects of the curriculum to maximize its potential in fostering student engagement.
2. PjBL be integrated into teaching practices to enhance student engagement, focusing on critical

thinking, problem-solving, and real-world applications.

3. PjBL be more extensively integrated into the curriculum to enhance student engagement and foster a dynamic learning environment.
4. Enhanced training and improved resource provision be offered to teachers to fully harness the potential of PjBL in boosting student engagement and creating a more dynamic learning environment.
5. The proposed learning session guides be implemented to enhance student engagement and mastery of high school science lessons.

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