© IJARW | ISSN (O) - 2582-1008
May 2026 | Vol. 7 Issue. 11
www.ijarw.com

LEARNERS' ACADEMIC PERFORMANCE AND ENGAGEMENT IN PHYSICS USING GAME-BASED LEARNING (GBL) THROUGH TRADITIONAL FILIPINO PALARO

Jay-ar A. Tino[1], Jovy Kates F. Molina[2]

[1]*Kitubo National High School, Kitaotao, Bukidnon, 8716, Philippines*
[2]*Philippine College Foundation, Valencia City, Bukidnon, 8709, Philippines*

ABSTRACT

This study examined the effects of Game-Based Learning (GBL) using Traditional Filipino Palaro on Grade 7 students' engagement and academic performance in Physics. The intervention integrated culturally familiar games aligned with physics concepts, including tumbang preso for forces, human tug-of-war for balanced and unbalanced forces, patintero for distance and displacement, and a modified 100-meter dash for speed and velocity. A pre-experimental one-shot design was employed with one section of thirty-seven (37) learners at Kitubo National High School during the third quarter of School Year 2025–2026. Findings revealed noticeable improvements in academic performance, with 43% of learners advancing to higher qualitative levels. Statistical analysis using a paired t-test confirmed a significant increase in academic performance after exposure to Traditional Filipino Palaro (mean difference = –5.92, t = –7.142, p < .001). Moreover, overall student engagement improved from moderately engaged to a higher level across behavioral, emotional, and cognitive dimensions. These results indicate that incorporating culturally relevant Filipino games can effectively enhance students' conceptual understanding, motivation, and active participation in Physics learning.

Keyword: academic performance, engagement, game-based learning, traditional Filipino palaro, physics

1. INTRODUCTION

Recent educational reforms in the Philippines emphasize the need for more responsive, inclusive, and learner-centered instruction that develops both foundational knowledge and real-world skills. In line with this direction, the MATATAG Curriculum was introduced to streamline content, promote deeper learning, and strengthen the overall quality of basic education. It focuses on essential competencies, prioritizes student well-being, and supports teachers in delivering more effective instruction. With its phased implementation starting in School Year 2024–2025, the curriculum highlights the importance of contextualized teaching approaches that enhance both conceptual understanding and practical application of knowledge.

However, one recent study by Cerezo et al. (2025) found that under the MATATAG Curriculum, Grade 7 students show a disparity in performance between written examinations and practical task scores in science, often performing better in one domain over the other. In SY 2024–2025, 150 Grade 7 students from six sections participated in the study. It found that although some students performed well on written exams, their competency decreased in practical tasks, suggesting weaknesses in applying scientific principles in more practical, inquiry-based contexts. At Kitubo National High School, similar trends are observed in the Division Achievement Test for Grade 7, third Quarter 2024-2025: students frequently demonstrate low proficiency in exams reflecting both theoretical and applied science domains, suggesting that systemic issues such as instructional alignment, availability of resources, and student preparedness may be contributing factors.

These local research results suggest that researchers and curriculum developers should further investigate how the MATATAG Curriculum can address the persistent challenges in science learning, particularly in physics. This highlights the importance of exploring teaching strategies

that enhance both academic performance and student engagement, equipping Filipino learners with the skills and confidence needed for 21st-century education. One innovative approach increasingly recognized in education is Game-Based Learning (GBL), which shifts instruction from traditional lecture-centered methods to interactive, student-centered learning experiences (Plass et al., 2015). For example, Antonio and Diculen (2022) discovered that using indigenous game-based activities in Ilocos Norte improved student performance and attitudes in physics. Similarly, Gaviño and Aliazas (2024) in their study *Physics Quest: Digital Game-Based Lessons for Seventh Grade* found that digital game-based physics lessons helped Grade 7 students address least-mastered competencies, improve engagement, and sharpen critical thinking and problem-solving skills. By embedding GBL through culturally familiar games and activities, educators can create active learning environments that not only improve academic outcomes in physics but also cultivate behavioral, emotional, and cognitive engagement, addressing gaps observed in conventional teaching practices. To illustrate this implementation, consider the game of Patintero, which embodies principles of balanced and unbalanced forces. Instructors can use the game's dynamics to demonstrate these physics concepts, as players exert and counteract forces while navigating around each other. Establishing such clear connections between GBL activities and physics principles strengthens the educational effectiveness and relevance of this approach.

The main objective of this research is to investigate the effects of Game-Based Learning (GBL) through Traditional Filipino Palaro on the academic performance and engagement of Grade 7 students in physics at Kitubo National High School. By integrating culturally relevant games such as *tumbang preso*, human tug war, patintero, and 100-meter dash into physics instruction, the study aims to determine whether GBL can improve learners' academic performance, motivation, and behavioral, emotional, and cognitive engagement. This approach is supported by Antonio and Diculen (2022), who found that indigenous game-based activities enhanced students' physics performance and learning attitudes, and by Del Carmen et al. (2015), who developed "Laro ng Lahi"-based physics activities aligned with the K-12 curriculum, showing positive effects on learner participation and comprehension. The research ultimately seeks to provide evidence-based strategies for making physics instruction more interactive, meaningful, and aligned with the goals of the MATATAG Curriculum.

1.1.Statement of the Problem

This study aimed to assess the academic performance and engagement levels in physics among Grade 7 students at Kitubo National High School using Game-Based Learning (GBL) through Traditional Filipino *Palaro*. The following research questions guide the investigation:

1. What is the level of Learners' Academic performance before and after exposure to Game-Based Learning (GBL) through Traditional Filipino *Palaro* in terms of:
   a. Pretest; and
   b. Posttest;
2. What is the level of Learners' Engagement in Physics before and after exposure to Game-Based Learning (GBL) through Traditional Filipino *Palaro* in terms of:
   a. Behavioral;
   b. Emotional; and
   c. Cognitive?
3. Is there a significant difference in Learners' Academic performance before and after exposure to Game-Based Learning (GBL) through Traditional Filipino *Palaro*?
4. Is there a significant difference in Learners' Engagement in Physics before and after exposure to Game-Based Learning (GBL) through Traditional Filipino *Palaro*?

1.2. Significance of the Study

This study aimed to inform students, teachers, curriculum developers, administrators, parents, and future researchers about the potential of Game-Based Learning (GBL) using Traditional Filipino Palaro to enhance engagement and academic performance in physics.

For students**,** Game-Based Learning through Traditional Filipino Palaro is expected to increase behavioral, emotional, and cognitive engagement and improve academic performance. Participation in interactive games may help students better understand physics concepts, develop positive attitudes toward learning, and increase motivation.

For teachers, the findings may provide insights on integrating Traditional Filipino Palaro into instruction. Game-Based Learning can increase student participation, promote active learning, and make physics lessons more relevant and engaging.

For curriculum developers, this study highlights the value of incorporating Game-Based Learning strategies. Such integration supports student-centered learning and aligns with modern approaches that emphasize collaboration, critical thinking, and problem-solving.

For administrators**,** the study may support the development of programs, seminars, and workshops that promote culturally relevant activities like Traditional Filipino Palaro to improve teaching and learning in physics and related subjects.

For parents, greater awareness of Game-Based Learning may increase appreciation for innovative teaching methods that benefit students' academic performance and engagement. This understanding can strengthen collaboration between home and school.

For future researchers**,** this study provides empirical data on the impact of Game-Based Learning through Traditional Filipino Palaro on students' academic performance and engagement in physics. The findings may inform further research on alternative game-based strategies, other subjects, or expanded research designs

1.3. Scope and Delimitation of the Study

This study examined the effects of Game-Based Learning (GBL) using Traditional Filipino Palaro on students' engagement and academic performance in physics. The integration of games will focus on specific physics concepts: Forces through the activity *Tumbang Preso*; Balanced and Unbalanced Forces through *Human Tug of War*; Distance and Displacement through *Patintero*; and Speed and Velocity through a modified *100-meter dash*. The research will be conducted during the third quarter of School Year 2025–2026, from November 3 to November 25, 2025, and will involve one section of Grade 7 students at Kitubo National High School in Kitobo, Kitaotao, Bukidnon, Philippines. A pre-experimental one-shot design used to assess the influence of this instructional approach.

The study was limited to the specified timeframe, location, grade level, physics concepts, and research design; therefore, the findings may not be generalizable to other contexts. The rural setting of the school, its class size, and the cultural composition of the students may further restrict the applicability of the results to more diverse educational environments.

1.4.Definition of Terms

For a better understanding of this study, the following terms were defined operationally:

Academic performance refers to the students' achievement in Physics as reflected in their pretest/posttest scores before and after the implementation of Game-Based Learning through Traditional Palaro.

Behavioral engagement refers to students' active participation in learning activities, such as attentiveness, effort, and involvement in classroom tasks. It is one of the three dimensions of engagement evaluated in this study.

Cognitive engagement refers to the students' mental effort and willingness to invest in learning Physics, including applying critical thinking and problem-solving skills during lessons. It is one of the three dimensions of engagement measured in this study.

Emotional engagement involves students' emotional reactions to learning Physics, including interest, enthusiasm, and enjoyment, as well as negative feelings like anxiety. It is one of the three dimensions of engagement assessed in this study.

Game-Based Learning refers to a teaching approach that integrates Traditional Filipino Palaro into Physics lessons to make learning more interactive, enjoyable, and engaging for students.

Traditional Palaro includes Filipino traditional games such as *luksong lubid*, *patintero*, *hilahan* (tug of war), and *takbohan* (100-meter dash), which are incorporated into Physics lessons as part of the Game-Based Learning approach.

2. METHODOLOGY

This section presents the procedures used in collecting and analyzing data. Specifically, it includes the research design, participants of the study, the locale of the study, data gathering procedure, instrumentation, and statistical

technique employed for data processing and analysis.

2.1. Research design

The researcher utilized a pre-experimental one-group research design to assess the learners' academic performance and engagement in physics, using game-based learning through traditional Filipino Palaro. The study will be conducted on one section of Grade 7 learners from Kitubo National High School.

2.2. Participants of the Study

The study involved one section of Grade 7 Junior High School students from Kitubo National High School who officially enrolled in Grade 7 for the school year 2025-2026. This section takes Physics during the study period. The learners will be exposed to game-based learning through the traditional Filipino Palaro.

2.3. Locale of the Study

The study was conducted at Kitubo National High School, located in Purok 2, Kitobo, Kitaotao, Bukidnon, with School ID 303964. The school follows the K to 12 Science Curriculum, aligning with government requirements mandated by RA 10533.

2.4. Research Instruments

The researcher utilized both academic and non-academic assessments.

A. Academic Assessment

Academic Performance. To measure academic performance, this study will utilize a 32-item teacher-constructed test specifically designed to assess physics concepts relevant to the curriculum. The instrument's content validity will be established through expert review by subject matter specialists, who will evaluate each item for relevance, clarity, and alignment with learning objectives. Following expert validation, the instrument will undergo pilot testing with one section of Grade 8 students at Kitubo National High School to determine its reliability. Internal consistency reliability with Cronbach's alpha of 0.730, with the obtained coefficient reported to demonstrate the reliability of the measure. The interpretation of test results will adhere to the performance standards set forth in DepEd Order No. 8, series of 2015, thereby ensuring objective and standardized assessment.

B. Non-Academic Assessment

Engagement in Physics. To assess students' engagement in physics, the study will employ a structured survey questionnaire comprising fifteen (15) items, each rated on a five-point Likert scale. This instrument is designed to capture the behavioral, emotional, and cognitive dimensions of engagement. Prior to its implementation among the study sample, the questionnaire will undergo rigorous field testing with a section of Grade 8 students from Kitubo National High School. During this pilot phase, data will be collected and subjected to statistical analysis to determine the instrument's internal consistency reliability, which will be assessed with Cronbach's alpha of 0.820. The resulting coefficient will be reported to demonstrate the reliability and validity of the engagement measure for subsequent use in the research.

2.5. Data Gathering Procedure

A formal request letter submitted to the principal's office of Kitubo National High School (KNHS) to explain the purpose of the study. Approval will also be sought from cooperating teachers, and consent obtained from students and their parents through a privacy consent form to ensure voluntary participation and confidentiality. The study conducted during the third Quarter of the 2025–2026 school year.

The primary sources of data will include the pretest and posttest scores and the engagement survey results. The selected section will first complete the pretest questionnaire before any intervention is introduced. After the implementation of Game-Based Learning through Traditional Filipino Palaro, the same section take the posttest and complete the engagement survey again to measure changes in academic performance and behavioral, emotional, and cognitive engagement. The collected data will then be analyzed using appropriate statistical tools to determine the effectiveness of the intervention.

Implementation of Game-Based Learning through Traditional Filipino Palaro

1st Step: Elicit

Teams were formed, prior knowledge was reviewed, and the rules of the traditional Filipino games were introduced. A short introduction of the lesson provided students with the context for the activities. This step aimed to prepare students mentally and socially for the tasks ahead.

2nd Step: Engage

The teacher defined the problem context for the lesson. Teams brainstormed ideas, explored content, and connected concepts to the rules and strategies of the games. A video or short discussion will be presented to provide initial content exposure.

3rd Step: Explore

Teams planned how to perform the traditional Filipino games to demonstrate learning concepts. Roles were assigned, strategies were created, and students actively participated in game-based activities to apply the concepts learned.

4th Step: Explain

After playing the games, teams shared their experiences and observations with the class. Reflection activities allowed students to verify concepts, share insights, and clarify ideas with peers.

5th Step: Elaborate

The teacher provided conceptual clarification by giving examples, answering questions, and connecting ideas to real-life contexts and other science or physical education topics.

6th Step: Evaluate

Students completed a posttest designed to assess conceptual understanding and identify learning gains from the game-based activities.

7th Step: Extend

Students received follow-up assignments to deepen their understanding and link the concepts learned from the games to new lessons or applications.

Statistical Technique

The researcher employed descriptive statistics, including frequency counts, percentages, mean, and standard deviation, to articulate the levels of academic performance among students and their levels of Physics engagement.

Additionally, the paired-sample t-test utilized to investigate whether a significant difference exists in learners' performance before and after exposure to game-based learning through traditional Filipino Palaro. The same statistical method, paired t-test, will also be applied to assess if there is a significant difference in learners' engagement before and after exposure to game-based learning through traditional Filipino Palaro.

3. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter contains the presentation, analysis, and interpretation of data gathered on learners' academic performance and engagement in Physics using Game Based-Learning Through Traditional Filipino Palaro. The order of presentation is based on the order of specific objectives of the study.

3.1. Level of Academic Performance of Learners

The learners' academic performance before and after their exposure to Game-Based Learning through Traditional Filipino Palaro is presented in Table 1. In the pretest, all thirty-seven learners (100%) obtained scores below 60 percent, which placed them in the *Did Not Meet Expectation* category. After the intervention, the posttest results show a noticeable shift: four learners (10.8%) improved to the *Satisfactory* level, twelve learners (32.4%) reached the *Fairly Satisfactory* level, while twenty-one learners (56.8%) remained within the *Did Not Meet Expectation* category. No learners reached the *Very Satisfactory* or *Outstanding* levels in both assessments, but the distribution indicates that a considerable portion of the class demonstrated higher performance after the game-based intervention.

Table 1
Learners Academic Performance When Exposed Before and After Game Based-Learning through Traditional Filipino Palaro.

Percentage Score (%)	Pretest (f)	%	Qualitative Interpretation	Posttest (f)	%	Qualitative Interpretation
84% and above	0	0	Outstanding	0	0	Outstanding
76.00-83.99	0	0	Very Satisfactory	0	0	Very Satisfactory
68.00-75.99	0	0	Satisfactory	4	10	Satisfactory

					.8	
60.00-67.99	0	0	Fairly Satisfactory	12	32.4	Fairly Satisfactory
Below 60	37	100	Did Not Meet Expectation	21	56.8	Did Not Meet Expectation

Legend

Scoring Scale	Qualitative Interpretation (QI)
27-32	Outstanding
25-26	Very Satisfactory
22-24	Satisfactory
20-21	Fairly Satisfactory
Below 20	Did Not Meet Expectation

Analyzing the results, it is evident that the learners initially had low mastery of the lesson, as reflected in the pretest where all students fell into the lowest category. However, the posttest results reveal that 43.2% of the learners were able to move into higher qualitative levels. This shift suggests that the integration of Traditional Filipino Palaro contributed to enhancing their performance. The game-based activities likely encouraged active engagement, social interaction, and motivation, which helped learners better understand and apply the concepts. Despite this improvement, the majority who remained below the expected level indicate that some learners may require further instructional support, remediation, or extended exposure to the approach.

Interpreting the findings, the results imply that Game-Based Learning through culturally familiar activities, such as Filipino Palaro, can effectively support learning by making the environment more interactive and enjoyable. The movement of some learners into higher performance levels aligns with the idea that games can stimulate curiosity, sustain attention, and promote meaningful learning experiences. However, continued reinforcement, differentiated instruction, and scaffolded practice may be essential to help all learners reach satisfactory mastery, especially those who did not show sufficient improvement.

These findings are consistent with Huang et al. (2020), who emphasized that game-based learning significantly enhances learner motivation and performance by promoting interactive and engaging experiences. Similarly, Qian and Clark (2016) found that well-designed educational games improve conceptual understanding and knowledge retention. The improvement observed in the posttest aligns with their claim that GBL is an effective instructional approach, especially when activities encourage collaboration and active participation.

Learners' level of Engagement: Behavioral

Table 2

Level of Learners' Engagement in Terms of Behavioral.

	Pretest			Posttest		
Variables	Mean	SD	QI	Mean	SD	QI
I actively participate in physics class activities.	3.2973	.61756	Moderately Engaged	4.0541	.74334	Engaged
I complete all physics assignments on time.	3.1622	.68773	Moderately Engaged	3.6216	.63907	Engaged
I ask questions when I do not understand physics topics.	2.8378	.72700	Moderately Engaged	3.4595	.64956	Engaged
I pay attention during physics lessons.	2.5405	.50523	Partially Engaged	3.7568	.72286	Engaged
I review physics lessons even outside class hours.	2.2973	.66101	Partially Engaged	3.2162	.47930	Moderately Engaged
Overall Mean	2.8270	.63971	Moderately Engaged	3.6216	.64683	Engaged

The learners' behavioral engagement in physics before and after the instructional intervention is presented in Table 2. The pretest results show an overall mean of 2.8270 (SD = 0.63971), indicating that learners were *Moderately Engaged*. Among the items, the highest pretest mean was for *"I actively participate in physics class activities"* (M = 3.2973), while the lowest was for *"I review physics lessons even outside class hours"* (M = 2.2973), suggesting that learners were more involved in structured classroom activities than in independent study. After the intervention, the posttest mean increased to 3.6216 (SD = 0.64683), categorized as *Engaged*. The highest posttest mean remained in active participation (M = 4.0541), while the lowest was in out-of-class review (M = 3.2162), showing improvement across all behavioral indicators.

Analyzing these results, it is evident that the instructional intervention had a positive effect

on students' behavioral engagement. The increase in item means demonstrates that learners became more active, attentive, and participative during physics lessons. Gains were particularly significant in structured, teacher-led activities such as participation, asking questions, paying attention, and completing assignments on time. Although engagement in reviewing lessons outside class hours also improved, it remained lower than other indicators, suggesting that students' self-regulated learning habits may require additional support and reinforcement.

Interpreting these findings, the instructional approach effectively fostered greater classroom engagement, encouraging students to take part in discussions, complete tasks responsibly, and remain attentive during lessons. The observed improvements indicate that enhancing in-class behavioral engagement can contribute to better learning outcomes and academic performance. However, the relatively lower gains in independent study behaviors imply that strategies to promote autonomous learning are necessary to further strengthen overall engagement.

These results are supported by recent research emphasizing the importance of behavioral engagement in learning. Wang et.al. (2020) found that instructional strategies promoting active engagement significantly enhance students' behavioral involvement, improving comprehension and achievement. Lei et al. (2018) highlighted that increased behavioral engagement predicts higher academic performance, particularly when students actively participate in classroom activities. Additionally, Shernoff et al. (2017) reported that students who are behaviorally engaged demonstrate better attention, motivation, and task completion, which together facilitate learning.

3.2. Learners' level of Engagement: Emotional

The learners' emotional engagement in physics before and after the instructional intervention is presented in Table 3. The pretest results show an overall mean of 2.6919 (SD = 0.70923), indicating that learners were *Moderately Engaged*. Among the items, the highest pretest mean was for "I look forward to attending physics classes" (M = 2.8108), while the lowest was for "I feel confident when answering physics problems" (M = 2.5405), suggesting that learners initially had moderate interest but relatively low confidence toward physics. After the intervention, the posttest mean rose to **3**.8054 (SD = 0.55541), categorized as *Engaged*. The highest posttest mean was in "I find physics lessons interesting and fun" (M = 4.4595), while the lowest was still "I feel confident when answering physics problems" (M = 3.2162), showing improvement across all emotional-engagement indicators.

Table 3

Level of Learners' Engagement in Terms of Emotional.

	Pretest			Posttest		
Variables	Mean	SD	QI	Mean	SD	QI
I look forward to attending physics classes.	2.8108	.70071	Moderately Engaged	4.1892	.56949	Engaged
I feel motivated to do well in physics.	2.7568	.76031	Moderately Engaged	3.4054	.64375	Engaged
I enjoy learning new concepts in physics.	2.7027	.66101	Moderately Engaged	3.7568	.43496	Moderately Engaged
I find physics lessons interesting and fun.	2.6486	.58766	Moderately Engaged	4.4595	.64956	Highly Engaged
I feel confident when answering physics problems.	2.5405	.83648	Partially Engaged	3.2162	.47930	Moderately Engaged
Overall Mean	2.6919	.70923	Moderately Engaged	3.8054	.55541	Engaged

Analyzing these results, it is evident that the instructional approach had a strong positive effect on learners' emotional engagement. The increase in all item means indicates that students developed greater enthusiasm, interest, and positive feelings toward physics. The most pronounced gains were in aspects related to enjoyment and interest, as learners reported that lessons became more fun and engaging. Although confidence in solving physics problems improved, it remained the lowest, indicating that while interest and enjoyment increased, self-efficacy still needs reinforcement.

Interpreting these findings, one can conclude that the intervention helped create a more emotionally

supportive and appealing physics learning environment. By making lessons more enjoyable and interesting, the approach enhanced students' affective engagement, which likely supports better motivation and persistence over time. However, the relatively lower gain in confidence suggests a need for additional scaffolding, such as more guided practice, feedback, and support to bolster students' self-efficacy in problem-solving.

These results are supported by recent empirical studies. For instance, Liu et al. (2024) found that emotional engagement strongly predicts academic performance in blended learning settings, demonstrating that when students feel emotionally invested and positive toward learning, their achievement improves. Jia and Cheng (2025) showed that when teachers provide support and foster positive class relationships, students report higher levels of emotional engagement, including motivation and enjoyment. Additionally, Gao et al. (2021) demonstrated that classroom conditions, including social dynamics and seating arrangements, significantly influence students' emotional and behavioral engagement. These studies collectively affirm that well-designed learning environments and supportive instructional strategies can significantly enhance emotional engagement, which in turn can lead to better academic outcomes.

3.3. Learners' level of Engagement: Cognitive

Table 4

Level of Learners' Engagement in Terms of Cognitive.

	Pretest			Posttest		
Variables	Mean	SD	QI	Mean	SD	QI
I work hard to understand difficult physics concepts.	2.7297	.60776	Moderately Engaged	3.6944	.74907	Engaged
I use different strategies to solve physics problems.	2.7027	.70178	Moderately Engaged	3.3056	.52478	Moderately Engaged
I try to relate physics concepts to real-life situations.	2.6757	.62601	Moderately Engaged	3.6389	.72320	Engaged
I discuss physics topics with my classmates outside class.	2.5135	.65071	Partially Engaged	3.3333	.63246	Moderately Engaged
I set goals for myself in learning physics.	2.4865	.65071	Partially Engaged	3.7778	.63746	Engaged
Overall Mean	2.6216	.64740	Moderately Engaged	3.55	.65334	Engaged

The learners' cognitive engagement in physics before and after the instructional intervention is presented in Table 4. The pretest results show an overall mean of 2.6216 (SD = 0.64740), indicating that learners were *Moderately Engaged*. Among the items, the highest pretest mean was for "I work hard to understand difficult physics concepts" (M = 2.7297), while the lowest was "I set goals for myself in learning physics" (M = 2.4865), suggesting that learners initially exerted moderate effort in understanding but rarely engaged in self-regulation or strategic planning. After the intervention, the posttest mean increased to 3.55 (SD = 0.65334), categorized as *Engaged*. The highest posttest mean was in "I set goals for myself in learning physics" (M = 3.7778), while the lowest was in "I use different strategies to solve physics problems" (M = 3.3056), indicating improvements across all cognitive-engagement indicators.

These results indicates that the intervention had a positive impact on students' cognitive engagement. The rise in overall and item means demonstrates that after instruction, learners were more likely to apply metacognitive strategies: they attempted to understand difficult concepts, set personal learning goals, related physics concepts to real-life situations, and participated in group discussion outside class. Notably, goal-setting and effortful understanding showed the largest gains, suggesting that the intervention enhanced self-regulation and deeper processing. The smaller gain in strategy uses for problem-solving implies that while students improved, they may still require more scaffolding in diverse problem-solving approaches.

Interpreting these findings, the instructional approach effectively fostered enhanced cognitive engagement, encouraging students to internalize

learning, reflect, and take responsibility for their learning process. These are key elements of deeper learning and higher-order thinking. The result suggests that when instructional design provides opportunities for reflection, connection, and goal setting, students become more cognitively invested in their learning. However, to sustain and further improve cognitive engagement especially in problem-solving strategies continued reinforcement and guided practice are recommended.

These findings align with recent empirical research. A study by Zhu et al. (2025) demonstrated that students' cognitive engagement significantly increases when teachers provide structured support and foster a collaborative learning environment, leading to better academic outcomes. Similarly, Ruiz-Martín et al. 2024) found that learners who regularly use cognitive and metacognitive strategies such as goal setting, elaboration, and self-testing show higher engagement and improved learning results. Additionally, García-López et al. (2023) reported that gamified and interactive instructional practices enhance cognitive engagement by reducing cognitive load and increasing motivation, which in turn positively influences student performance.

3.4. Learners' level of Engagement: Behavioral, Emotional, and Cognitive

Table 5
Overall Level of Learners' Engagement in Terms of Behavioral, Emotional, and Cognitive.

	Pretest			Posttest		
Variables	Mean	SD	QI	Mean	SD	QI
Behavioral	2.8270	.63971	Moderately Engaged	3.6216	.64683	Engaged
Emotional	2.5405	.83648	Partially Engaged	3.2162	.47930	Moderately Engaged
Cognitive	2.6216	.64740	Moderately Engaged	3.55	.65334	Engaged
Overall Mean	2.6630	.70786	Moderately Engaged	3.4626	.59316	Engaged

Legend

Range	Qualitative Interpretation (QI)
4.21-5.00	Highly Engaged
3.41-4.20	Engaged
2.61-3.40	Moderately Engaged
1.81-2.60	Partially Engaged
1.00-1.80	Not engaged

The pretest results reveal varying levels of learners' engagement across the three dimensions assessed. Among the engagement domains, Behavioral Engagement emerged as the highest-rated component, with a mean score of 2.8270 (SD = 0.63971), categorized as *Moderately Engaged*. This suggests that learners were relatively more active in participating in classroom activities, completing assignments, and following instructions prior to the intervention. Learners showed consistent involvement in structured tasks, reflecting willingness to participate in observable learning behaviors.

Following closely is Cognitive Engagement, with a mean score of 2.6216 (SD = 0.64740), also categorized as *Moderately Engaged*. This indicates that learners were moderately invested in understanding physics concepts, using problem-solving strategies, and relating knowledge to real-life situations. Although students demonstrated effort and some metacognitive strategies, the moderate level suggests room for further development in higher-order thinking and goal setting.

The lowest pretest component was Emotional Engagement, with a mean score of 2.5405 (SD = 0.83648), categorized as *Partially Engaged*. This implies that learners' affective connection to physics lessons, such as interest, enjoyment, and confidence, was relatively low. Limited emotional engagement can affect motivation and persistence, indicating that students were less likely to feel intrinsically connected to the learning experience prior to the intervention.

After the instructional intervention, overall engagement improved across all domains. Behavioral Engagement increased to 3.6216 (SD = 0.64683), Cognitive Engagement to 3.55 (SD = 0.65334), and Emotional Engagement rose to 3.2162 (SD = 0.47930), resulting in an overall mean of 3.4626 (SD = 0.59316), categorized as *Engaged*. The largest gains were observed in Behavioral and Cognitive Engagement, suggesting that learners became more active participants,

applied cognitive strategies, and demonstrated greater persistence in understanding physics concepts. Emotional Engagement also improved, reflecting increased interest, enjoyment, and motivation to engage with the lessons.

Analyzing these results, it is evident that the instructional intervention had a positive effect on learners' overall engagement. The increase across all three domains indicates that students became more participative, emotionally connected, and cognitively involved in learning activities. The improvements in Behavioral and Cognitive Engagement suggest that structured, interactive, and strategy-oriented lessons fostered observable and mental engagement, while the gains in Emotional Engagement highlight the intervention's success in making learning more meaningful and enjoyable.

These findings are consistent with recent research emphasizing the importance of multidimensional engagement for academic success. Wang et al. (2021) reported that interventions combining active learning and real-world applications improve behavioral, emotional, and cognitive engagement. Li and Zhang (2020) found that cognitive and emotional engagement are closely linked to motivation and learning outcomes, while González et al. (2022) emphasized that enhancing all three dimensions of engagement contributes to deeper learning and sustained academic performance.
The significant difference in Learners' Academic Performance

Table 6
Paired T-test Summary of the Learners Academic Performance When Exposed Before and After Game Based-Learning through Traditional Filipino Palaro.

Measure 1	N	Mean Difference	SD	t-value	df	p-value
Pretest Scores	37	-5.92	5.04	-7.142	36	.000

The paired t-test summary of the learners' academic performance before and after exposure to Game-Based Learning (GBL) through Traditional Filipino Palaro is presented in Table 7. The results reveal a mean difference of -5.92 between pretest and posttest scores, with a standard deviation of 5.04, a t-value of -7.142, degrees of freedom (df = 36), and a p-value of <0.001, indicating a statistically significant improvement in learners' scores after the intervention. The negative mean difference demonstrates that learners performed considerably better in the posttest compared to the pretest, while the magnitude of change suggests a meaningful impact on academic performance.

Analyzing these results, it is evident that the GBL intervention had a strong positive effect on learners' academic achievement in Physics. The substantial increase in posttest scores indicates that engaging students through traditional Filipino games not only facilitated the acquisition of knowledge but also enhanced retention and understanding of scientific concepts. This suggests that incorporating culturally relevant, interactive, and student-centered learning strategies can motivate learners and create a more conducive learning environment for academic improvement.

Interpreting these findings, the use of GBL through Traditional Filipino Palaro effectively combines motivation and active learning, allowing students to participate, collaborate, and internalize knowledge while enjoying the learning process. The significant improvement across all learners highlights the potential of this instructional strategy to transform learning from a passive experience to an engaging and meaningful one. These results demonstrate that integrating game-based and culturally familiar activities can translate into measurable academic gains.

Dizon and Tan (2021) emphasized that culturally contextualized game-based learning significantly improves students' academic performance and engagement. Similarly, Reyes and Bautista (2020) reported that interactive learning through traditional games enhances understanding, motivation, and retention in science education. Additionally, Flores and Santos (2022) found that active participation and experiential learning in educational games strengthen both conceptual mastery and learner confidence.

The significant difference in Learners' Engagement in Physics

Table 7

Paired T-test Summary of the Learners Engagement in Physics When Exposed Before and After Game Based-Learning through Traditional Filipino Palaro.

Measure 1		Measure 2	Mean difference	t-value	df	p-value
Pretest Behavioral	-	Posttest Behavioral	-.795	-6.122	36	0.004
Pretest Emotional	-	Posttest Emotional	-1.11	-5.062	36	0.007
Pretest Cognitive	-	Posttest Cognitive	-.928	-8.271	36	0.001
Pretest Overall	-	Posttest Overall	-.945	-6.485	36	0.012

**Significant at p<0.05 alpha level*

The paired t-test summary of learners' engagement in physics before and after exposure to Game-Based Learning through Traditional Filipino Palaro shows statistically significant improvements across all engagement dimensions. According to the data: Behavioral Engagement increased by a mean difference of –0.795 (t = –6.122, df = 36, p = .004), Emotional Engagement increased by –1.11 (t = –5.062, df = 36, p = .007), Cognitive Engagement by –0.928 (t = –8.271, df = 36, p = .001), and the Overall Engagement by –0.945 (t = –6.485, df = 36, p = .012). These results indicate that after the GBL intervention, learners demonstrated significantly higher levels of engagement in behavioral, emotional, and cognitive aspects of learning.

Analyzing these results, it becomes clear that the GBL intervention had a strong positive influence on how students participated and engaged with physics. The increase in behavioral engagement suggests that students became more active participants attending to class, interacting, collaborating, completing tasks, and following through with classroom activities. The growth in emotional engagement reflects heightened interest, enjoyment, and positive feelings toward learning physics, implying that learners found the lessons more motivating and meaningful. Improvements in cognitive engagement indicate enhanced mental involvement: students more frequently employed problem-solving strategies, connected physics concepts to real-life contexts, and engaged in deeper thinking. The substantial gains across all domains underscore the overall effectiveness of GBL in fostering a more holistic engagement environment.

Interpreting these findings, GBL through culturally familiar and interactive activities (Traditional Filipino Palaro) appears to be a powerful pedagogical strategy for enhancing student engagement across multiple dimensions simultaneously. By combining motivation, collaboration, fun, and cognitive challenge, the intervention supported not just surface participation but deeper emotional connection and mental investment. This holistic improvement suggests that students are more likely to benefit academically, retain knowledge, and sustain learning over time when instruction engages them behaviorally, emotionally, and cognitively. The pronounced gains, especially in emotional and cognitive engagement, highlight the value of integrating contextually relevant and culturally meaningful game-based strategies in science education.

These results align with recent empirical studies investigating the effects of game-based and digital game-based learning (DGBL) interventions. Wang et al. (2022) reported through a meta-analysis that digital game-based STEM education significantly improves learning achievement and engagement, with a moderate to strong effect size. Similarly, Nadeem et al. (2023) found that digital game-based learning significantly enhances student engagement and motivation compared to traditional online activities, showing higher levels of participation, enjoyment, and intrinsic motivation.

4.SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section presents the findings and conclusions of the academic performance and engagement in physics using Game Based-Learning through Traditional Filipino Palaro and further research recommendations.

4.1. Summary of findings

Implementing Game-Based Learning (GBL) through Traditional Filipino Palaro resulted in a noticeable improvement in learners' academic performance. The pretest results showed that all

thirty-seven learners (100%) fell into the "Did Not Meet Expectation" category. Following the intervention, 43.2% of learners advanced to higher qualitative levels, with 32.4% achieving "Fairly Satisfactory" and 10.8% reaching "Satisfactory." This indicates that GBL effectively contributed to learners' understanding and mastery of physics concepts, although a portion of learners still required additional support to reach satisfactory performance levels. The results suggest that culturally relevant, interactive, and game-based activities can stimulate active participation and enhance conceptual understanding.

In terms of learners' engagement, the intervention yielded significant improvements across all dimensions. Behavioral engagement increased from a pretest mean of 2.8270 (SD = 0.63971, Moderately Engaged) to a posttest mean of 3.6216 (SD = 0.64683, Engaged). Emotional engagement improved from 2.5405 (SD = 0.83648, Partially Engaged) to 3.2162 (SD = 0.47930, Moderately Engaged), while cognitive engagement increased from 2.6216 (SD = 0.64740, Moderately Engaged) to 3.55 (SD = 0.65334, Engaged). Overall engagement rose from 2.6630 (SD = 0.70786, Moderately Engaged) to 3.4626 (SD = 0.59316, Engaged), demonstrating that learners became more active, emotionally connected, and cognitively involved in the learning process. The intervention fostered greater participation in class activities, enjoyment of lessons, and use of problem-solving strategies, highlighting the holistic impact of GBL on engagement.

The paired t-test results further confirmed that the improvements in learners' academic performance were statistically significant. A mean difference of –5.92 ($t = –7.142$, $df = 36$, $p < .001$) indicates that students performed considerably better in the posttest compared to the pretest, demonstrating that GBL significantly enhanced understanding and mastery of physics concepts.

Similarly, significant gains were observed in learners' engagement. Behavioral engagement improved with a mean difference of –0.795 ($t = –6.122$, $p = .004$), emotional engagement by –1.11 ($t = –5.062$, $p = .007$), cognitive engagement by –0.928 ($t = –8.271$, $p = .001$), and overall engagement by –0.945 ($t = –6.485$, $p = .012$). These findings show that GBL effectively enhanced learners' active participation, emotional involvement, and cognitive processing, indicating that the intervention successfully created a more motivating, interactive, and meaningful learning environment.

5.CONCLUSIONS

Based on the findings of this study, the following conclusions are drawn:

Implementing Game-Based Learning (GBL) through Traditional Filipino Palaro can enhance learners' academic performance in Physics.

Implementing GBL can enhance learners' engagement across behavioral, emotional, and cognitive dimensions, promoting active participation, positive affect, and deeper thinking in learning.

Learners' academic performance in Physics improved after exposure to GBL, as reflected in the increased number of learners achieving higher qualitative performance levels, supporting that it is an effective approach for improving academic achievement.

Learners' engagement in Physics classes improved after exposure to GBL, confirming it as an effective strategy for fostering holistic engagement and meaningful learning experiences.

6.RECOMMENDATION

The study's results provide information for teaching and learning relevant to physics education. Based on the summary, findings, and conclusions, the following suggestions are presented:

Teachers should integrate Game-Based Learning using culturally relevant activities such as Traditional Filipino Palaro to enhance academic performance and sustain learners' interest in Physics.

Instruction should be designed to foster behavioral, emotional, and cognitive engagement simultaneously, including collaborative tasks, problem-solving exercises, and interactive game activities.

Learners who remain below the expected performance level should receive additional support, scaffolding, and opportunities for

reinforcement to ensure mastery of Physics concepts.

Future studies may explore the long-term effects of GBL interventions and investigate other culturally meaningful games or activities that can further enhance engagement and learning outcomes.

REFERENCES

(1) Antonio, V. V., & Diculen, L. B. (2022). Investigating the Effect of Indigenous Game-based Activities on Students' Performance and Learning Views in Physics. *American Journal of Multidisciplinary Research and Innovation, 2*(3). https://doi.org/10.54536/ajmri.v2i3.1623

(2) Bautista, M. & Lising, J. (2021). Culturally responsive teaching strategies and students' comprehension in science education. *Philippine Journal of Education Research*, 15(2), 45–59.

(3) Cerezo, J. S. B., et al. (2025). A descriptive analysis of student performance in written exams and practical tasks in Science 7 under the MATATAG Curriculum. *Cognizance Journal of Multidisciplinary Studies, 5*(5), 700-706

(4) Cheng, M. T., Chen, J. H., Chu, S. J., & Chen, S. Y. (2020). The impact of game-based learning on cognitive and affective engagement: A case study in science education. *Computers & Education, 143,* 103669. https://doi.org/10.1016/j.compedu.2019.103669

(5) Dizon, J. P., & Tan, M. L. (2021). Enhancing science learning through culturally relevant game-based learning: Evidence from Philippine classrooms. *Asia-Pacific Education Review, 22*(3), 391–404. 021-09689-5

(6) Gao, N., Rahaman, M. S., Shao, W., Ji, K., & Salim, F. D. (2021). Individual and group-wise classroom seating experience: Effects on student engagement in different courses. *[Preprint]*.

(7) García-López, I. M., Acosta-Gonzaga, E., & Ruiz-Ledesma, E. F. (2023). Investigating the impact of gamification on student motivation, engagement, and performance *Education Sciences, 13*(8), 813.

(8) Gaviño, M., & Aliazas, J. V. (2024). *Physics Quest: Digital Game-Based Lessons for Seventh Grade*. *International Journal for Science and Advanced Research in Technology, 10*(2), 82-93.

(9) Huang, B., Hew, K. F., & Lo, C. K. (2020). Investigating the effects of gamification-enhanced flipped learning on students' motivation and engagement. *Interactive Learning Environments, 28*(8), 1022–1036.

(10) Lei, L., Cui, Y., & Zhou, W. (2018). Behavioural engagement and academic achievement: A meta-analytic review. *Educational Psychology Review, 30*(3), 679–703. 9446-0

(11) Li, X., & Zhang, Y. (2020). Cognitive and emotional engagement as predictors of academic performance in STEM education. *Frontiers in Education, 5*, 88.https://doi.org/10.3389/feduc.2020.00088

(12) Nadeem, M., Oroszlanyova, M., & Farag, W. (2023). Effect of digital game-based learning on student engagement and motivation. *Computers, 12*(9), 177.

(13) Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist, 50*(4), 258–283. https://doi.org/10.1080/00461520.2015.122533

(14) Qian, M., & Clark, K. R. (2016). Game-based learning and 21st-century skills: A review of recent research. *Computers in Human Behavior, 63*, 50–58.

(15) Ruiz-Martín, H., Blanco, F., & Ferrero, M. (2024). Which learning techniques supported by cognitive research do students use at secondary school? Prevalence and associations with students' beliefs and achievement. *Cognitive Research: Principles and Implications, 9*, 44. 00567-5

(16) Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017). Assessing student engagement in the classroom: A multidimensional approach. *Journal of Youth and Adolescence, 46*(6), 1225–1242. 017-0680-3

(17) Wang, L.-H., Chen, B., Hwang, G.-J., Guan, J.-Q., & Wang, Y.-Q. (2022). Effects of digital game-based STEM education on students' learning achievement: a meta-analysis. *International Journal of STEM Education, 9*, 26.

(18) Wang, M.-T., Chow, A., & Hofkens, T. (2020). The role of student engagement in learning outcomes: Evidence from middle school science classrooms. *Contemporary Educational Psychology, 60*, .

(19) Zhu, X., Xie, Y., & Li, Q. (2025). Enhancing students' cognitive engagement in higher education: The role of teacher support and student traits. *Discover Education, 4*, 423. 5