Journal Of Teaching And Learning In Elementary Education
ISSN: 2622-3023
e-ISSN: 2622-3023

Journal Of Teaching And Learning In Elementary Education

Journal Title	**Journal Of Teaching And Learning In Elementary Education**
ISSN	2622-3023 **(online)**| 2622-3023 **(print)**
DOI Prefix	**Prefix 10.29408**
Editor in Chief	**Neni Hermita**
Publisher	**Department of Elementary Education, Universitas Riau**
Frequency	**2 issues in a year (February and August)**
Citation Analysis	**|GS|Garuda|Crossref|Base|Dimensions|CF|**



Journal of Teaching and Learning in Elementary Education (JTLEE) is a scientific journal published by the Department of Elementary Education, Universitas Riau. JTLEE publishes twice a year, February and August, and disseminates research and scientific studies in elementary education conducted by researchers, teacher educators, and teachers in order to improve teaching and learning quality in elementary education. JTLEE has been accredited by Science and Technology Index (SINTA), The Ministry of Research and Technology/National Agency for Research and Innovation (SINTA-RISTEKBRIN) since 2018.

Announcement

Begining in volume 6 edition 1, 2023, authors should use a new journal template that can be download here (New Template)

Vol 6, No 1 (2023)

Table of Contents

Articles

The effect of vide learning media on fourth-grade students' mathematical learning achievement on fractions PDF 1-7
10.33578/jtlee.v6i1.7943
Afifa Yusriza, Kowiyah Kowiyah

The effect of comic strip media on third-grade students' writing story essay PDF 8-18
10.33578/jtlee.v6i1.7949
Rohmadhani Herlandita, Ermawati Zulikhatin Nuroh

The effect of example and non-example learning model on fourth-grade students' critical thinking skills on civic education PDF 19-26
10.33578/jtlee.v6i1.7951
Amelia Lutfian Nurunissa, Kusmajid Abdullah

Implementation of the PREMIER model based on river area to improve fourth-grade students' mathematical problem-solving ability PDF 27-38
10.33578/jtlee.v6i1.7955
Yogi Prihandoko, Herti Prastitasari, Taufik Kurahmah, Muhammad Fendrik, Tia Nur Istianah

The influence of active knowledge sharing strategies on fifth-grade students' social studies learning outcomes PDF 39-45
10.33578/jtlee.v6i1.7952
Rifani Amanda, Kusmajid Abdullah

The effect of problem based learning (PBL) model on fourth-grade students' learning outcomes of data presentation PDF 46-56
10.33578/jtlee.v6i1.7961
Dwi Kartika Sari, Yarisda Ningsih

The influence of think pair share (TPS) learning model on fifth-grade students' learning outcomes of civic education PDF 57-63

10.33578/jtlee.v6i1.7954
Mifta Hidayanti, Kusmajid Abdullah

Development of animated videos in social science learning for fourth-grade elementary schools PDF 64-79
10.33578/jtlee.v6i1.7968
Faber Faber, Erlisnawati Erlisnawati, Syahrilfuddin Syahrilfuddin, Hendri Marhadi, Eddy Noviana

Improving fifth-graders' learning outcomes of cube and cuboid nets using number head together cooperative learning PDF 80-89
10.33578/jtlee.v6i1.7971
Vini Winda Puspita, Yarisda Ningsih

The influence of blended learning model assisted by YouTube application during the Covid-19 pandemic on fifth graders' thematic learning outcomes PDF 90-95
10.33578/jtlee.v6i1.7981
Kharisma Nur Fitriyana, Khavisa Pranata

Enhancing numeracy instruction through games in pre-primary classrooms PDF 96-110
10.33578/jtlee.v6i1.7984
Olabisi Adedigba

RECOMENDATION TOOLS

KEYWORDS

Covid-19 Indonesia blended learning character education civic education critical thinking development education elementary school fractions learning activities learning model learning motivation learning outcomes online learning primary school problem solving project-based learning research and development teaching materials thematic learning

VISITORS



Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Enhancing numeracy instruction through games in pre-primary classrooms

Olabisi Adedigba
Department of Adult and Primary Education
University of Ilorin, Ilorin, Nigeria

Article Info

Article history:

Received: January 11th, 2023
Revised: February 08th, 2023
Accepted: February 17th, 2023

Keywords:

Arithmetic
Games
Interest in numeracy
Math
Numeracy instruction
Pre-primary

ABSTRACT

The enormous importance of numeracy skill to pre-primary school children has tasked teachers with the burden of imparting the skill in an effective manner. Despite the fact that literature has documented the effectiveness of games approach in children instruction, to some, use of game is disruptive to actual learning. This necessitates more experimental studies to further clear ambiguities about the use of games in pre-primary classrooms. This study examined the impact of games on pre-primary children's interest and performance in numeracy. A pretest-posttest, control group, quasi-experimental was adopted. Fifty Nursery Two pupils were randomly assigned to treatment and control groups. The instruments used were Pre-primary Children's Numeracy Achievement Test (r=0.86) and Pupils' Interest in Numeracy Scale (r=0.81). The data collected were analyzed using Analysis of Covariance (ANCOVA) and Scheffe's Post Hoc Pairwise Comparison. Results indicated that games method was effective on pre-primary children's learning of numeracy ($F_{(1, 42)} = 373.502$; $P < 0.05$) and also increased their interest in numeracy instruction ($F_{(1, 42)} = 9.773$; $P < 0.05$). Based on these findings, recommendations were made that teachers, parents and curriculum developers should encourage the use of games method to improve numeracy instruction in pre-primary education.

This is an open access article under the CC BY-SA license.

Corresponding Author:

Department of Adult and Primary Education
University of Ilorin, Ilorin, Nigeria
Email: adedigba.o@unilorin.edu.ng

INTRODUCTION

The importance of numeracy in pre-primary education and a nation's life is reflected in their efforts to include mathematical principles into their policies. The early years should be used to lay the foundation for studying mathematics, according to educational policies in different countries. For instance, "teaching the rudiments of numbers, letters, colours, shape and form" is

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

one of the declared objectives for pre-primary education and inculcating permanent numeracy for primary education in the Nigerian National Policy on Education (Federal Republic of Nigeria, 2013). Additionally, a goal of the British National Curriculum for the early years' foundation stage is to promote the development of numbers and symbols, methods of counting, arithmetic, shape, space, and measurements (The National Curriculum in England, 2013).

Literature has made it abundantly evident that numeracy abilities are crucial for supporting a child's daily experiences (Jenni, 2012). Everyone needs numbers to get through in daily life, according to Mehta (2020). Also, understanding interest rates and calculating the worth of money are made easier by numeracy. As well, numerous factors, including job rates, moral behaviour, and degree completion, have been connected to strong numeracy abilities. Schleicher (2013), for instance, contended that strong numeracy skills are the best defence against underemployment, low pay, and ill health. Numerous social, emotional, and behavioural issues in children have been linked in some studies to underdeveloped numeracy abilities. French (2012) proposed a relationship between reading and numeracy issues and truancy, marginalization, and social repercussions including alcohol and drug usage. The majority of children and adults in detention have a numeracy level that is significantly lower than that of their peers, according to James (2013), who made the connection between poor numeracy abilities and the crime rate. Later in secondary school, math skills help learners avoid expulsion and other anti-social actions. In actual fact, poor numeracy abilities, according to Mehta (2020), have an impact on individuals as well as the nation's ability to produce and address inequity.

According to research, there are many reasons why learners perform poorly in mathematics, including difficulty in understanding the material, a lack of adequate teaching resources, a student's poor attitude (such as phobia or hatred of the subject), the language of instruction, and particularly weak foundations established at the elementary level (Onasanya, 2008; Etukudo, 2007; Olayinka, 2006). More importantly, the high percentage of math failure was linked, in large part, to the teaching methods used by teachers (Katmada, 2014; Anaduaka, 2011; Euler, 2011; Ebisino, 2010; Onwuka et al., 2010; Kurumah and Imoko, 2008; Eze, 2007). So many times, the methods used to teach mathematics do not maintain the growth of the learner's interest. Taranto (2022) also noted that many teachers still don't design activities that can help children explore mathematical ideas. These studies confirmed that math ideas and concepts are delivered to learners in an overly theoretical and abstract way which doesn't give children enough chances to engage in practical tasks, problem-solving, and experimenting. This approach, according to Euler (2011), is out of date and disconnected from children's interests and experiences.

Studies have confirmed that, a learner's curiosity and math proficiency go hand in hand (Digitale, 2018; Dowker et al., 2019). Without an interest in arithmetic, Udegbe (2009) said, there can be no true math education. Since children learn the foundational principles of numbers and numeracy in their early years, it is important to develop and correctly harness their interest and attitude in numeracy from an early age in order to promote high arithmetic performance in children's following learning (Ekine, 2010). A high interest in numeracy can have a good impact on children's math skills, according to the literature. Digitale (2018) submitted that children who exhibited more interest in math had better math scores and thought they were better at it. The author stated further that a positive attitude toward math strengthens the memory centre of the brain and predicts math performance independently of variables like a child's IQ. Also, concluded that the unique contribution of a positive attitude to math achievement is equal to or greater than the contribution of IQ.

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Many scholars have argued that using games to teach pre-primary children new abilities is the most effective strategy given the range of learners seen in pre-primary classrooms. The literature supports the idea that playing games increases interaction, which fosters higher learning and enables children to think at various levels while also learning from one another. Games were viewed as interesting, inspiring, and academically beneficial by Kankia (2008). Nzaka (2012) also submitted that games offer a singular chance for integrating the cognitive, emotive, and social facets of learning.

Despite the fact that using games to teach children math skills is becoming more and more common, parents, educators, and teachers are still concerned about how games affect learners. They question if playing games is genuinely helping children learn or just keeping them from acquiring the essential abilities. Coffey (2008) raised one such worry, saying that games might be more distracting than a traditional learning tool and that the aims of the games do not always correspond with the goals of the classroom. There is a perception that learners are merely playing games instead of learning anything. Researchers are still concerned about and may argue over the use of games in teaching and learning. As a result of the literature's inconsistency, more empirical studies must be done to further clarify all the ambiguities surrounding the use of games in Pre-primary classrooms, notably their impact on the interest and performance of children in numeracy skills. Therefore, this study investigated the effects of the game strategy on pre-primary children's numeracy abilities and interest, in Ilorin South Local Government Area, Kwara State.

Researchers have also expressed worry about how gender affects the acquisition of numeracy, but the report has not been consistent in this regard. Conflicting opinions exist on the use of games as a teaching tool (Bragg, 2007). They have long sought to understand if gender variations affect children's interest and success in numeracy. For instance, some researchers claimed that boys are more capable in math and are more confident than girls (Skaalvik and Skaalvik, 2004; Herbert and Stipek, 2005; Etukudo, 2007; Eniayeju, 2010; Kyttala and Bjorn, 2010; Upadyaya and Eccles, 2015; Ganley and Lubienski, 2016; Markovits and Forgasz, 2017; Contrarily, Colleen and Sarah (2016) submitted that scores on many assessments are comparable for boys and girls in both elementary and secondary school. However, they added, boys are more likely to pursue careers in particular branches of mathematics, like engineering. Therefore, gender was investigated in this study along with the independent and dependent factors.

The purpose of this study was to find out the effect of games on pre-primary school children' performance and interest in numeracy. Also, to measure the significant main effect of gender on pre-primary children' numeracy skills and interest in numeracy. The study will likewise measure the interaction effect of treatment and gender on pre-primary children's numeracy skills and interest in numeracy.

LITERATURE REVIEW/ THEORETICAL FRAMEWORK

Importance of numeracy

In the literature, the importance of numeracy abilities in the life of a child has been extensively discussed. Learning the fundamentals of mathematics will facilitate the development of permanent numeracy at the elementary school level and afterwards enhance performance at higher educational levels (Nurudeen, 2007; Kankia, 2008). A child who has strong numeracy skills will be able to use math principles in real-world situations. Understanding numbers, counting, working out mathematical problems, measuring, sorting, spotting patterns, adding and subtracting

Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

numbers, and other operations are all part of it (Greg, 2012). Numeracy abilities lay the groundwork for future mathematical understanding, which will result in aptitude for scientific and technological growth. Basic numeracy and mathematics principles used in a Pre-primary or elementary classroom lay the groundwork for learning more complex mathematical concepts, as correctly stated by Ramani and Siegler (2008; French, 2012). This was supported by Aunio and Niemivirta (2010), who reported a longitudinal study on early numeracy and found that a child's grasp of numbers and numeric relationships can influence when they learn to add and subtract later on and become mathematically proficient.

Klynveld Main GoerdelerPeat: KPMG (2009) estimated the cost of numeracy and found that the lifetime cost for an annual cohort of 35,843 children with very poor numeracy could be as high as £2,389 million, as opposed to a cost of £89 million for additional support to improve these children's numeracy skills through the 'Every Child Counts programme'. According to the Leitch Review (2006), a nation will invariably endure slower economic growth without better numeracy abilities and will be unable to compete with the rest of the world. Numeracy is the cornerstone of increased social mobility. It creates the foundation for a more robust and inclusive economy. Pre-primary math instruction has a big influence on later learning; therefore, it needs to get the attention it deserves. If a solid foundation is set for acquiring numeracy, the persisting issue of underachievement in elementary, secondary and postsecondary would likely be evaded.

Games and numeracy

According to Stathakis (2014), playing games can help learners learn new concepts or ideas, adopt an alternative viewpoint, or explore with various possibilities or variables. As Rebekah (2013) noted, games draw learners' attention, actively engage them and motivate them to participate fully in the class. Young children's interest is sustained, their tension is released, their boredom is eliminated, and an atmosphere of enjoyable, fascinating, and exciting teaching and learning is fostered when instruction is delivered through games. Through playing games, children can pick up a variety of vital abilities like critical thinking, creativity, language, teamwork, and good sportsmanship (Rebekah, 2013).

The effectiveness of various game types in teaching numeracy and mathematics is supported by empirical data. Aunio and Mononen (2017) investigated the effects of educational video games on the early numeracy abilities of underachieving children. It was a pre-primary-based intervention trial. The study found no difference between groups; however, the intervention group did perform better in numeracy from the pretest to the posttest. The use of kinesthetic games to enhance early mathematics abilities was also studied by Utoyo (2018). The findings demonstrated that kinesthetic game activities can considerably boost young children's math skills, and that the lesson was well-received by the learners since it suited their learning preferences. Additionally, Andika, et al. (2019) studied how playing board games with a mathematical self-concept could promote young children's development of early numeracy skills. The outcome showed that playing the board game greatly improved the early numeracy abilities of 5- and 6-year-old children as well as the learners' mathematical self-concept. This was further supported by a study on the impact of games on young children's mathematical ability by Ompok and Teng (2021). They compared the mathematical aptitude of children before and after intervention, using one sample t-test. In the pretest, the scores for mathematical aptitude varied significantly. The findings demonstrated that using games created by writers significantly enhanced pre-primary children proficiency in early mathematics.

In contrast, Din and Caleo (2000) and Lim, Nonis, and Herdberg (2006) came to the conclusion that there is a detrimental influence of games on academic achievement in their studies on

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

mathematical achievement using game strategy. This is further supported by Alanazi (2020), who examined how math anxiety and performance in primary school children were affected by active recreational math games and found a substantial negative association between the variables

Theoretical framework

Constructivist learning theory served as the foundation for this study. According to the theorists, children build knowledge and meaning from their environment and experiences. Piaget, Vygotsky, Ausubel, Bruner, and Dienes were among the theorists who held the view that children actively develop their own knowledge and skills. Child-centred constructivist theory, which is based on active learning processes, promotes problem-solving and group learning (Vygotsky, 1962; Strandberg, 2007). Playing games is one of the constructivists' learning theory-based techniques that has significant ramifications for early education. If multisensory learning is learner-centred and promotes collaborative and problem-solving learning, playing games boosts learning motivation (Fletcher and Tobias, 2006; Simpson, Hoyles, and Noss, 2006; Euler, 2011; Akinsola and Fredrick-Jonah, 2014).

Theorists believed that early math instruction should be grounded in practical experiences; as a result, learning should be experiential, involving "hands-on" exercises or the handling of actual objects. The method of problem solving used by constructivists encourages learners to work through difficulties through trial and error, which is similar to what children do when they play games. The child begins by exploring the game, makes some glaring errors, and keeps trying until he or she succeeds. Later, the child develops tactics for avoiding these errors in the future. Because of this, when the child plays the game, he or she is able to construct, reinterpret, and make meaning of the knowledge in the game process, adding new knowledge on top of old. Constructivism also has a feature called collaborative learning, which is a crucial aspect of the advantages the game technique offers. Games aid young people's learning in social contexts and this is related to Vygotsky's theory of social construction.

Based on the literature reviewed, the following null hypotheses were tested at 0.05 level of significance.

Ho1: There is no significant main effect of treatment on Pre-primary children
- a. numeracy skills and
- b. interest in numeracy.

Ho2: There is no significant main effect of gender on Pre-primary children
- a. numeracy skills
- b. interest in numeracy.

Ho3: There is no significant interaction effect of treatment and gender on Pre-primary children
- a. numeracy skills
- b. interest in numeracy.

METHOD

This research adopted pretest-posttest, control group, quasi-experimental design.
The factorial matrix was represented as below:

O_1	X_1	O_2 Experimental Group
O_3	X_2	O_4 Control Group

Where
O_1O_2- Pretest scores of experiment

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

O_3O_4- Posttest scores of experiment
X_1 Experimental Group 1- Game
X_2 Experimental Group 2- Control Group

All pre-primary school children in Ilorin South Local Government Area, Kwara State, made up the study's population. The two schools that took part in the study were chosen using a simple random sampling method. The sampled schools were randomly assigned to experimental group and the control group. The intact classes of Nursery 2 of the selected schools were chosen. The total number of fifty children participated in the study. Nursery 2 was sampled in the study because this is where the basis of numeracy is established.

The instruments used to gather data were the Pre-Primary Children Numeracy Test (PCNT) and the Pre-Primary Children Interest in Numeracy Checklist (PCINC). The study also created guides for both games and conventional methods, which it used. PCNT was used to measure pre-primary children's aptitude in math on the following topics: identifying shapes and colours, simple addition, subtraction, and multiplication. Sections A and B were used to categorize PCNT. The pre-primary children's demographic information was presented in Part A, and the eight exercises in Section B included addition and subtraction, shapes and colours, and multiplication. The activities chosen were based on the curriculum for Nursery 2 and the schedule of work for the weeks of the research as laid out in the schedule of work for the instructors. Pre-primary children's interest in maths was assessed using the second data collection tool, PCINC. The instrument's 12 items were created to measure the children' s level of interest in numeracy.

Drafts of each instrument were sent to four instructors in the Department of Early Childhood and Primary Education at two universities in Kwara State so that they could assess its applicability. The instruments were validated for face and content validity. The modifications and recommendations helped to improve the instruments. The internal consistency was measured using the split-half method in order to determine the reliability of the data gathering instruments. The Pre-primary Children Numeracy Test (PCNT) and the Pre-primary Children Interest in Numeracy Checklist were administered to twenty pre-primary children who were not a participant in the research (PCINC). The confirmed coefficients were 0.86 and 0.82, respectively, using Pearson Product Moment Correlation.

Across the course of eight weeks, the study was conducted. One week was allotted to visits, familiarization, and securing permission from the participating schools, parents, and children. Over the course of another one week, the classroom teachers who would serve as research assistants were trained. During the same week, the pretest was administered to both groups. Five weeks was spent on the treatment. For the time of the intervention, children in the experimental group played games to receive instruction in numeracy while those in the control group got instruction using conventional methods. Posttesting was carried out on the 8th week.

To test the hypotheses and identify differences between the groups, the data were examined using inferential statistics from the Analysis of Covariance (ANCOVA). In order to pinpoint the cause of a significant difference, post hoc analysis was performed using the Scheffe multiple range test. At the significance threshold of 0.05, every hypothesis was tested.

All guidelines governing the conduct of educational research were strictly followed by the researcher. The researcher obtained a letter from her department approving the study. The researcher visited the two schools used for the experimental and control groups to request approval from the school administration and the participants' parents. The heads, teachers, and learners were informed of the study's objective. It was hoped that everyone would participate voluntarily. The

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

respondents were given the assurance that any information obtained through the research would be handled in the strictest of confidentiality and utilized only for that purpose.

RESULTS

Ho1: (a). There is no significant main effect of treatment on pupils' numeracy skill.

Table 1: Summary of Analysis of Covariance (ANCOVA) of the main effect of treatment on Pre-primary children numeracy skills.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	30016.078[a]	2	15008.039	213.358	.000
Intercept	19180.237	1	19180.237	272.671	.000
Numeracy Pretest	118.300	1	118.300	1.682	.202
Treatment	26272.911	1*	26272.911	373.502*	.000*
Error	2954.367	42	70.342		
Total	168546.000	45			
Corrected Total	32970.444	44			

Table 1 displayed the effect of treatment on the numeracy abilities of pre-primary school children. The main impact of treatment on pre-primary children's numeracy abilities was significant ($F_{(1, 42)} = 373.502$; $P < 0.05$). Given the outcome and the fact that the significant value is less than 0.05, the hypothesis is therefore rejected. This suggests that there was a substantial difference between pupils who were taught using game strategy and conventional methods in terms of post-test numeracy achievement. Table 2 outlined the sources of the disparity in pre-primary students' post-test math performance.

Table 2: Summary of Scheffe's Post Hoc pairwise Comparison of the numeracy scores between the two Groups

Treatment	Mean Score	Experimental Group	Control Group
Games strategy	78.534		*
Conventional method	27.866	*	

Table 2 showed that the major reason for the treatment's significant impact on pre-primary children's numeracy as shown in Table 1 is due to the significant difference between game strategy and conventional method. This suggests that those exposed to game strategy (Mean = 78.534) outperformed those exposed to the conventional method (Mean = 27.866) by a considerable margin.

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Ho1: (b). There is no significant main effect of treatment on Pre-primary children interest in numeracy

Table 3: Summary of Analysis of Covariance (ANCOVA) of the main effect of treatment on Pre-primary children interest in numeracy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	21.362[a]	2	10.681	5.509	.008
Intercept	147.991	1	147.991	76.324	.000
Pre-interest	.187	1	.187	.097	.757
Treatment	18.950	1	18.950	9.773	.003
Error	81.438	42	1.939		
Total	19447.000	45			
Corrected Total	102.800	44			

Table 3 showed the effect of treatment on pre-primary children's interest in math. The main impact of treatment on pre-primary school children's interest in numeracy was significant ($F_{(1, 42)} = 9.773$; $P < 0.05$). Given the outcome and the fact that the significant value is less than 0.05, the hypothesis is therefore rejected. This suggests that there was a sizable difference in the interest of pupils who were taught using game strategy versus conventional methods. The sources of the difference in pre-primary children's interest in numeracy following treatment are shown in Table 4.

Table 4: Summary of Scheffe's Post Hoc Pairwise Comparison of the Pre-primary children interest in the two Groups

Treatment	Mean Score	Experimental Group	Control Group
Games strategy	21.386		*
Conventional method	19.988	*	

Table 4 showed that the main effect of treatment on pre-primary children's interest in numeracy is due to the significant difference between game strategies and conventional method. This suggests that when compared to those exposed to conventional methods (Mean = 19.988), those exposed to game strategy (Mean = 21.386) substantially demonstrated a greater positive interest in numeracy.

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Ho2: (a). There is no significant main effect of gender on Pre-primary children numeracy skills.
Table 5: Summary of Analysis of Covariance (ANCOVA) of the main effect of gender on Pre-primary children numeracy skills.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3.968[a]	1	3.968	.005	.943
Intercept	134875.435	1	134875.435	175.925	.000
Gender	3.968	1	3.968	.005	.943
Error	32966.476	43	766.662		
Total	168546.000	45			
Corrected Total	32970.444	44			

Table 5 revealed the impact of gender on pre-primary school children numeracy skills. The main impact of gender on pre-primary children's numeracy skills was not statistically significant ($F_{(1,43)} = .005$; $P > 0.05$). As a result, given that the significant value is higher than 0.05, the hypothesis is not rejected in light of the outcome. This implies that gender had no significant main effect on pre-primary children's numeracy skill.

Ho2: (b). There is no significant main effect of gender on pre-primary school children interest in numeracy.

Table 6: Summary of Analysis of Covariance (ANCOVA) of the main effect of gender on pupils' interest in numeracy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.175[a]	1	.175	.073	.788
Intercept	19250.486	1	19250.486	8065.977	.000
Gender	.175	1	.175	.073	.788
Error	102.625	43	2.387		
Total	19447.000	45			
Corrected Total	102.800	44			

The impact of gender on pre-primary children's interest in numeracy was shown in Table 6. Gender did not significantly influence children's interest in numeracy ($F_{(1,43)} = .073$; $P > 0.05$). As a result, given that the significant value is higher than 0.05, the hypothesis is not rejected in light of the outcome. This suggests that interest in numeracy among pre-primary children was not significantly influenced by gender.

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Ho3: (a). There is no significant interaction effect of treatment and gender on pre-primary school children numeracy skills.

Table 7: Summary of Analysis of Covariance (ANCOVA) of the interaction effect of treatment and gender on pre-primary school children numeracy skills.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	30026.002[a]	4	7506.501	101.975	.000
Intercept	18820.370	1	18820.370	255.673	.000
Pretest	125.518	1	125.518	1.705	.199
Gender * Treatment	7.444	1	7.444	.101	.752
Error	2944.442	40	73.611		
Total	168546.000	45			
Corrected Total	32970.444	44			

The interaction between treatment and gender on the numeracy skills of pre-primary school children was shown in Table 7. In terms of children's numeracy skills, there was no significant interaction between treatment and gender ($F_{(1, 40)} = .101$; $P > 0.05$). As a result, given that the significant value is higher than 0.05, the hypothesis is not rejected in light of the outcome. This suggests that there was no discernible interaction between treatment and gender that would have affected the children's numeracy ability.

Ho3: (b). There is no significant interaction effect of treatment and gender on Pre-primary children interest innumeracy.

Table 8: Summary of Analysis of Covariance (ANCOVA) of the interaction effect of treatment and gender on pupils' interest in numeracy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	26.006[a]	4	6.501	3.386	.018
Intercept	3222.596	1	3222.596	1678.556	.000
Pre-interest	.389	1	.389	.202	.655
Gender * Treatment	4.604	1	4.604	2.398	.129
Error	76.794	40	1.920		
Total	19447.000	45			
Corrected Total	102.800	44			

The interaction between treatment and gender on pre-primary children's interest in numeracy was shown in Table 8. In terms of pre-primary children's interest in numeracy, there was no significant interaction between treatment and gender ($F_{(1, 40)} = 2.398$; $P > 0.05$). As a result, given that the significant value is higher than 0.05, the hypothesis is not rejected in light of the outcome. This suggests that there was no apparent relationship between treatment and gender that would have affected pre-primary school children's interest in interest.

Journal Of Teaching And Learning In Elementary Education
Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

DISCUSSION

The finding of the study showed that games have a positive effect on pre-primary school children's numeracy abilities. This is consistent with the findings of Moreno (2002) and Ke and Grabowski (2007) who found that games have a positive impact on mathematics achievement using an experimental method. The finding also concurred with a review of 32 empirical studies reported by Vogel et al. (2006) who found that interactive simulations and games improved learners' cognitive development more than conventional classroom education. On the other side, the result is not consonance with Din and Caleo (2000) who found no improvement in their study of mathematics achievement using game strategy. This concurs with Lim, Nonis, and Hedberg's (2006) report that video games have a detrimental effect on academic attainment. Using a quantitative experimental methodology, Moore and Todree (2003) found conflicting results about the impact of games on Pre-primary pupils' achievement. Additionally, several researches claimed that games had no discernible impact on children' performance. Lieury (2012), for instance, divided 88 learners into four groups, three of which received treatment utilizing distinct game designs. The results showed that there is no discernible impact of games on cognitive learning. Hays (2005) similarly found no evidence that suggested instructional games were a preferred technique of instruction in all circumstances based on a study of 48 empirical studies. Similar to this, Mitchell and Savill-Smith (2004) discovered that instructional games affected learners' academic performance in both positive and bad ways. The inconsistent and disparate results of the studies could be a result of incorrect methodology, inadequate data processing, or an inappropriate research environment.

The study's results also revealed a substantial difference between learners' interests when taught via game strategies and conventional techniques; learners who played games exhibited greater interest in numeracy. This finding is in agreement with the study of Ghent University (2003) which separated 88 learners into three groups and employed 'monkey talos'. The result showed that, those exposed to the game have better attitude to the task and performed better than the other two groups. This is also in agreement with Digitale (2018) who reported that children who showed more interest in math have higher math scores. She came to the conclusion that a child's accomplishment in arithmetic would be aided by their high interest in the subject, which leads to improved memory and more effective use of the brain's problem-solving abilities**.** This implies that truly, teachers of mathematics in the early years need to change their methods if they want to improve their pupils' learning outcomes while also making mathematics more appealing to children.

Additionally, one of the results showed that there is no gender-related main influence on pre-primary children interest in numeracy. This supported the findings of Galadima and Yushua (2007), Abubakar (2008), and Ebisine (2010), who likewise found no discernible difference between the academic achievement of male and female pupils. The finding is not in agreement with the study of Dowker et al. (2019) where boys in primary school rate their arithmetic skills higher than girls do. This finding also conflicts with that of Onasanya (2008) who found that male learners performed better in mathematics, and Etuduko (2007), who found that girls performed better. The results of Skaalvik and Skaalvik (2004), Kyttala and Bjorn (2010), Upadyaya and Eccles (2015), Ganley and Lubienski (2016), and Markovits and Forgasz (2017), who found that gender has an impact on student performance, are in direct conflict with this finding. Boys are more likely than females to have superior numeracy or mathematical ability, according to some of these academics, and they also tend to have a better attitude toward learning math. They also tend to be more confident and interested in arithmetic.

Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

CONCLUSION

The study revealed a positive impact of games on pre-primary school children numeracy skills and showed a significant difference between the interests of learners who are taught using game strategy and those who are not, with learners who have access to games showing a positive interest in numeracy. As a result, the study clarifies the issue that usually bothers on whether games are just merely recreational activities, time wasting or whether they contribute to meaningful learning in the classroom and academic success. From the study, it can be concluded that using games' approach in pre-primary classrooms is highly beneficial to numeracy instruction.

On the basis of the study's findings, suggestions were made that pre-primary school curriculum should be designed and planned to allow appropriate use of games during instructions in the classroom. Also, in order to encourage teachers to employ the game approach in teaching numeracy at the pre-primary level, school officials should set aside spaces for the use of games in actual classroom instruction and provide instructors with game resources. So also, parents should be informed of the advantages of educational games. As a result, parents will be able to offer their children educational games and motivate them to play games to enhance their learning of numeracy.

REFERENCES

Akinsola, M. K., and Frederick-Jonah, T. M. (2014). Effects of game and poem enhanced instruction on Pre-primary children achievement in mathematics. *International Journal of Education and Research*, *2*(6), 373-386.

Alanazi, H. M. N. (2020). The effects of active recreational math games on math anxiety and performance in primary school children: An experimental study. *Multidisciplinary Journal for Education, Social and Technological Sciences*, *7*(1), 89-112.

Anaduaka, U. S. (2011). The multiple intelligences teaching method and mathematics teaching. *Journal of Research in National Development*, *9* (1), 116-123.

Andika, W. D., Akbar, M. R.,Yufiarti & Sumarni, S. (2019). Playing board games with mathematical self-concept to support early numeracy skill of 5-6 years old children. In *Journal of Physics*: Conference Series. 1166 (1), IOP Publishing.

Aunio, P., & Niemivirta, M. (2010). Predicting children's mathematical performance in grade one by early numeracy. *Learning and Individual Differences, 20*(5), 427–435. https://doi.org/10.1016/j.lindif.2010.06.003

Aunio, P., & Mononen, R. (2018). The effects of educational computer game on low-performing children's early numeracy skills–an intervention study in a Pre-primary setting. *European Journal of Special Needs Education, 33*(5), 677-691.

Azuka, B.F. (2002). Strategies for popularization of mathematics in secondary schools: A paper presented at University of Nigeria Nsukka during the workshop for Retraining Mathematics Teachers. (9th-11th December).

Bragg, L. (2007). Learners' conflicting attitudes towards games as a vehicle for learning mathematics: a methodological dilemma, *Mathematics Education Research Journal*, 19 (1). 29-44.`

Bragg, L. A. (2012). Testing the effectiveness of mathematical games as a pedagogical tool for children's learning. *International Journal of Science and Mathematics Education*, *10*(6), 1445-1467.

Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Coffey, P., & Sharpe, R. (2021). An investigation into the teaching of numeracy in subjects other than mathematics across the curriculum. International Journal of Mathematical Education in Science and Technology, 1-28. https://doi.org/10.1080/0020739X.2021.1978570

Chen, Y. C. (2017). Empirical study on the effect of digital game-based instruction on students' learning motivation and achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(7), 3177-3187. https://doi.org/10.12973/eurasia.2017.00711a

Colby, R.S. (2017). Game-based pedagogy in the writing classroom. *Computers and composition* 43. 55-72. Retrieved from https://collegecompositionweekly.com/2017/05/11/colby-rebekah-shultz-games-as-pedagogical-tools-cc-2017-posted-05112017/

Colleen, G. & Sarah, L. (2016). Current research on gender differences in math. National Council of Teachers of Mathematics. https://www.nctm.org/Publications/TCM-blog/Blog/Current-Research-on-Gender-Differences-in-Math/

Digitale, E. (2018). Positive attitude toward math predicts math achievement in children. Stanford Medicine News. Retrieved from https://med.stanford.edu/news/all-news/2018/01/positive-attitude-toward-math-predicts-math-achievement-in-children.html

Din, F. S., Caleo, J. (2000). Playing computer games versus better learning. Paper presented at the Eastern Educational Research Association. Clearwater, Florida.

Dowker, A., Cheriton, O., Horton, R. & Mark, W (2019). Relationships between attitudes and performance in young children's mathematics. *Ann Educational Studies in Mathematics*. 100:211–230 https://doi.org/10.1007/s10649-019-9880-5

Ebisine, S. S. (2010). Difficulties encountered by senior secondary school learners' in understanding nontechnical words in mathematics multiple choice tests. ABACUS. *Journal of the Mathematical Association of Nigeria*, *35*(1), 97-105.

Ekine, A.O. (2010). Impact of video tape instructional strategy on Preschool children interest and achievement in primary science in selected private schools in Ibadan, Nigeria. PhD Thesis. University of Ibadan.

Eniayeju, A.A (2010). Effect of cooperative learning strategy on the achievement of primary six boys and girls in Mathematics Abacus: *The Journal of Mathematical Association of Nigeria* 35(1) 1-9

Euler (2011). The PRIMAS project: Promoting inquiry-based learning (IBL) in mathematics and science education across Europe. http://www.primasproject.eu/servlet/ supportBinaryFiles?referenceId=8&supportId=1247.

Etukudo, U. E. (2002). The Effect of computer–assisted instruction on gender and performance of junior secondary school learners in mathematics. *ABACUS, Journal of Mathematical Association Nigeria*, *27* (1), 1-8.

Eze J. E. (2007) Re-positioning mathematics education for job creation: implication for tertiary education. *ABACUS: Journal of mathematical association of Nigeria*, 27.1:1-8.

Federal Government of Nigeria (2012). The National Policy on Education revised edition. Lagos; government printing office.

French, G. (2012). Early literacy and numeracy matters: enriching literacy and numeracy experience in early childhood. Dublin, Barnados.

Galadima, I., &Yushau, M. A. (2007). An investigation into mathematics performance of senior secondary school learners in Sokoto State. *ABACUS: The Journal of the Mathematical Association of Nigeria (MAN)*, *32*(1), 24-31.

Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Ganley, C. M., & Lubienski, S. T. (2016). Mathematics confidence, interest, and performance: Examining gender patterns and reciprocal relations. Learning and Individual Differences, 47, 182–193. https://doi.org/10.1016 /j.lindif.2016.01.002

Hays, T.R. (2005). Th e effectiveness of instructional games: A literature review and discussion. Technical report 2005-004. Retrivied August, 8, 2008 from http://handle. dtic.mil/100.2/ADA441935.

Herbert, J., & Stipek, D. (2005). The emergence of gender differences in children's performance of their academic competence. Applied Developmental Psychology, 26, 276–295. https://doi.org/10.1016/j. appdev.2005.02.007

Jenni, B. (2012). Manupulatives in the primary classroom: published by NRICH. www.maths.org/1046.

Kankia, A.D. (2008). The importance of games in the teaching and learning of lowest common multiples of numbers in overcrowded junior secondary classes. *Journal of Issues on Mathematics,* 11(1), 1-12

Katmada, A., Mavridis, A., & Tsiatsos, T. (2014). Implementing a game for supporting learning in mathematics. *Electronic Journal of e-Learning,* 12(3), pp230-242.

Ke, F. & Grabowski, B. (2007). Game playing for mathematics learning: cooperative or not? *British Journal of Educational Technology*, 38(2),

Kolb, A. Y. & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, 4(2), 193-212.

Kyttala, M., & Bjorn, P. M. (2010). Prior mathematics achievement, cognitive appraisals and anxiety as predictors of Finnish learners' later mathematics performance and career orientation. Educational Psychology, 30, 432–448. https://doi.org/10.1080/01443411003724491

Lim, C. P., Nonis, D., & Hedberg, J. (2006). Gaming in a 3-D multiuser virtual environment: engaging learners in Science lessons. British Journal of Educational Technology, 37(2), 211-231111.

Lorant, S., & Lieury, A. (2014). Efficiency of brain training vs. recreational video games for cognitive/academic performance: A synthesis of 3 experiments. Video Games. Retrieved from https://www.academia.edu

Markovits, Z., & Forgasz, H. (2017). "Mathematics is like a lion": Elementary learners' beliefs about mathematics. Educational Studies in Mathematics, 96, 49–64. https://doi.org/10.1007/s10649-017-9759-2

Nurudeen, T. S. (2007). Secondary school learners' misconceptions in solving mathematics problems. ABACUS. *Journal of Mathematical Association of Nigeria*, *32*.

Okigbo, E. C., & Okeke, S. O. (2011). Effects of games and analogies on learners' interest in mathematics. *Journal of Science Teachers Association of Nigeria (STAN)*, *46*(1), 101-112.

Olayinka, A.Y. (2006). A survey of problems in the teaching of mathematics in secondary schools in Damaturu Local Government Area of Yobe State. ABACUS: *Journal of the Mathematical Association of Nigeria* 31.1, pp130-142.

Onasanya, A. W. (2008). Effectiveness of team teaching in mathematics with respect to universal basic education. *ABACUS: Journal of mathematical Association of Nigeria.* 33.1:1-5

Onwuka, P. I., Iweka, S., & Moseri, P. O. (2010). Games and simulation for teaching selected concepts in basic mathematics. *ABACUS: Journal of the Mathematical Association of Nigeria,* 35(1), 115-119.

Vol. 6, No.1, February 2023, pp. 96-110
DOI: http://dx.doi.org/10.33578/jtlee.v6i1.7984
ISSN : 2615-4528 (Print) 2622-3023 (Online)

Omeodu M. D. & Fredrick, F. C. (2019). Effect of game teaching method on learners' mathematics achievement in Aboh-Mbaise Local Government Area, Imo State. *International Journal of Innovative Social and Science Education Research* 7(3):18-23

Ompok, C. S., Mei Teng, L., & Sapirai, J. (2021). Effect of games towards children"s mathematics performance. *Southeast Asia Early Childhood Journal,* 10(1), 1-17. https://doi.org/10.37134/saecj.vol10.1.1.2021

Ramani, G.B. & Siegler, R.S. (2008). Promoting broad and table improvements in low income children's numerical knowledge through playing number board games. *Child Development*, 79 (2), 375-394.

Rebekah (2013). Five reasons to use games in the classroom. education world. Retrieved from

Russo, J., Bragg, L. A., & Russo, T. (2021). How Primary Teachers Use Games to Support Their Teaching of Mathematics. International Electronic Journal of Elementary Education, 13(4), 407-419

Schleicher, A. (2013). Attitudes towards mathematics. Recessed online from www.nationalnumeracy.org.uk/research.

Strandberg, L. (2007). Vygotsky, a practical friend. *Children in Europe*, pp. 16–18.

Skaalvik, S., & Skaalvik, E. M. (2004). Gender differences in math and verbal self-concept, performance expectations and motivation. Sex Roles, 50, 241–252. https://doi.org/10.1023/B:SERS.0000015555.40976. e6

Stathakis, R. (2013). Five reasons to use games in the classroom. Sótt af http://www. educationworld. com/a_urr/reasons-to-play-games-in-the-classroom. shtml.

Taranto, E. (2020) "Telling Mathematics": Storytelling and counting in pre-elementary school *Journal of Teaching and Learning in Elementary Education (*JTLEE) Vol. 3 (1), 1-20. https://jtlee.ejournal.unri.ac.id/index.php/JTLEE/article/view/7820

The National Curriculum in England (2013) Key stages 1 and 2 framework document. *https://assets.publishing.service.gov.uk* ›

Tokac, U., Novak, E., & Thompson, C. G. (2019). Effects of game-based learning on students' mathematics achievement: A meta-analysis. *Journal of Computer Assisted Learning*, *35*(3), 407-420.

Udegbe, G. I. (2009, September). Learners' interest as an important factor in improving the Teaching and learning of Mathematics. In *Proceedings of September 2009 Annual Conference of Mathematical association of Nigeria MAN* (pp. 77-83).

Upadyaya, K., & Eccles, J. (2015). Do teachers' perceptions of children's math and reading related ability and effort predict children's self-concept of ability in math and reading? Educational Psychology, 35, 110–127. https://doi.org/10.1080/01443410.2014.915927

Utoyo, S. (2019). Improving early mathematical skills using kinesthetic games. In 1st Non Formal Education International Conference (NFEIC 2018) (pp. 96-99). Atlantis Press. https://doi.org/10.2991/nfeic-18.2019.21

Vankúš, P. (2021). Influence of game-based learning in mathematics education on students' affective domain: A systematic review. Mathematics, 9(9), 986.

Vogel, J. J., Vogel, D. S., Cannon-Bowers, J., Bowers, C.A., Muse, K., & Wright, M. (2006). Computer gaming and interactive simulations for learning: A meta-analysis. *Journal of Educational Computing Research*, 34(3)*, 229-243*.

Vygotsky, L.S. (1962). Thoughts and language, Wiley, New YorkDowker, A., Bennett, K., and Smith, L. (2012). Attitudes to mathematics in primary school children. Child Development Research, 2012, 124939–124938. https://doi.org/10.1155/2012/124939