Revitalizing Science Education: Harnessing the Power of Traditional Filipino Games in the Classroom

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Abstract **– The primary aim of this research endeavour was to assess the efficacy of integrating traditional Filipino games as an instructional tool for enhancing the motivation, enthusiasm, and academic performance of seventh-grade students in the field of science. The study employed a combined approach, encompassing a descriptive analysis and a quasi-experimental one-group pretest-posttest design. A total of 57 students enrolled in the seventh grade of a laboratory high school participated in the study. The outcomes of the investigation indicated a substantial positive impact of traditional Filipino games on students' motivation, interest, and academic achievements in the context of science. The t-test reveals a significant difference in motivation ($t=-3.818$, $p<0.01$), interest ($t=-4.913$, $p<0.01$), and achievement ($t=-8.781$, $p<0.01$) in science before and after the intervention. These findings imply that traditional Filipino games can be effectively leveraged as a pedagogical strategy to enhance students' motivation, interest, and academic performance in the domain of science.**

Keywords **– Science achievement, science interest, science motivation, traditional Filipino games.**

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1. Introduction

In accordance with the 2018 Program for International Student Assessment (PISA) conducted by the Organization for Economic Co-operation and Development (OECD), Filipino students exhibit academic performance below that of 79 other nations in the domains of mathematics, science, and reading [1]. Likewise, findings from the 2019 Trends in International Mathematics and Science Study (TIMSS) by the International Association for the Evaluation of Educational Achievement (IEA) indicate that the Philippines achieved a score of 297 in mathematics and 249 in science, signifying a notable disparity when compared to neighbouring Singapore, which recorded scores of 625 in mathematics and 595 in science [2]. These findings were concerning for educators and the Philippine government because they reflect the country's educational system. Furthermore, while the Philippines is under lockdown, the pandemic has exacerbated the educational system, compelling students to enrol in distance learning programs [3].

Distance education has been practised in the Philippines for more than two years. During these times, one of the most noticeable student behaviours is apathy toward studying [4]. Students and pupils are dissatisfied with the education they receive at home [5]. In addition, the majority of students reported lower physical activity, later bed/wake hours, and slight improvements in mental health and well-being [6]. Moreover, during the lockdown, students use more social media, online gaming, and other online activities, diverting their attention away from studying. Students spend more time on screens, which is associated with poorer learning achievement and emotional well-being [7]. These findings indicate that the lockdown during the pandemic had a detrimental influence on students' attitudes and behaviours in the classroom [8]. Regrettably, the behavior of students during lockdowns had a noticeable impact on their behavior in in-person classes.

This behaviour was also notable in the grade 7 students of Nueva Ecija University of Science and Technology-Gabaldon.

The majority of students today are inclined to the digital world; they are more aware of the trends that are taking place in the digital world than non-digital natives. They are frequent internet users, and the majority of them have full access to a smartphone, a laptop, and broadband internet [9]. As a result, instructors are increasingly utilizing different digital and online learning platforms to improve students' enthusiasm to study. Christel et al. [10], for example, utilized RumbleBlocks to teach engineering concepts of tower stability to children ages 4-7, and the educational efficacy findings were positive. Hwang et al. [11] developed a competitive board game-style web-based problem-solving game. It increased students' experiences, learning attitudes, learning interests, and technological acceptability, as well as their learning successes in the web-based problem-solving exercise, according to their trial results. However, students experience both good and bad consequences from digital and online learning; the problem is that the downsides exceed the positives [12]. A negative effect could be caused by the high cognitive load due to an ineffective learning design [13]. Furthermore, the use of digital technologies had a negative impact on student's physical and mental health. Students who use digital media have physical and mental health symptoms such as difficulties with vision, headaches, not eating, exhaustion, cognitive salience of online events, frustration, and difficulty sleeping [14].

On the other hand, digitalization has an impact not only on the education sector but also on the fundamental aspect of human standards, causing Filipino students to forget their cultures and norms. Filipino traditional games, for example, are an important element of Filipino culture but are gradually diminishing as children increasingly choose to play with their iPads, Xboxes, laptops, computers, and mobile phones rather than play outside with other children [15]. According to Morales [16], to encourage sustainability and the preservation of indigenous knowledge, students must learn according to their cultural background. Moreover, Article XIV, Section 14 of the 1987 Philippine Constitution articulates the State's commitment to nurturing the safeguarding, enhancement, and vibrant progression of Filipino national culture, underpinned by the principle of unity within diversity, while upholding an environment conducive to the unhindered expression of artistic and intellectual endeavours [17].

Cultural games may potentially improve students' understanding and appreciation of science.

According to the findings of Tupas et al. [18], it has been observed that traditional Philippine games inherently incorporate scientific ideas and concepts, thereby offering valuable potential as educational resources within the framework of the Department of Education's K-12 Basic Education Program for teaching and learning science.

Thus, based on the aforementioned literature, the researcher intends to use some Filipino games to improve students' motivation, interest, and achievement in learning science. Furthermore, the investigator constructed the subsequent specific inquiries: (a) How can we characterize the motivation, interest, and academic performance of students in the field of science both before and following the implementation of Filipino games as an intervention?; and (b) Is there a statistically significant distinction in the levels of interest, motivation, and academic achievement among students in science before and after the integration of Filipino games as an intervention?

Hypotheses: It is posited that there exists no statistically significant disparity in the levels of interest, motivation, and academic performance of students in the domain of science before and after the introduction of Filipino games as an intervention.

2. Research Methodology

The research methodology included the study design, sampling procedure, participant distribution, experimental procedure, games used in the study, materials and instruments, instrument validity and reliability, data collection procedure, and data analysis.

2.1. Research Design

Given that the study involved only a single section of grade 7 students, the researcher opted for a one-group pretest-posttest design. This particular design entails the administration of both pretest and posttest assessments; however, it lacks a comparison group for juxtaposing against the experimental group [19]. A non-random group of participants is exposed to an intervention or treatment, and the outcome of interest is measured twice: once before and once after [20].

2.2. Sampling Procedure

The researcher employed purposive sampling in this study due to its focus on a single group of participants. Purposive sampling, also known as judgmental, selective, or subjective sampling, is a methodological approach wherein the researcher exercises discretion in choosing specific individuals from the population to participate in the research [21].

2.3. The Participants

The study comprised 57 grade 7 students hailing from the Laboratory High School of Nueva Ecija University of Science and Technology – Gabaldon Campus. Within this cohort, there were 23 (constituting 40.35%) male students and 34 (representing 59.65%) female students in the grade 7 class.

2.4. Experimental Procedure

The researcher employed a quasi-experimental single-group pre-test-post-test design in this study. To assess students' motivation, interest, and science performance, the researcher administered a pre-survey questionnaire and pre-test at the commencement of the course.

The researcher utilized some traditional Filipino games as an intervention in teaching science. The Filipino games utilized in this study were obtained from Larong-pinoy Weebly [22]. The games were done once a week after the discussion of the topic. The researcher slightly modifies some of the game to insert questions about the topics covered. Depending on the game mechanics, students competed against one another or in groups. Each game event has had a champion, the first runner-up, the second runner-up, and the third runner-up. Each winner is announced in class. The researcher re-administered the questionnaire on motivation and interest in learning science after 6 weeks of intervention. The post-test was also given by the researcher.

2.5. Filipino Traditional Games and Procedures

"Tatsing"

A game that necessitates strategy and a great level of control. It is performed with a "Pamato" and bottle caps. The objective is to collect as many caps as possible. A player can also get rid of opponents by attacking their weak Pamatos.

The researcher will draw a square on the ground and then fill it with bottle caps. There are questions behind the bottle caps; when a player/s hits the caps and reflects them outside the box, they must answer the questions to earn points. The participant achieving the highest score will be designated as the victor for the day.

"Piko" (hopscotch)

Each participant is required to launch their cue ball from a position situated behind the boundary of a designated area.

Prior to commencing the game, the players reach a consensus regarding the initial player's selection, which could be determined by factors such as proximity to celestial objects, physical attributes like wings, or a simple consensus like drawing lots. The player who throws the cue ball closest to the predetermined spot gets to go first. The next closest match comes in second, and so on.

Questions will be placed on each of the boxes. Players will hop on each box, answer the questions correctly, and continue on each box until they finish all the boxes. If they cannot answer the questions, they cannot continue to the other boxes. Scores depend on each correct answer.

"Harang Taga"

Every "It" participant within the group positions themselves along the lines demarcated. The central perpendicular line serves as a point of intersection for the "It" labelled on that line, enabling them to intersect with the lines occupied by the "It" designated on the parallel line. This strategic positioning enhances the probability of the runners getting tagged. If, in the course of the game, a solitary member of the group is tagged, the entire group is then designated as "It."

The class is divided into three groups by the researcher. The researcher developed fifteen questions based on the topic covered. Five pairs of students were stationed at the end of the intersecting lines. The remaining eight students on the other side of intersecting lines will deliver the questions to the ten pairs of students without getting tagged by "It." Each question is worth two points.

"Iring-Iring" (Continue in a circular motion until the handkerchief is released.)

First, an "It" will be determined by providing different questions that will be answered by the players. The first player who answers the questions correctly will be the IT. After the "It" is determined, all players will sit in a circle, facing each other. The "It" will carry a piece of paper with the question and he/she will go around the circle of other players and will drop the paper behind one of the players in the circle. If this player notices that the paper was dropped behind him/her, he/she will try to answer the questions, if the player answers it correctly, he/she will get 5 points and go after the "It" around the circle. Should the player provide an incorrect response to the question, they will remain in their current position.

2.6. Materials and Instrument

The survey assessing motivation and interest in science education was derived from the research conducted by Capinding [23]. These questionnaires were used for college students; hence the researcher revised some of the items to conform to the grade level and subject matter of the students. The responses were categorized as follows: 4 - Strongly Agree, 3 - Agree, 2 - Disagree, 1 - Strongly Disagree. Additionally, the researcher developed both the pre-test and post-test, which centred on grade 7 science topics.

2.7. Validity of the Instruments

The researcher validated the questionnaires using the Lawshe technique, which was originally devised by Lawshe [24] for item validation within a construct. In this process, the researcher engaged the feedback of 12 faculty members to evaluate each item pertaining to motivation and interest. The findings presented in Table 1 demonstrate that the content validity index for each construct falls within the accepted range, affirming the validity of the motivation and interest questionnaire.

Table 1. Content validity index

Construct	Content Validity Index (CVI)	Critical Value of CVI for 12 Raters	Interpretation
Motivation	0.73	0.56	Essential
Interest	0.76	0.56	Essential

2.8. Evaluation of the Reliability of Questionnaires and Test Items

To assess the reliability of the questionnaires and test items, the researcher conducted a pre-test with a sample of 30 high school students who were not included in the main study. The results revealed reliability coefficients of .89, .90, and .87 for motivation, interest, and test questions, respectively.

2.9. Data Collection Procedure

The researcher has formally requested authorization to carry out the study from the principal of the NEUST Laboratory High School and the campus director of Nueva Ecija University of Science and Technology, Gabaldon campus.

The questionnaires were utilized in the initial session to evaluate students' motivation and interest in science education, alongside the administration of pre-test questions.

Subsequently, an equivalent set of questionnaires and test items (post-test) was redeployed after six weeks following the intervention.

2.10. Data Analysis

To characterize students' motivation, interest, and performance in science, the study employed descriptive statistics, specifically the mean and standard deviation. The data's normal distribution is presented in Table 2, thus justifying the utilization of the dependent t-test to evaluate disparities in students' motivation, interest, and performance before and following the incorporation of Filipino games as an intervention.

Table 2. Normality test for all construct

	Shapiro-Wilk		
	Statistic	df	Sig.
Motivation (Before)	.922	57	.132
Motivation (After)	.896	57	.112
Interest (Before)	.947	57	.151
Interest (After)	.912	57	.122
Pre-test	.960	57	.158
Post-test	.970	57	.161

3. Research Results

In this section, a comprehensive overview of the findings, encompassing the presentation of raw data through descriptive statistics such as mean and standard deviation are presented. Additionally, results from inferential statistics are provided to reveal the outcomes of statistical analyses and their significance, while also addressing hypothesis testing. This section aims to offer a clear and concise account of the research outcomes and their alignment with existing literature or prior studies.

3.1. Student Motivation in Science Education Before and After the Introduction of Traditional Filipino Games

Table 3 illustrates the students' attitudes and motivation towards learning science both before and after the introduction of traditional Filipino games.

Before the intervention, students expressed strong agreement that they were committed to putting in extra effort to enhance their understanding of science (mean = 3.32). They also strongly agreed that achieving high scores in science was a primary goal (mean = 3.26).

Furthermore, they held positive views about science, particularly biology, motion, speed, velocity, and acceleration, finding these topics fascinating (mean = 3.18). Their interest in science was piqued by curiosity (mean = 3.02), and they believed that learning science would improve their comprehension of the world (mean = 3.23). Additionally, they recognized the value of science in expanding their knowledge, particularly in physics (mean = 3.11). The intention to allocate more time to studying specific science areas, such as biology, motion, speed, velocity, and acceleration, was also evident (mean = 3.21).

Students expressed confidence in achieving a score of 85 or higher in science (mean = 3.05) and were excited about experiments and research related to biology, motion, speed, velocity, and acceleration (mean = 3.07). Lastly, they believed in their ability to excel in learning about these subjects (mean = 3.05). Overall, students indicated a high level of motivation to learn science, with a mean score of 3.15.

Following the intervention of traditional Filipino games in teaching Science 7, students consistently rated all motivational aspects as strongly agreeing (mean = 3.32). This shift suggests a notable increase in student motivation for this specific unit after the introduction of Filipino games.

Table 3. Student motivation in science learning pre and post-implementation of Filipino games.

Motivation	**Before**		**After**	
	WM	Verbal Interpretation	WM	Verbal Interpretation
Science is a fascinating subject, particularly biology, motion, speed, velocity, and acceleration.	3.18	Agree	3.26	Strongly Agree
I find my curiosity about science to be a source of heightened interest.	3.02	Agree	3.35	Strongly Agree
I aspire to acquire knowledge in science as it contributes to a deeper understanding of the world.	3.23	Agree	3.30	Strongly Agree
Learning about sciences will broaden my physics knowledge.	3.11	Agree	3.31	Strongly Agree
I'm going to work harder to learn more about science.	3.32	Strongly Agree	3.50	Strongly Agree
I intend to devote more time to studying biology, motion, speed, velocity, and acceleration.	3.21	Agree	3.60	Strongly Agree
I believe I can get an 85 or higher in science.	3.05	Agree	3.28	Strongly Agree
My current goal is to achieve a high score in science.	3.26	Strongly Agree	3.65	Strongly Agree
Experiments and research involving biology, motion, speed, velocity, and acceleration excite me greatly.	3.07	Agree	3.35	Strongly Agree
I'll be very proficient in learning about biology, motion, speed, velocity, and acceleration.	3.05	Agree	3.26	Strongly Agree
Total Weighted Mean	3.15	Agree	3.39	Strongly Agree

3.2. Student Interest in Science Learning Pre and Post-Implementation of Filipino Games

Table 4 illustrates that prior to the implementation of traditional Filipino games, students exhibited a strong inclination towards expanding their knowledge in the fields of biology, motion, speed, velocity, and acceleration, as evidenced by a strong agreement (mean = 3.25).

Students also agree that they love to acquire new knowledge in science (3.19), that they like to constantly attend science subjects, specifically biology, motion, speed, velocity, and acceleration (3.14), that they like to do experiments regarding biology, motion, speed, velocity, and acceleration (3.16), that they express a preference for engaging in discussions with both peers and their instructor concerning topics related to biology, motion, speed, velocity, and acceleration (mean = 3.02),that they love solving problems regarding biology, motion, speed, velocity, and acceleration (3.02), that studying biology, motion, speed, velocity, and acceleration is a very interesting topic (3.13), that they intend to continue learning about biology, motion, speed, velocity, and acceleration even after they finished this course (3.09), that they possess an affinity for participating in additional science-related activities (mean = 3.23) and are open to the idea of preparing a report on subjects encompassing biology, motion, speed, velocity, and acceleration, followed by a presentation to the class (mean = 2.89). Overall, students agree that they are interested in learning science (2.89).

On the other hand, after the introduction of traditional Filipino games into science education, students become more interested in learning them, as evidenced by an increase in their level of agreement on the items of interest. All of the items relevant to the interest in learning science increase in a certain unit. The students are unanimous in their interest in learning about science (3.32).

Table 4. Student Interest in Science Learning Pre and Post-Implementation of Filipino Games

Interest	**Before**		**After**	
	WM	Verbal Interpretation	WM	Verbal Interpretation
I am interested to learn more about biology, motion, speed, velocity, and acceleration.	3.25	Strongly Agree	3.40	strongly agree
I love to acquire new knowledge in science.	3.19	Agree	3.35	strongly agree
I like to constantly attend science subjects, specifically biology, motion, speed, velocity, and acceleration.	3.14	Agree	3.27	strongly agree
I like to do experiments regarding biology, motion, speed, velocity, and acceleration.	3.16	Agree	3.28	strongly agree
I like to talk to my classmates and my professor regarding biology, motion, speed, velocity, and acceleration.	3.02	Agree	3.30	strongly agree
I love solving problems regarding biology, motion, speed, velocity, and acceleration.	3.02	Agree	3.32	strongly agree
Studying biology, motion, speed, velocity, and acceleration is a very interesting topic.	3.13	Agree	3.26	strongly agree
I intend to continue learning about biology, motion, speed, velocity, and acceleration even after I finish this course.	3.09	Agree	3.27	strongly agree
I love to do more activities in science.	3.23	Agree	3.33	strongly agree
I am willing to make a report about biology, motion, speed, velocity, and acceleration and present it to the class.	2.89	Agree	3.42	strongly agree
Total Weighted Mean	3.11	Agree	3.32	strongly agree

3.3. Students' Achievements in Science 7 Before and After the Intervention of Traditional Filipino Games

Table 5 provides an overview of the student's performance on the pre-test and post-test. Prior to the intervention, the student's scores ranged from a minimum of 10 to a maximum of 32, with an average score of 21.29 and a standard deviation of 5.74. In contrast, after the intervention, the post-test scores exhibited a minimum of 14 and a maximum of 47, with a mean score of 29.49 and a standard deviation of 8.22. The data illustrates a consistent increase in all descriptive parameters. Specifically, the minimum and maximum scores witnessed increments of 4 and 15 points, respectively. Similarly, the mean and standard deviation increased by 8.2 and 2.48 units, respectively. This indicates a discernible difference in scores between the pre-test and post-test results.

Table 5. Findings from Pre-assessment and Post-assessment.

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	57	10.00	32.00	21.29	5.74
Posttest	57	14.00	47.00	29.49	8.22
Difference		4.00	15.00	8.20	2.48

3.4. Comparison of Students' Motivation, Interest and Achievement in Science 7 Before and After the Intervention of Traditional Filipino Games

Table 6 presents the results of the t-test conducted to assess changes in students' motivation, interest, and science performance before and after the incorporation of traditional Filipino games as an intervention. A significant difference is observed in student motivation for learning science ($t=-3.818$, $df=56$, $p<0.01$), with a substantial effect size (Cohen's $d=.80$). Similarly, a significant difference is evident in their interest in learning science ($t=-4.913$, $df=56$, $p<0.01$), accompanied by noteworthy effect size (Cohen's $d=.79$). Moreover, there is a significant difference in science performance ($t=-8.781$, $df=56$, $p<0.01$), with a considerable effect size (Cohen's $d=1.15$), when comparing the results before and after the integration of traditional Filipino games.

Table 6. Paired Sample t-test.

	Mean	t	df	Sig. (2-tailed)	Cohen's d	Effect Size
Motivation (Before)	3.15	-3.818	56	.000	0.8	Large
Motivation (After)	3.39					
Interest (Before)	3.11	-4.913	56	.000	0.79	Large
Interest (After)	3.32					
Pre-test	21.29	-8.781	56	.000	1.15	Large
Post-test	29.49					

4. Discussion

The data shows that before the intervention of traditional Filipino games, the students were already motivated to learn science, particularly biology and physics. After the intervention of Filipino games, students become more motivated to learn science, as is seen in the increase of their agreement on the items about motivation. Students get more fascinated by science-related topics and are inspired to conduct scientific experiments and studies. They also agreed that they would devote more time to studying science and perform better. Based on initial observations, it appears that students exhibit a heightened motivation to participate in science education following the incorporation of Filipino games as an intervention.

Additionally, traditional games have been found to yield advantages in terms of children's physical and psychological well-being, encompassing cognitive, emotional, and social aspects [25]. Trajkovik et al. [26], on the other hand, find that there is only a slight improvement in student motivation during traditional gameplay.

According to the findings, before the inclusion of traditional Filipino games, students seemed to be interested in learning science. Following the introduction of traditional Filipino games, students demonstrate increased engagement in their science education. They are more eager to attend, conduct experiments, and discuss science-related issues. Furthermore, their passion and love for science grow in a particular unit.

Data suggest that incorporating traditional Filipino games boosts students' interest in learning science. Similarly, Tupas et al. [27] showed that including traditional games boosts students' interest in learning science.

The data indicates a noticeable improvement in student performance, as reflected by the shift or increase in mean scores from the pre-test to the post-test following the introduction of Filipino games as an intervention. This suggests that students learn and gain knowledge in science while playing Filipino games during meetings. In contrast, the standard deviation of the post-test score exceeds that of the pre-test, indicating that the post-test outcomes exhibit a higher degree of dispersion or deviation from the mean when compared to the pre-test results. This suggests that the incorporation of Filipino games into the teaching and learning process may not have been suitable for every student. On the other hand, an increase in the science performance of the students is evident. The same finding was observed by Del Carmen et al. [28] that traditional Filipino games can enhance and improve students' thinking and knowledge in physics subjects.

The data suggests a significant disparity in student motivation both before and after the implementation of traditional Filipino games, suggesting that the intervention had a substantial positive impact on enhancing students' motivation towards science learning. Students become more fascinated and willing to participate in science activities and experiments. They became more interested in achieving outstanding results in science. Moro and Billote [29] discovered the same findings: incorporating Ivatan indigenous games into physics learning modules boosts students' enthusiasm to learn the subject.

The data also indicates a notable disparity in students' interest in learning science before and after the introduction of traditional Filipino games. This signifies a significant enhancement in student interest towards science education. They become more engaged in acquiring new knowledge and conducting scientific experiments in science subjects. They get more interested in attending science classes and participating in scientific discussions. Similarly, Capinding [30] found that students had a greater interest in participating in mathematics activities when he included certain traditional Filipino games in the Teams-Games-Tournament strategy.

Furthermore, data suggests that when traditional Filipino games are used to teach science, students' achievement in science improves dramatically. It means that traditional Filipino games are useful in increasing students' science achievement. Avila [31] asserts that incorporating "Laro ng Lahi" or traditional games can help students develop knowledge and abilities for a certain course lesson.

Additionally, the substantial effect size suggests that the relationship between the pre-test and post-test results is notably stronger [32]. The significant effect size also shows that traditional Filipino games have a large impact on students' motivation, interest, and achievement. Practical significance demonstrates that the effect is large enough to have real-world implications [33].

5. Conclusion

In light of the study's findings, it becomes evident that the incorporation of traditional Filipino games into science education offers a promising avenue for enhancing students' motivation, interest, and performance in the subject. These results underscore the potential of culturally rooted pedagogical interventions to not only enrich learning experiences but also contribute significantly to academic outcomes in science education. Before the integration of traditional Filipino games into science education, students had already shown motivation and enthusiasm for learning science. However, following the introduction of traditional Filipino games, students exhibited a notable increase in motivation and interest in science, as indicated by a significant rise in agreement with motivation and interest-related items. Statistical analysis using the t-test confirmed the statistical significance of this improvement, underscoring the substantial potential of incorporating Filipino games into the educational process to greatly enhance student enthusiasm and engagement. Additionally, descriptive data illustrated an enhancement in students' science performance, with the t-test aligning with these findings, thus demonstrating the effective impact of traditional Filipino games on improving students' science achievement.

6. Recommendations

Utilizing traditional Filipino games in the educational process serves a dual purpose: it not only fosters an appreciation for Filipino culture but also enhances students' motivation, interest, and academic accomplishments. Curriculum developers may incorporate traditional Filipino games into the creation of curriculum guidelines and/or syllabi. Researchers who want to employ Filipino games in their action research may perform it every day or twice a week.

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