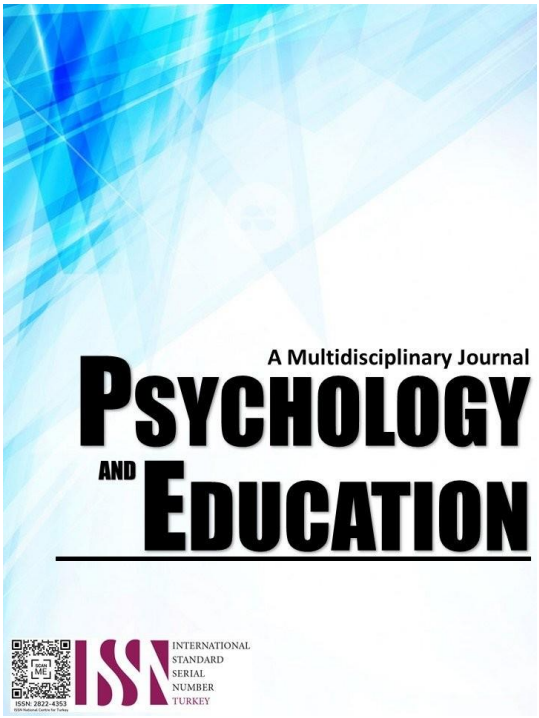
FILIPINO ETHNIC GAME-BASED APPROACH: EFFECTS ON GENDER DIFFERENCES IN STUDENTS' INTEREST AND SKILLS IN PHYSICS



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Research Article

Filipino Ethnic Game-Based Approach: Effects on Gender Differences in Students' Interest and Skills in Physics

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Abstract

Physics education plays a vital role in developing students' cognitive, problem-solving, and decision-making skills. However, traditional methods often fail to align with how students naturally learn, making physics more challenging and less engaging. This highlights the need for innovative, culture-based, and interactive teaching approaches to enhance student engagement and learning relevance. This study investigated the effect of the Filipino Ethnic Game-Based Approach (FEGBA) on the interest and physics skills of Grade 9 students at Datu Embak Mangansing Memorial High School (DEMMHS) in the Division of Special Geographic Area of BARMM (SGA-BARMM). Using a quasi-experimental pre-test and post-test one-group design, validated tests and survey questionnaires were administered to assess changes in student interest and skills. Results revealed significant improvements in male and female students' interest across science classroom experiences, teacher influence, and informal science learning. Male and female students' cognitive, problem-solving, and decision-making skills in physics showed marked advancement, with many transitioning from "Did Not Meet Expectation" to "Satisfactory", "Very Satisfactory" and "Outstanding" categories after FEGBA implementation. Statistical analyses confirmed no significant gender differences in interest or skill improvement, and a strong positive correlation was observed between interest and physics skills. These findings highlight FEGBA's effectiveness in enhancing student engagement and academic performance through culturally relevant and interactive teaching strategies, offering valuable insights for educators in similar contexts.

Keywords: *Filipino Ethnic game-based approach, interest, physics skills, gender differences, game-based learning*

Introduction

Interest is a crucial educational objective since it is also favorably correlated with non-cognitive results and job decisions. For a student to be successful in their studies, they should be interested in what they are studying. Many struggle with physics due to its perceived difficulty and traditional teaching. A lack of real-world applications further lowers engagement. Thus, Educators must use interactive strategies to enhance participation and foster scientific literacy.

Research suggests that interest enhances learning by improving attention, motivation, and cognitive engagement, ultimately leading to better academic outcomes (Hazari et al., 2020). Despite being essential for developing analytical and problem-solving skills, physics is widely regarded as challenging (Hoft & Bernholt, 2019). Factors such as low self-confidence, lack of interest, and limited teacher motivation contribute to students' negative attitudes toward the subject (Tadele, 2016).

Additionally, studies indicate that interest in physics declines significantly during secondary school (Lazowski & Hulleman, 2016), with gender disparities influencing engagement levels (Walper et al., 2013). While nations with greater gender equality show a narrower gender gap, sustaining long-term interest in physics remains a challenge (Stoet & Geary, 2018). Research highlights that effective learning occurs when theoretical knowledge is combined with practical applications (Kolb, 2014).

In response to these challenges, the use of game-based learning has gained momentum as an effective strategy to enhance student engagement in physics. Specifically, game theory has been shown to improve student motivation and learning outcomes (Morris et al., 2013). In Indonesia, traditional games have been successfully integrated into physics instruction, helping students grasp complex concepts while fostering better comprehension and critical thinking (Dewi et al., 2020).

Similarly, Del Carmen et al. (2015) found that teaching physics through traditional Philippine games enhanced students' learning, critical thinking, and communication skills, highlighting the importance of culturally relevant instructional approaches in making physics more accessible and engaging. This approach is particularly valuable because one major reason students often struggle in science education is their difficulty in connecting abstract concepts to practical applications (Camarao & Nava, 2017).

Additionally, in the Philippines, 0.4 million of the 3.56 million students are enrolled in engineering and technology programs (Licuanan, 2015) to pursue STEM degrees in order to support national Science and Technology programs and create a highly trained workforce (DOST, 2016). Negative perceptions of physics contribute to low achievement, with 2022 PISA results showing a score of 373 in scientific literacy, far below the OECD average (OECD, 2022). Thus, more interactive teaching strategies are needed to foster interest and improve performance.

While research on physics education is expanding, studies focusing on students' interest and skill development in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) remain limited, particularly in the Special Geographic Area (SGA). Most existing studies concentrate on urban schools, often overlooking the socio-cultural and educational challenges faced by students in resource-limited settings (Abuza & Lischin, 2020).

Moreover, at Datu Embak Mangansing Memorial High School, students exhibit low engagement and poor performance in physics assessments. Given the potential of game-based learning to enhance motivation and comprehension, this study explores the effectiveness of integrating local and traditional games into physics instruction. By providing a more interactive and culturally relevant learning experience, this research aims to improve student engagement and academic performance. Additionally, addressing this gap will contribute to a broader understanding of game-based learning in physics, particularly in underrepresented educational settings such as SGA-BARMM.

Research Questions

Generally, this study was conducted to determine the effectiveness of Filipino Ethnic Game-based Approach to the interest and physics skills of grade 9 students of Datu Embak Mangansing Memorial High School in Science. Specifically, this study answered the following questions:

1. What is the level of interest between male and female science Grade 9 students before and after administering the FEGBA in terms of:
    1.1. Science classroom experiences,
    1.2. Teacher influence, and
    1.3. Informal learning experiences?
2. What is the level of Physics Skills between male and female Grade 9 science students in the pre-test and post-test in terms of:
    2.1. Cognitive Skills,
    2.2. Problem-Solving Skills, and
    2.3. Decision-making Skills?
3. Is there a significant difference between the interest of male and female Grade 9 science students after administering the FEGBA?
4. Is there a significant difference between the physics skills of male and female Grade 9 science students after administering the FEGBA?
5. Is there a significant relationship between the interest and physics skills of students?

Methodology

Research Design

This study utilized the quasi-experimental design, specifically the pre-test and post-test one-group design (Smith & Johnson, 2019) to determine the effectiveness of the Filipino Ethnic Game-Based Approach in enhancing the interest and physics skills of Grade 9 students at Datu Embak Mangansing Memorial High School. This design is appropriate as it allows the researcher to measure changes in students' interest and skills in physics before and after the intervention. Through this method, the study examines how integrating Filipino ethnic games into Physics 9 topics influences student engagement and learning outcomes. The pre-test and survey questionnaire before FEGBA assesses baseline knowledge and interest, while the post-test and survey questionnaire after FEGBA evaluates improvements following the intervention.

Respondents

The respondents of this study are Grade 9 students enrolled at Datu Embak Mangansing Memorial High School, located in Barangay Nunguan, Malidegao, SGA, BARMM, during the school year 2023–2024. These students were selected as they are at a critical stage in their secondary education, where the transition from basic scientific concepts to more abstract physics principles often pose challenges in learning engagement and skill development. The respondents are the ones who provide all the necessary information, so without them, there would be no research (Moura, 2021). The inclusion criteria for selecting respondents primarily must be, 1) student is officially enrolled as Grade 9 learners at Datu Embak Mangansing Memorial High School during the school year 2023–2024. 2) Students must have prior exposure to conventional physics instruction to enable a comparative assessment of the intervention, and 3) students must be willing to participate in the study, as informed consent was obtained to ensure ethical research practices.

Table 1. *The Distribution of Respondents of the Study*

Grade 9 Students	*Number of Respondents*	*Percentage (%)*
Male	24	52
Female	22	48
Total	46	100

The researcher used complete enumeration of Grade 9 students, employing total enumeration, which consisted of 24 males and 22 females. Thus, there were 46 students who served as the respondents of the study.

Instrument

To gather data, the study used a modified survey questionnaire from Lamb et al. (2012) and a test questionnaire for pre-test and post-test assessments. The survey questionnaire measured students' interest in physics before and after applying the Filipino Ethnic Game-

Based Approach (FEGBA). It consisted of two parts: the respondents' profile, which included name and gender, and an interest checklist that assessed interest in physics through three indicators—Science classroom experiences, Teacher influence, and Informal learning experiences—each containing five items, for a total of 15 items.

The test questionnaire evaluated students' cognitive, problem-solving, and decision-making skills based on the Science 9 Learning Module and a Table of Specifications (TOS). It included 35 items for cognitive skills, 10 for problem-solving skills, and 5 for decision-making skills. To validate the instruments, a try-out test was conducted with 44 Grade 10-Gumawan students. The survey questionnaire's reliability was tested using Cronbach's alpha, while the Kuder-Richardson Formula 20 (KR20) was used for the test questionnaire.

For validation, 100 initial test items were reviewed for clarity and relevance. After item analysis, 65 were selected for reliability testing, and a final set of 50 was chosen for the pre-test and post-test. These covered key physics topics such as Forces and Motion, Work, Power and Energy, Heat, and Electricity and Magnetism.

To describe the performance of the students in Grade-9 science for the lessons which have incorporated the Filipino Ethnic Game-based Activities, the researcher used the following transmuted table, based on DepEd Order No. 8, s. 2015,

For the cognitive skills test, problem-solving skills test, and decision- making skills test, the following score intervals will be used to describe the level of cognitive skills, problem-solving skills, and decision- making skills of the students. This is based on the proper method for creating a frequency distribution table. Tabulation and analysis of the gathered data, the results will be subjected to appropriate statistical treatment as described in the later section.

Procedure

The study followed a structured process to ensure accuracy, reliability, and ethical standards. First, the survey and test questionnaires were developed and validated to match the study's goals. The test questionnaire was checked for accuracy and consistency through validity and reliability testing.

Once the research instruments were validated, institutional approval was sought. Permission was first requested from the Office of the Dean of Graduate Studies at Sultan Kudarat State University, ensuring compliance with academic and ethical guidelines. After securing approval, a formal request letter was submitted to the Schools Division Superintendent and Principal of Datu Embak Mangansing Memorial High School, seeking authorization to conduct the study within the school.

Following the necessary approvals, an orientation was conducted for the respondents, informing them about the study's purpose, procedures, and ethical considerations, including voluntary participation and confidentiality of responses.

Students first took a pre-test and pre-survey questionnaire to measure their initial interest and skills in physics. The Filipino Ethnic Game-Based Approach (FEGBA) was then introduced into Grade 9 physics lessons on Forces, Motion, and Energy. After the intervention, students took a post-test and post-survey questionnaire to assess any changes in their interest and skills.

Finally, the retrieval of data aims to determine how effective the Filipino Ethnic Game-Based Approach was in improving student engagement and physics competency.

Data Analysis

First, the weighted mean with standard deviation was applied to determine the interest of male and female Grade 9 students before and after administering the Filipino Ethnic Game-Based Approach (Pearce, 1992).

Second, frequency counts, percentage distribution, and mean were employed to determine the physics skills of male and female Grade 9 students during the pre-test and post-test.

Additionally, the dependent sample t-test was used to determine the significant difference between the interest and physics skills of male and female Grade 9 students after administering the Filipino Ethnic Game-Based Approach, (Student, 1908).

Finally, the Pearson Product Moment Coefficient of Correlation (r) was used to assess the significant relationship between the interest and physics skills of the students (Pearson, 1895). This tool was used as it effectively measures the strength and direction of the linear relationship between two continuous variables, making it ideal for analyzing quantitative data in educational research.

Results and Discussion

This section includes the presentation, analysis, and interpretation of the quantitative data.

Interest in Science among Grade 9 Students

Student interest is a key factor in enhancing engagement, motivation, and learning outcomes, particularly in complex subjects like physics (Ainley & Ainley, 2022). When educators incorporate interactive and culturally relevant teaching strategies, they can foster deeper curiosity and improve students' conceptual understanding. The following table shows the interest of the Grade 9 students:

Table 1.1. *Level of Interest in Science among Grade 9 Male Students before and after Administering the FEGBA in terms of Science Classroom Experiences*

Indicator	*Before*			*After*		
	Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1 The topics taught in my physics class are important in the real world.	3.25	0.44	Moderately Interested	4.25	0.61	Highly Interested
2 The topics taught in my physics class are not boring.	2.21	0.59	Uninterested	4.00	0.59	Interested
3 My physics classroom has interesting equipment.	2.42	0.50	Uninterested	4.04	0.36	Interested
4 We use most of the equipment in our physics classroom	2.17	0.38	Uninterested	4.00	0.42	Interested
5 Topics in physics encourage me to continue learning in physics courses.	3.04	0.46	Moderately Interested	4.13	0.54	Interested
Section Mean / SD / Interpretation	2.62	0.25	Moderately Interested	4.08	0.38	Interested

It can be gleaned in Table 1.1, the significant improvement in the level of interest among male Grade 9 students in science classroom experiences after the administration of the Filipino Ethnic Game-Based Approach (FEGBA). The overall mean interest score increased from M= 2.62 (moderately interested) before the intervention to M = 4.08 (interested) after the intervention, indicating a positive shift in student interest.

Among the indicators, the highest mean after the intervention was M = 4.25 (highly interested), highlighting that the topics taught in the physics class are important in the real world. This suggests that integrating Filipino ethnic games helped students recognize the real-world relevance of physics concepts, making learning more meaningful and engaging. Conversely, the lowest mean score before the intervention was M = 2.17 (uninterested), indicating that students rarely used most of the equipment in their physics classroom. This suggests that, prior to the integration of FEGBA, students had limited hands-on experiences in their physics classes. However, after the intervention, this indicator significantly improved to M= 4.00 (interested), demonstrating that game-based activities provided interactive learning experiences that helped students engage with the subject more effectively.

Table 1.2. *Level of Interest in Science among Grade 9 Female Students before and after Administering the FEGBA in terms of Science Classroom Experiences*

Indicator	*Before*			*After*		
	Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1 The topics taught in my physics class are important in the real world.	3.18	0.50	Moderately Interested	4.32	0.57	Highly Interested
2 The topics taught in my physics class are not boring.	2.23	0.43	Uninterested	4.32	0.57	Highly Interested
3 My physics classroom has interesting equipment.	2.45	0.60	Uninterested	4.41	0.59	Highly Interested
4 We use most of the equipment in our physics classroom	2.23	0.43	Uninterested	4.23	0.53	Highly Interested
5 Topics in physics encourage me to continue learning in physics courses.	3.27	0.46	Moderately Interested	4.32	0.65	Highly Interested
Section Mean / SD / Description	2.67	0.19	Moderately Interested	4.32	0.46	Highly Interested

It is presented in Table 1.2 a significant increase in female Grade 9 students' interest in science classroom experiences after implementing the Filipino Ethnic Game-Based Approach (FEGBA). The overall mean improved from (M = 2.67), indicating that students were moderately interested in the indicators before the intervention, to (M = 4.32), reflecting that they became highly interested after the intervention, indicating a substantial rise in engagement.

The highest post-intervention mean of (M = 4.41) corresponded to highly interested, indicating that students found their physics classroom equipment engaging, which suggests the development of a more interactive learning environment. Conversely, the lowest pre-intervention mean of (M = 2.23) signifies that students were uninterested, as they perceived the topics taught in their physics class as boring and were also uninterested in using most of the equipment in their classroom. This initial disinterest and lack of hands-on learning significantly improved after the intervention.

Findings in Tables 1.1 and 1.2 suggest that before the implementation of FEGBA, both male and female students were moderately interested. However, after FEGBA both genders effectively increased their interest in physics with female students showed a slightly higher level of engagement and enthusiasm after the intervention.

This implies that culturally relevant and interactive teaching strategies, such as game-based learning, can be particularly effective in fostering interest in physics for both male and female learners who may benefit from more engaging and participatory instructional methods.

This suggests that focused approach like FEGBA can boost students' enthusiasm for science by improving classroom instruction and making it more applicable to real-world situations, which will benefit both genders equally. Culturally relevant, ethnic games can keep students interested by fusing well-known, entertaining activities with scientific ideas.

Research supports the idea that meaningful and engaging experiences increase student interest. Durik and Harackiewicz (2007) state that positive attitudes come from meaningful experiences, enhancing situational interest. Similarly, Rosenzweig et al. (2020) found that interactive teaching methods improve student motivation and interest in learning. When science is taught in a hands-on and engaging way, students tend to develop a stronger interest in the subject.

Studies also show that incorporating culturally relevant games, such as Filipino ethnic games, into science lessons can boost student interest and their perception of the subject's relevance (Morales, 2015). Similarly, Moro and Billote (2023) found that using indigenous games in physics classes improved students' attitudes and connection to the subject. Likewise, Shaenfeld (2016) highlights the benefits of game-based learning (GBL) in enhancing knowledge and fostering interest in science.

These findings suggest that culturally relevant teaching methods using familiar and enjoyable activities can improve learning and interest in science.

Table 1.3. *Level of Interest in Science among Grade 9 Male Students before and after Administering the FEGBA in terms of Teacher Influence*

Indicator	*Before*			*After*		
	Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1 My physics teacher has encouraged me to learn in physics	3.04	0.55	Moderately Interested	4.17	0.48	Interested
2 My physics teacher makes physics interesting.	3.25	0.53	Moderately Interested	4.25	0.61	Highly Interested
3 My teacher is enthusiastic about physics.	3.21	0.41	Moderately Interested	4.08	0.41	Interested
4 I do pay attention when my teacher explains the concept of physics.	3.25	0.61	Moderately Interested	4.04	0.46	Interested
5 My teacher's passion for physics inspires curiosity and exploration.	3.17	0.54	Moderately Interested	4.08	0.41	Interested
Section Mean / SD / Interpretation	3.18	0.30	Moderately Interested	4.13	0.33	Interested

As shown in Table 1.3, there is a notable increase in the level of interest among Grade 9 male students in Science, specifically in terms of teacher influence, after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA). The section mean improved from 3.18 (Moderately Interested) before the intervention to M=4.13 (Interested) after the intervention, that students developed a stronger appreciation for their teacher's role in making physics engaging.

The highest post-intervention mean of M = 4.25 corresponded to highly interested, indicating that students found their physics teacher made physics interesting. Conversely, the lowest pre-intervention mean of M = 3.04 signifies that students were moderately interested in how their physics teacher encouraged them to learn physics. However, this significantly improved after the intervention, reaching M = 4.17 (interested), demonstrating increased motivation and engagement in the subject.

Table 1.4. *Level of Interest in Science among Grade 9 Female Students before and after Administering the FEGBA in terms of Teacher Influence*

Indicator	*Before*			*After*		
	Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1 My physics teacher has encouraged me to learn in physics	3.32	0.57	Moderately Interested	4.32	0.57	Highly Interested
2 My physics teacher makes physics interesting.	3.32	0.57	Moderately Interested	4.32	0.57	Highly Interested
3 My teacher is enthusiastic about physics.	3.27	0.46	Moderately Interested	4.32	0.57	Highly Interested
4 I do pay attention when my teacher explains the concept of physics.	3.36	0.49	Moderately Interested	4.41	0.59	Highly Interested
5 My teacher's passion for physics inspires curiosity and exploration.	3.32	0.47	Moderately Interested	4.27	0.55	Highly Interested
Section Mean / SD / Interpretation	3.32	0.28	Moderately Interested	4.33	0.43	Highly Interested

As presented in Table 1.4, indicates a significant improvement in the level of interest among Grade 9 female students in science, particularly in terms of teacher influence, after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA). The section mean increased from 3.32 (Moderately Interested) before the intervention to 4.33 (Highly Interested) after the intervention, suggesting that students developed a stronger appreciation for their teacher's role in making physics more engaging and inspiring. Before the intervention, students were only moderately interested in how their teacher encouraged them to learn physics. However, after the intervention, students became highly interested in these aspects, made the subject interesting, and inspired curiosity

The highest post-intervention mean of (M=4.41) corresponded to highly interested, indicating that students paid attention when their teacher explained physics concepts. Conversely, the lowest pre-intervention mean of (M=3.27) signifies that students were moderately interested in their teacher's enthusiasm for physics. However, this significantly improved after the intervention, reaching M=4.32 (highly interested), demonstrating a greater appreciation for their teacher's enthusiasm.

Findings in Tables 1.3 and 1.4 suggest that before the implementation of FEGBA, both male and female students were moderately interested in their teacher's role in making physics engaging. However, after the FEGBA intervention, both groups showed a significant improvement in their perceptions. Female students became highly interested, while male students also reported a notable increase in their engagement. These results indicate that interactive and culturally relevant teaching strategies, such as FEGBA, can enhance students' perceptions of their teacher's influence in making physics more enjoyable and stimulating.

This implies that the intervention not only increased students' interest in the subject but also improved their perception of their teacher's enthusiasm, effectiveness, and ability to inspire curiosity. These results suggest that interactive and culturally relevant teaching strategies, such as FEGBA, can strengthen students' views of their teacher's role in making physics more enjoyable and engaging.

Research shows that key aspects of teaching, such as student support, can increase interest in science (Dorfner et al., 2018). The rise in student interest after FEGBA highlights the important role of teachers in keeping students engaged. Enthusiastic and supportive teachers can make science more exciting, creating a positive learning environment for all students.

Pejaner and Mistades (2020) emphasized that culturally responsive teaching improves student engagement by connecting science concepts to familiar cultural experiences. Similarly, Christidou (2011) found that a good science teacher plays a key role in sparking student interest. Teachers can improve their student's academic experiences and physics interests by fostering a learning atmosphere that prioritizes cultural relevance.

Table 1.5. *Level of Interest in Science among Grade 9 Male Students before and after Administering the FEGBA in terms of Informal Learning Experiences*

Indicator	*Before*			*After*		
	Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1 I do enjoy visiting science museums and science centers to learn more about physics.	2.17	0.64	Uninterested	4.29	0.46	Highly Interested
2 Visiting science museums and exhibits make me consider a career in science, specifically in physics.	2.13	0.61	Uninterested	4.08	0.50	Interested
3 I love watching science program in television rather than dramas.	2.17	0.38	Uninterested	4.08	0.41	Interested
4 Engaging in hands-on experiment at home sparks my interest in physics outside the classroom	2.04	0.46	Uninterested	4.08	0.41	Interested
5 Attending science fairs and workshops outside formal settings connects theoretical physics to real-world applications in an engaging way.	2.08	0.50	Uninterested	4.21	0.51	Highly Interested
Section Mean / SD / Interpretation	2.12	0.28	Uninterested	4.15	0.31	Interested

As glimpse in Table 1.5, results show a significant increase in the level of interest among Grade 9 male students in science, particularly in terms of informal learning experiences, after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA). The section mean improved from 2.12 (Uninterested) before the intervention to 4.15 (Interested) after, indicating that students became more engaged with science-related activities beyond the classroom.

The highest post-intervention mean of M = 4.29 was observed, highlighting students' high interest in visiting science museums and science centers to learn more about physics. Conversely, the lowest pre-intervention mean of M = 2.04 signifies that students were uninterested in engaging in hands-on experiments at home to spark their interest in physics outside the classroom. However, after the intervention, this indicator significantly improved to M = 4.08, indicating that students became Interested.

The results in Table 1.6 indicate a substantial increase in the level of interest among Grade 9 female students in science, particularly in terms of informal learning experiences, after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA). The section mean improved from 2.23 (Uninterested) before the intervention to 4.35 (Highly Interested) after, reflecting a significant positive shift in students' enthusiasm for engaging with science beyond the classroom.

The highest post-intervention mean of M = 4.45 was obtained for the fifth indicator, signifying that students were highly interested in attending science fairs and workshops outside formal settings, as they found these experiences connected theoretical physics to real-world applications in an engaging way.Conversely, the lowest pre-intervention mean of M = 2.14 for the same indicator signifies that students were uninterested before the intervention.

Findings in Tables 1.5 and 1.6 suggest that before the implementation of FEGBA, both male and female students were uninterested in informal science learning activities, such as visiting museums or watching science-related shows. However, after the FEGBA intervention, both groups exhibited a significant increase in interest. Female students became highly interested in engaging in these activities, while male students also reported a notable improvement. These results indicate that culturally relevant and interactive

learning strategies, such as FEGBA, can effectively enhance students' interest in informal science learning experiences.

Table 1.6. *Level of Interest in Science among Grade 9 Female Students before and after Administering the FEGBA in terms of Informal Learning Experiences*

	Indicator	*Before*			*After*		
		Mean	*SD*	*Interpretation*	*Mean*	*SD*	*Interpretation*
1	I do enjoy visiting science museums and science centers to learn more about physics.	2.27	0.46	Uninterested	4.36	0.49	Highly Interested
2	Visiting science museums and exhibits make me consider a career in science, specifically in physics.	2.23	0.53	Uninterested	4.27	0.55	Highly Interested
3	I love watching science program in television rather than dramas.	2.32	0.57	Uninterested	4.32	0.65	Highly Interested
4	Engaging in hands-on experiment at home sparks my interest in physics outside the classroom	2.18	0.39	Uninterested	4.32	0.57	Highly Interested
5	Attending science fairs and workshops outside formal settings connects theoretical physics to real-world applications in an engaging way.	2.14	0.64	Uninterested	4.45	0.60	Highly Interested
	Section Mean / SD / Interpretation	2.23	0.26	Uninterested	4.35	0.46	Highly Interested

These results imply that integrating culturally relevant and interactive learning strategies, such as FEGBA, not only increases students' engagement in formal science education but also strengthens their interest in informal science activities. By making science more relatable and enjoyable, these strategies encourage students to explore science beyond the classroom, fostering a lasting curiosity in the subject.

Research supports the idea that incorporating culturally relevant games into education enhances student engagement and learning. Tupas and Palmares (2018) found that integrating traditional games into the K–12 curriculum helps students connect scientific concepts to real-life situations, making learning more meaningful. Similarly, Anderson et al. (2003) emphasized that learning is personal, meaning each student experiences education differently based on their background and interactions.

In physics education, Tabago (2014) demonstrated that Filipino game-based activities improve students' understanding of complex topics in physics. By fostering a culturally relevant learning environment, teachers can enhance students' academic experiences and interest in science. Similarly, Pho and Dinscore (2015) further highlighted that game-based learning can increase motivation and engagement, while Arciosa (2021) explored gamification as an effective teaching approach, though not necessarily better than other methods.

Moreover, Falk and Dierking (2000) introduced the contextual model of informal learning, emphasizing its role in shaping student interest beyond the classroom. These studies collectively suggest that game-based, culturally responsive teaching bridges the gap between formal and informal education, fostering long-term interest and deeper engagement in science.

Physics Skills among Students

Students' physics skills are crucial for developing problem-solving abilities, critical thinking, and scientific literacy, which help them navigate real-world challenges and technological advancements (Redish, 2017). Understanding physics concepts allows students to analyze motion, energy, and forces, applying these principles to everyday situations like transportation, electricity, and engineering (Bybee, 2013).

Strong physics skills prepare students for STEM careers, where analytical and quantitative reasoning are essential (Osborne, 2014). As society relies more on science and technology, equipping students with physics helps them drive innovation, boost the economy, and promote sustainability. The tables below show the physics skills of Grade 9 students.

The results in Table 2.1 show a significant improvement in the cognitive skills of Grade 9 science students after using the Filipino Ethnic Game-Based Approach (FEGBA). Before the intervention, most students (91.67% of males and 90.91% of females) scored below expectations (74 and below). After the approach, this showed a significant overall improvement.

In the post-test, 54.54% of female students scored in the outstanding range (90–100), compared to 37.5% of males. This means more female students showed exceptional cognitive skills in physics after the intervention. Additionally, 41.67% of males and 31.82% of females received a very satisfactory rating (85–89), proving the approach's effectiveness.

The mean scores showed a clear improvement between male and female students. In the pre-test, both groups were in the "Did Not Meet Expectation" category, with males scoring M=12.9 (69) and females slightly higher at M=14 (70). After the intervention, both groups improved, with males reaching 28.63 (88), a "Very Satisfactory" level, and females reaching 30.1 (91), an "Outstanding" level. Overall, the mean score increased from 13.45 (69) in the pre-test to 29.37 (89) in the post-test. It demonstrate a significant positive shift.

The significant gain in post-test scores indicates that the FEGBA intervention significantly improved students' cognitive skills in physics for both male and female students, although females exhibited a slightly higher level of improvement. This trend is consistent

with culturally sensitive teaching approaches and implies that the intervention enhances students' comprehension and application of physics concepts.

Table 2.1. *Level of Physics Skills between Male and Female Grade 9 Science Students in the Pre-test and Post-test in terms of Cognitive Skills*

Score Equivalence	*Pretest*				*Posttest*				*Description*
	Male		*Female*		*Male*		*Female*		
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	
90 - 100	0	0.00	0	0.00	9	37.5	12	54.54	Outstanding
85 - 89	0	0.00	0	0.00	10	41.67	7	31.82	Very Satisfactory
80 - 84	0	0.00	0	0.00	4	16.67	2	9.09	Satisfactory
75 - 79	2	8.33	2	9.09	1	4.16	1	4.55	Fairly Satisfactory
below - 74	22	91.67	20	90.91	0	0.00	0	0.00	Did Not Meet Expectations
Total	24	100	22	100	24	100	22	100	

Gender	*Pre-test score (35 items)*			*Posttest (35 items)*		
	Mean	*Score equivalence*	*Description*	*Mean*	*Score equivalence*	*Description*
Male	12.9	69	DNME	28.63	88	VS
Female	14	70	DNME	30.1	91	Outstanding
Overall	13.45	69	Did not meet expectation	29.37	89	Very satisfactory

This finding is supported by Kolb (2015), who emphasized that the physical aspect of games supports kinesthetic learning, helping students develop cognitive skills and better understand, anticipate, and apply physics concepts. In STEM subjects like physics, hands-on activities enhance cognitive processing, making abstract ideas easier to grasp. Similarly, Wilson et al. (2013) define game-based learning (GBL) as using games in teaching to create a student-centered approach that improves problem-solving and critical thinking skills. Gaviola (2023) also highlighted that digital game-based.

These studies collectively reinforce the idea that incorporating games into science instruction improves students' cognitive processing, making complex concepts more accessible and engaging. The study's results further validate the effectiveness of FEGBA as an instructional strategy that enhances physics learning through experiential and culturally relevant educational approaches.

Table 2.2. *Level of Physics Skills between Male and Female Grade 9 Science Students in the Pre-test and Post-test in terms of Problem-Solving Skills*

Score Equivalence	*Pretest*				*Posttest*				*Description*
	Male		*Female*		*Male*		*Female*		
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	
90 - 100	0	0.00	0	0.00	2	8.33	1	4.55	Outstanding
85 - 89	0	0.00	0	0.00	11	45.83	10	45.45	Very Satisfactory
80 - 84	0	0.00	0	0.00	10	41.67	9	40.91	Satisfactory
75 - 79	3	12.5	6	27.27	1	4.17	2	9.09	Fairly Satisfactory
below - 74	21	87.5	16	72.73	0	0.00	0	0.00	Did Not Meet Expectation
Total	24	100	22	100	24	100	22	100	

Gender	*Pre-test score (10 items)*			*Posttest (10 items)*		
	Mean	*Score equivalence*	*Description*	*Mean*	*Score equivalence*	*Description*
Male	4.17	70	DNME	7.58	84	Satisfactory
Female	4.82	72	DNME	7.45	84	Satisfactory
Overall	4.49	71	Did not meet expectation	7.52	84	Satisfactory

The table shows that most students had poor problem-solving skills before FEGBA, with 87.5% of males and 72.73% of females falling in the "did not meet expectation" category. After FEGBA, many improved to a very satisfactory level (45.83% of males and 45.45% of females), while some achieved an outstanding score (8.33% of males and 4.55% of females).

The mean scores show a significant improvement in problem-solving skills for both male and female students. In the pre-test, both groups were in the "Did Not Meet Expectation" category, with males scoring M= 4.17 (70) and females M= 4.82 (72). After the intervention, their scores increased, with males reaching M= 7.58 (84) and females M= 7.45 (84), both in the satisfactory range. The overall mean score rose from M= 4.49 (71) in the pre-test to M= 7.52 (84) in the post-test.

This implies that integrating culturally relevant and experiential learning methods, like FEGBA, can significantly enhance students' problem-solving skills in physics. This suggests that both male and female science students' problem-solving abilities can be significantly enhanced by structured treatments. Students participate in experiential learning where they are urged to think critically and apply theoretical information to real-world situations by integrating problem-solving exercises into these well-known activities.

Research shows that structured approaches like FEGBA help improve students' problem-solving and analytical skills in science. Gee (2007) emphasized that game-based learning boosts motivation, enhances problem-solving, and improves learning outcomes. Similarly, Freeman et al. (2014) also confirmed that active learning improves STEM performance, while Van Meter et al. (2006) highlighted the benefits of structured activities. Furthermore, Ocampo and Gutierrez (2020) found that traditional Philippine games increase student engagement and problem-solving skills.

Additionally, Han (2015) showed that interactive learning strengthens understanding, and Hmelo-Silver (2004) confirmed that problem-based active learning improves analytical thinking. These studies collectively highlight the importance of experiential and interactive approaches in science education, reinforcing the study's findings on the benefits of FEGBA in improving student learning outcomes.

Table 2.3. *Level of Physics Skills between Male and Female Grade 9 Science Students in the Pre-test and Post-test in terms of Decision-making Skills*

Score Equivalence	*Pretest*				*Posttest*				*Description*
	Male		*Female*		*Male*		*Female*		
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	
90 - 100	0	0.00	0	0.00	11	45.83	17	77.27	Outstanding
85 - 89	0	0.00	0	0.00	12	50.00	5	22.73	Very Satisfactory
80 - 84	0	0.00		0.00	0	0.00		0.00	Satisfactory
75 - 79	11	45.83	13	59.09	1	4.17	0	0.00	Fairly Satisfactory
below -74	13	54.17	9	40.91	0	0.00	0	0.00	Did Not Meet Expectation
Total	24	100	22	100	24	100	22	100	

Gender	*Pre-test score (5 items)*			*Posttest (5 items)*		
	Mean	*Score equivalence*	*Description*	*Mean*	*Score equivalence*	*Description*
Male	2.37	71	DNME	4.41	92	Outstanding
Female	2.59	72	DNME	4.77	96	Outstanding
Overall	2.48	72	Did not meet expectation	4.59	94	Outstanding

It is shown in Table 2.3 that there is a significant improvement in the decision-making skills of both male and female Grade 9 science students after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA).

Before the intervention, most students were in the "Fairly Satisfactory" and "Did Not Meet Expectation" categories, with 45.83% of males and 59.09% of females scoring between 75 and 79. After the intervention, no students remained in these lower categories, showing that FEGBA effectively improved decision-making skills in physics. Female students showed the most improvement, with 77.27% achieving an "Outstanding" rating (90–100), compared to 45.83% of males. This suggests the intervention had a stronger impact on female students.

The mean scores show a clear improvement in both male and female students. In the pre-test, both groups were in the "Did Not Meet Expectation" category, with males scoring 71 (M=2.37) and females slightly higher at 72 (M=2.59). After the intervention, both groups reached the "Outstanding" category, with males improving to 92 (M=4.41) and females to 96 (M=4.77). Overall, the mean score increased from 72 (M=2.48) to 94 (M=4.59), demonstrating a significant positive shift.

These results suggest that while both male and female students benefited from FEGBA, female students exhibited a slightly higher level of improvement in decision-making skills. The results imply that incorporating indigenous Filipino games, such as FEGBA, into physics education is an effective strategy for enhancing students' decision-making skills.

This is further supported by research results highlighting that incorporating indigenous Filipino games into physics education enhances students' decision-making skills. Moro and Billote (2023) found that using games improved students' critical thinking and quick decision-making abilities due to dynamic gameplay.

Additionally, students can use these educational hands- on learning games to develop decision-making and problem-solving skills in a dynamic learning environment (Macayan et al., 2022).

The following table shows the comparison of male and female student's interest in Physics.

Table 3. *Significant Difference between the Interest of Male and Female Grade 9 Science Students after Administering the FEGBA*

	Levene's Test for Equality of Variances		*t-test for Equality of Means*				
	F	*P-Value*	*t*	*df*	*P-Value)*	*Mean Difference*	*Std. Error Difference*
Equal variances assumed	3.905	.054	1.850	44	.071	.21086	.11400
Equal variances not assumed			1.825	38.391	.076	.21086	.11552

It is gleaned from Table 3 that the p-value for the t-test for equality of means is 0.071 (when equal variances are assumed) and 0.076 (when equal variances are not assumed), both of which are greater than the standard significance level of 0.05. This indicates that there is no statistically significant difference between the interest levels of male and female Grade 9 science students after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA).

The t-value of 1.850 supports this, suggesting that while female students showed slightly higher interest levels than male students (mean difference = 0.21086), this difference is not statistically significant. This further suggests that female students showed slightly higher interest levels than male students, but this variation is not strong enough to conclude that gender plays a significant role in determining interest after the intervention.

Additionally, Levene's test for equality of variances resulted in F = 3.905 with a p-value of 0.054, indicating that the assumption of equal variances is marginally met. Overall, these findings suggest that FEGBA was equally effective in increasing student interest in physics, regardless of gender, reinforcing its potential as an inclusive and culturally relevant teaching strategy that benefits both male and female learners.

The findings imply that the Filipino Ethnic Game-Based Approach (FEGBA) is an inclusive and effective teaching strategy that enhances student interest in physics regardless of gender. The lack of a statistically significant difference in interest levels between male and female students suggests that both groups benefit equally from this culturally relevant approach.

These findings support previous research on the gender inclusivity of game-based learning. Punzalan (2022) found no significant gender differences in STEM interest among junior high school students in the Philippines, showing that both male and female learners can develop interest in science equally. Similarly, Papastergiou (2019) found that digital learning games motivated students of all genders equally, with no observed differences.

Additionally, Stoet and Geary (2018) noted that the gender gap in science interest, especially in physics, decreases in societies with greater gender equality. This suggests that interest in science is shaped more by cultural and social factors than by gender itself. The Gender Similarities Hypothesis (Hyde, 2005) also supports this, emphasizing that men and women share more similarities than differences in cognitive abilities, motivation, and learning preferences.

Overall, these studies reinforce the conclusion that FEGBA is an inclusive and culturally relevant teaching strategy that effectively enhances physics interest for all students, regardless of gender.

Table 4. *Significant Difference between the Physics Skills of Male and Female Grade 9 Science Students after Administering the FEGBA*

		Levene's Test for Equality of Variances		*t-test for Equality of Means*				
		F	*P-value*	*t*	*df*	*P-value*	*Mean Difference*	*Std. Error Difference*
Cognitive	Equal variances assumed	.216	.645	1.668	44	.102	1.47	.881
	Equal variances not assumed			1.667	43.50	.103	1.47	.882
Problem Solving	Equal variances assumed	2.481	.122	.453	44	.653	.13	.293
	Equal variances not assumed			.460	41.19	.648	.13	.288
Decision Making	Equal variances assumed	.538	.467	1.644	44	.107	.36	.217
	Equal variances not assumed			1.628	40.35	.111	.36	.219

α = 0.05

The results in Table 4 indicate that across all skill categories; cognitive skills, problem-solving skills, and decision-making skills, the p-values in the t-test for equality of means are all greater than the standard significance level of 0.05. Specifically, for cognitive skills, the p-value is 0.102, for problem-solving skills, it is 0.653, and for decision-making skills, it is 0.107, indicating that while there are slight differences in mean scores, they are not statistically significant.

Additionally, the mean differences across all skill areas are relatively small (1.47 for cognitive skills, 0.13 for problem-solving skills, and 0.36 for decision-making skills), further supporting the conclusion that gender did not significantly impact the effectiveness of the intervention. The Levene's test for equality of variances also shows p-values above 0.05, meaning that the assumption of equal variances is met for all skill areas. These results suggest that FEGBA was equally effective in improving physics skills for both male and female students, reinforcing its potential as an inclusive instructional approach that enhances learning outcomes regardless of gender. Thus, there is no statistically significant difference between the physics skills of male and female Grade 9 science students after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA).

These findings suggest that FEGBA was equally effective in improving physics skills for both male and female students, reinforcing its potential as an inclusive teaching strategy. This implies that FEGBA promotes gender equity in physics education by providing an effective and inclusive approach to skill development, ensuring that both male and female students have equal learning opportunities.

Research shows that societal, cultural, and educational factors influence perceived performance differences between genders. Lindberg et al. (2010) found that when gender biases and opportunities were considered, there was no significant difference between male and

female performance in math and science, including physics. Similarly, Voyer and Voyer (2014) reported only minor gender differences in academic achievement, which were not statistically significant, further challenging the idea of inherent gender disparities in learning.

Supporting this, Klisch et al. (2012) found that both male and female students benefited equally from an educational science game, highlighting the effectiveness of interactive learning tools for all learners. Hyde and Mertz (2009) also emphasized that teaching methods and social norms play a crucial role in reducing gender gaps in science achievement. Additionally, Freeman et al. (2014) demonstrated that active learning strategies in STEM classrooms improved learning outcomes for both genders, reinforcing the value of inclusive and engaging teaching approaches.

Research shows that traditional games promote an inclusive learning environment and lessen gender biases in cognitive, problem-solving, and decision-making by encouraging equal participation from male and female students. Both male and female benefit from this balance of mental and physical stimulation as they develop essential skills they may use in academic and practical contexts.

Table 5. *Significant Relationship between the Interest and Physics Skills of Students*

	Mean	*SD*	*Interest*	
			r	*P-value*
Interest	4.22	0.40	.908	0.000
Physics Skills	41.48	3.10		

As gleaned in Table 5 the high mean score of 4.22 for interest and 41.48 for physics skills, along with the low standard deviations (0.40 and 3.10, respectively), indicate that the majority of students experienced both an increase in engagement and enhanced performance in physics. These findings imply that fostering student interest through interactive and culturally relevant teaching strategies, such as FEGBA, can significantly contribute to the development of cognitive, problem-solving, and decision-making skills in physics.

Furthermore, results indicate a significant positive relationship between students' interest and their physics skills after the implementation of the Filipino Ethnic Game-Based Approach (FEGBA). The computed correlation coefficient (r) is 0.908, with a p-value of 0.000, which is well below the standard significance level of 0.05. This strong positive correlation suggests that as students' interest in physics increases, their physics skills also improve.

This suggests that as students become more interested in physics, their skills also improve, reinforcing the effectiveness of FEGBA in promoting both engagement and learning. Moreover, this correlation implies that interest levels can serve as a predictive measure of students' performance in physics, highlighting the importance of fostering curiosity and enthusiasm for the subject.

Prior research supports this connection, emphasizing the role of motivation in physics learning. Kwarikunda et al. (2020) found that interest is closely linked to motivation, which plays a crucial role in learning physics. Additionally, Adamma et al. (2018) demonstrated that motivation significantly enhances academic achievement.

Further supporting these findings, Ainley and Ainley (2011) showed that enjoyment and interest in science contribute to students' cognitive engagement and academic success. Likewise, Logan and Skamp (2013) found that the quality of science instruction plays a critical role in shaping students' interest in science education. These studies reinforce the study's conclusion that enhancing students' interest through engaging, culturally relevant approaches like FEGBA can significantly improve their physics skills and overall academic performance.

Conclusions

Based on the study's findings, the researcher concluded that integrating Filipino ethnic games into physics education is an effective intervention for enhancing student engagement and skill development.

The findings confirm that integrating culturally relevant games into physics education fosters engagement by enhancing science learning experiences, strengthening teacher-student interactions, and encouraging exploration beyond the classroom through informal learning experiences. Moreover, it effectively enhanced students' cognitive, problem-solving, and decision-making skills. It implies that the game-based learning approach enhanced their analytical abilities and confidence in making informed decisions, underscoring its potential to develop critical thinking skills.

The findings further confirm that this strategy is inclusive, as both male and female students exhibited comparable levels of interest and skill development in physics. This ensures equitable learning outcomes and highlights the effectiveness of culturally relevant approaches for all learners. Additionally, the strong correlation between student engagement and skill development underscores the importance of interactive and meaningful instructional methods in improving academic performance. Thus, in the light of this study's findings it can be grateful to say that FEGBA positively influenced students' interest and skills in Physics.

Based on the findings of the study, the following recommendations were formulated:

Teachers may integrate Filipino ethnic games into physics lessons as interactive activities to make learning more engaging and relatable.

Educators may design game-based physics activities that challenge students to apply critical thinking and problem-solving skills in real-life scenarios.

Schools may implement inclusive teaching strategies that promote equal participation and learning opportunities for both male and female students.

The Department of Education may consider incorporating culturally relevant instructional methods, such as Filipino ethnic games, into the physics curriculum to enhance student engagement and achievement.

Future studies may explore the long-term impact of game-based and culturally relevant teaching strategies on student performance and engagement in science. Longitudinal research can help determine whether the improvements in interest and skills are sustained over time and how these approaches can be refined for broader application in various educational settings.

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