



Effect of Hands-On Activities on Pupils' Interest, Task Persistence and Academic Achievement in Mathematics in Nsukka Local Government Area, Enugu State, Nigeria

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ABSTRACT

This study investigated the effects of hands-on activities on pupils' interest task persistence and academic achievement, in Mathematics in Nsukka Local Government Area, Enugu State. Five research questions and five null hypotheses were used as a guide. More so, a quasi-experimental research design was adopted. Specifically, the pretest-posttest non-equivalent group design was employed. The population of the study consists of 2,674 primary five pupils in the 114 primary schools in Nsukka Local Government Area. The sample size of the study is 103 (57 males and 46 females) primary five pupils. A simple random sampling technique was used to draw two schools from the 114 schools in Nsukka Local Government Area. In each of the two schools drawn, categorized as school A and school B respectively, two intact classes of primary five pupils were used. School A served as the experimental group with 53 (30 males and 23 females) while school B served as the control group with 50 (27 males and 23 females) respectively. Mathematics Academic Achievement Test (MAAT), Pupils Mathematics Interest Scale (PMIS) and Mathematics Task Persistence Scale (MTPS) were used for data collection. Face and content validities were ensured by three experts. Confirmatory factor analysis formed the basis for construct validity. Internal consistency through Cronbach alpha gave reliability coefficients of 0.793 and 0.865 for Pupils Mathematics Interest Scale (PMIS) and Mathematics Task Persistence Scale (MTPS). The internal consistency reliability coefficient of Mathematics Academic Achievement Test (MAAT) was determined to be 0.748 using Kuder-Richardson₂₀ formula (KR₂₀). Research questions were answered using mean and standard deviation. Analysis of Covariance (ANCOVA) is adopted for testing the null hypotheses at 0.05 level of significance. The eta squared value was used to determine the experimental effect size on the subjects. The findings show that pupils' mathematics interest, task persistence and achievement significantly improved after being exposed to hands-on activities when compared to pupils not exposed to similar experiment. Also, the findings showed that methods and gender had no interaction effect on mathematics interest and achievement of the pupils but had significant interaction effect on their mathematics task persistence. It is recommended that Head-teachers should avail the teachers opportunities through seminars, conferences and workshops on capacity development that can enhance the application of hands-on activities in Mathematics classes in order to improve on pupils' interest, persistence and academic achievement in Mathematics. The teachers should provide varieties of hands-on activities that can properly engage the pupils in Mathematics.

Keywords: Hands-on activities, pupils' interest, task persistence, academic achievement, mathematics

Introduction

In recent times, primary education has increasingly become a concern due to the challenges associated with managing modern-age pupils, particularly in the public school system. This has drawn the attention of stakeholders, teachers, and education enthusiasts to strategies for improving pupils' academic achievement. Structured within the 6-3-3-4 system of education—six years of primary, three years of junior secondary, three years of senior secondary, and four years of tertiary education—primary education serves as the foundation for all subsequent levels of learning (FRN, 2014). It caters to children aged 6–12 years and is designed to provide critical literacy and numeracy skills necessary for further education (Nzokurum, 2019). Primary education therefore plays a pivotal role in individual and societal development by establishing the fundamental skills in reading, writing, and mathematics that enable smooth transitions to higher levels of education (Anero, 2014; Bagdonaitė, 2019). Mathematics, a compulsory subject across all levels of education in Nigeria, is central to primary education. Defined as the study of numbers, space, and logical relationships (Okeke, Abugu & Orga, 2020; Iji, 2014), mathematics develops logical and creative reasoning abilities, fosters problem-solving skills, and underpins scientific, technological, and economic advancement (Sharma, 2021; Vos, 2018). Mastery of mathematics equips pupils to apply knowledge in real-life situations, organize and interpret data, and make informed decisions. The level of a pupil's interest often determines the extent of engagement and learning in mathematics, making it a critical factor in academic achievement (Egbe, 2015; Ekweoba & Nji, 2015; Walkington & Bernack, 2014).

Interest, defined as curiosity or a desire to engage with a subject, plays a key role in learning outcomes. Pupils are naturally inquisitive and are more likely to learn effectively when their interest is stimulated through motivation, experimentation, and active engagement (Kanno, Obih, Okoro & Ukegbu, 2017; Nnachi, 2016). High interest enhances commitment and positive performance, whereas low interest often results in poor engagement, low task persistence, and underachievement (Ibe & Osuji, 2020; Toh & Kaura, 2019). Task persistence, the sustained effort a pupil applies to accomplish a task despite challenges, is essential for academic success in mathematics (Uçar & Sugar, 2017). Pupils with high task persistence demonstrate focus, goal orientation, and mastery-oriented behaviors, whereas those with low persistence tend to avoid challenging tasks, contributing to poor literacy and numeracy outcomes (Atwood & Pretz, 2016; Kikas & Silinskas, 2015; Amoke, 2022). Achievement, the hallmark of primary education, reflects the acquisition and application of knowledge, skills, and competencies within and beyond the classroom (Odagboyi, 2015; Tambunan, Sinaga & Wadada, 2021; Mbonu-Adigwe, Oguezie & Nwankwo, 2021). Academic achievement in mathematics, measured through tests, assignments, and examinations, indicates the extent to which pupils realize learning goals (Okafor & Anaduaka, 2013; Nwuche, 2023; Obioha, 2023). Despite its importance, performance in mathematics at the primary level remains low. Reports from the Federal Common Entrance Examination and school-based assessments reveal that only a small percentage of pupils attain passing or excellent grades, reflecting widespread underachievement in the subject (FRN, 2014; Chief Examiners Report, 2017).

One major factor contributing to poor outcomes is the continued reliance on conventional, teacher-centered methods, where pupils are passive recipients of knowledge (Kennedy, 2016). Such methods often fail to stimulate interest, task persistence, or meaningful engagement in mathematics. To address these challenges, hands-on activities have been proposed as a learner-centered approach that encourages active manipulation of objects, experimentation, and problem-solving (Haury & Rillero, 2015; Nnachi, 2016; Buehl, 2017). By providing concrete experiences, hands-on activities can enhance understanding, critical thinking, and academic performance in mathematics, as evidenced by improved outcomes in basic science and mathematics studies (Ekwueme, Ekon & Ezenwa-Nebife, 2015). Gender may also moderate pupils' interest, task persistence, and achievement in mathematics. Defined as the culturally ascribed roles, attitudes, and expectations associated with males and females (Peterson, 2014; Nwaubani, Okafor, Okeke, Onuorah & Ugwonna, 2020), gender differences have been shown to influence performance, with some studies indicating boys outperform girls in higher-order cognitive tasks, while others report no significant differences in early education (Olasehinde & Olatoye, 2014). Understanding these dynamics is crucial for designing effective, inclusive teaching strategies that can enhance interest, persistence, and achievement in mathematics at the primary level.

Research indicates that hands-on activities can significantly influence students' interest in learning. Holstermann, Grube, and Bögeholz (2009) found that practical engagement in biology tasks improved students' interest, with positive correlations between the quality of hands-on experiences and interest. Similarly, Onyeka, Nwamarai, and Okafor-Agbala (2020) reported that using the mother tongue in teaching enhanced primary pupils' achievement and interest in mathematics. Zhang, Tucker, and Stigler (2022) demonstrated that live hands-on activities increased students' interest and understanding of randomness, while Okeke et al. (2022) showed that active learning strategies, such as spaced learning, enhanced pupils' interest and retention in mathematics. These studies highlight the motivational role of practical activities, although differences exist in location, subject focus, and research design. Hands-on activities have also been shown to affect task persistence. Hashmi, Seok, and Halik (2017) found that mastery motivation programs

increased persistence in preschool tasks. Onyishi et al. (2020) reported that strategic content learning enhanced task persistence in students with and without learning disabilities. Kehinde, Saddiq, and Sabitu (2021) observed that hands-on activities significantly improved pupils' achievement and retention in fractions, while Torgrimson, Tan, and Grammer (2021) showed that motivated pupils demonstrated higher task persistence. These findings suggest that interactive and practical learning approaches enhance pupils' sustained engagement with mathematical tasks.

In addition, studies consistently show that hands-on activities improve academic performance. Munir and Mumtaz (2013) reported higher achievement in science among students exposed to hands-on activities. Ekwueme, Ekon, and Ezenwa-Nebife (2015) found improvements in mathematics and science performance in mixed-ability classes using hands-on approaches. Agwuma, Ochogba, and Agwuma (2018) identified factors such as student interest, teaching methods, and availability of resources as determinants of mathematics achievement. Oludipe, Ojediran, and Kareem (2020) showed that hands-on/minds-on strategies increased achievement in science, while Adeyinka, Khalid, and Abiodun (2021) demonstrated improved performance and retention in mathematics fractions. Overall, hands-on approaches foster active engagement, understanding, and better academic outcomes in mathematics. Gender differences have also been found to influence interest and achievement in mathematics. Godpower-Echie and Ihenko (2017) and Allahnana et al. (2018) reported that male students generally showed higher interest and achievement in science and mathematics. Eriksson (2020) revealed that gender differences in mathematics interest vary across countries, with girls showing high interest in low-achievement contexts. Edwin-Ezeoka, Ekweuzor, and Bello (2020) highlighted that factors such as availability of instructional resources and parental support affect pupils' understanding of mathematics. Unwaba and Nworgu (2021) showed that gender, alongside study habits, significantly predicts interest in science subjects. These studies suggest that gender-related factors are important to consider when examining pupils' interest and performance in mathematics. The scenario is irrespective of the teacher necessitated conventional prevalent teaching method. Therefore, this research work strives to investigate the effects of hands-on activities on pupils' interest, task persistence and academic achievement in mathematics in primary schools in Nsukka local government area of Enugu State.

Statement of the Problem

The importance of academic achievement in mathematics in the school system cannot be underestimated. This is because Mathematics is a core science learning subject that must be passed by pupils irrespective of their gender in flying colours for onward progression in their educational pursuit. This is because it can help the pupils' in solving their own problems and also societal problems. It is expected that such individuals will be autonomous, confident and self-reliant after graduation from school. But the reverse is the case whereby some pupils cannot apply or transfer what has been learnt in school in solving real life situation as a result of poor acquisition of mathematic skills. This is evident in the Reports from Federal Unity schools that most pupils' achievement in mathematics in Common Entrance Certificate Examination (CECE) is very poor and so many factors are responsible for these poor achievements. Some of the factors can be traceable to the pupils' poor interest towards the study of mathematic, and their low level of persistence towards mathematics task that could be based on the kind of teaching method which does not involves pupils' active participation. This implies that the conventional approaches to teaching mathematics no longer boost the interest, task persistence and achievement of pupils in our education system. Research evidence has proven the efficacy of hands-on activities as one of the innovative approaches in enhancing pupils' achievement in mathematics, in other countries of the world. However, one does not know if such application of hands-on activities could enhance interest, task persistence and achievement of pupils in mathematics in the present study area. For this reason, the researcher is poised to investigate the effect of hands-on activities on pupils' academic achievement, interest and task persistence in mathematics of pupils enrolled in primary schools in Nsukka local government area of Enugu state.

Purpose of the Study

1. The main purpose of this study is to determine the effect of hands-on activities on pupils' interest, task persistence and academic achievement in mathematics in primary schools in Nsukka Local Government Area of Enugu state. To be specific, this study sought to:
2. determine the effect of hands-on activities on pupils' interest in mathematics.
3. find out the effect of hands-on activities on pupils' task persistence in mathematics.
4. ascertain the effect of hands-on activities on pupils' academic achievement in mathematics
5. determine the influence of gender on pupils' interest in mathematics.
6. ascertain the effect of gender influence on task persistence of pupils in mathematics.

Research Questions

1. The following research questions were raised to guide the study:

2. What is the difference between mean Mathematics interest scores of pupils exposed to hands-on activities and those with exposure to the conventional method?
3. What is the difference between mean Mathematics task persistence scores of pupils exposed to hands-on activities and those with exposure to the conventional method?
4. What is the difference between mean Mathematics achievement scores of pupils with exposure to hands-on activities and those with exposure to the conventional method?
5. What is the difference between mean interest scores of female and male pupils in mathematics?
6. What is the difference between mean task persistence scores of female and male pupils in mathematics?

Hypotheses

The following hypotheses were tested at 0.05 level of significant

H₀₁: There is no significant difference in the mean Mathematics interest scores of pupils with exposure to hands-on activities and those with exposure to the conventional method.

H₀₂: There is no significant difference in the mean Mathematics task persistence scores of pupils with exposure to hands-on activities and those with exposure to the conventional method.

H₀₃: There is no significant difference in the mean Mathematics achievement scores of pupils with exposure to hands-on activities and those without exposure to conventional method.

H₀₄: There is no significant difference in the mean interest scores of male and female pupils in mathematics.

H₀₅: There is no substantial difference in the mean task persistence scores of female and male pupils in mathematics.

Methods and Materials

This study adopted a quasi-experimental research design, specifically the pre-test, post-test non-equivalent control group design. Quasi-experimental designs do not allow random assignment of subjects to groups (Nworgu, 2015) and permit the use of intact classes in experimental settings. This design was suitable for the study because it allowed the selection of two intact classes as experimental (hands-on activity) and control (demonstration) groups. The experimental group was exposed to the hands-on activity strategy, while the control group received instruction through the conventional method. Pre-test and post-test measures were administered to both groups to assess their mathematics interest, task persistence, and achievement. The study was conducted in Nsukka Local Government Area of Enugu State, primarily in Nsukka Central. The area is characterized by a blend of traditional African religious beliefs and Christianity, with Igbo as the predominant language, while English is often used in educational settings. Nsukka experiences a tropical climate with distinct wet and dry seasons, and education is highly valued. Numerous primary and secondary schools are present in the area, including the University of Nigeria, Nsukka (UNN), which underscores the community's emphasis on academic advancement. Agriculture and small-scale trading are common occupations, although opportunities in academia and related sectors are also available. The study targeted primary school pupils in this area, as their interest, task persistence, and achievement in mathematics were the focus.

The population of the study consisted of 2,674 primary five pupils enrolled in 114 primary schools in Nsukka Local Government Area. Among them, 1,392 were males and 1,282 were females (ENSUBEB, 2022/2023). Primary five pupils were selected because they are not in examination classes, can actively participate in experimental sessions, and are capable of providing independent, clear responses. A sample of 103 pupils (57 males and 46 females) was drawn using a combination of simple random and purposive sampling techniques. Two schools were randomly selected from the population through balloting, and an intact primary five class from each school was purposively chosen. School A was assigned as the experimental group, comprising 53 pupils (30 males, 23 females), while School B was the control group, comprising 50 pupils (27 males, 23 females). Using intact classes ensured that normal school activities were not disrupted. Three self-designed instruments were used for data collection: the Pupils Mathematics Interest Scale (PMIS), Mathematics Task Persistence Scale (MTPS), and Mathematics Achievement Test (MAT). PMIS consisted of 16 items with four response options: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1), yielding scores from 16 to 64, with higher scores indicating greater interest in mathematics. MTPS comprised 14 items with identical response options, with scores ranging from 14 to 56, measuring pupils' persistence in completing mathematics tasks. MAT was a 20-item objective test with multiple-choice options, scored 0–20, assessing pupils' mathematics achievement based on primary five curricula. Validity of the instruments was established through face and content validation by three experts from the University of Nigeria, Nsukka, representing Early Childhood and Primary Education, Educational Psychology, and Measurement and Evaluation. Construct validity for PMIS and MTPS was confirmed through factor analysis conducted on 50 pupils in Igbo-Eze South LGA. Items with factor loadings of 0.35 or higher were retained, resulting in 16 pure items for PMIS and 14 pure items for MTPS. Reliability was

established using Cronbach's alpha, yielding coefficients of 0.793 for PMIS and 0.865 for MTPS, while the MAT achieved a KR-20 reliability coefficient of 0.748, confirming internal consistency.

The experimental procedure comprised three stages: pre-treatment, treatment, and post-treatment, conducted over six weeks with two 35-minute sessions per week. During the pre-treatment stage, the researcher visited the schools to introduce the study to school heads and classroom teachers, who served as research assistants. Teachers were briefed on the teaching strategies and experimental procedures, including a microteaching session to ensure mastery of the instructional approaches. Pupils were categorized into experimental and control groups, and pre-tests were administered to obtain baseline data. The treatment phase spanned four weeks. The experimental group received instruction using hands-on activities, which involved active manipulation of learning materials, discussion, investigation, creativity, and discovery with minimal teacher support. Materials included abacus, bottle tops, straw sticks, flashcards, number cards, fraction charts, and calendars to facilitate understanding of concepts such as whole numbers, fractions, addition, subtraction, multiplication, division, and quantitative problem-solving. The control group received conventional teacher-centered instruction using standard lesson plans. The post-treatment phase involved administering post-tests to both groups to measure outcomes in mathematics interest, task persistence, and achievement.

Measures were taken to control extraneous variables. Confidentiality was maintained to prevent subject-related biases, and research assistants strictly followed the hands-on activity steps. Statistical control was achieved through Analysis of Covariance (ANCOVA), which accounted for initial differences between groups by using pre-test scores as covariates. Test wiseness was minimized by reshuffling items in the instruments, and experimental bias was controlled through proper training of research assistants. Teachers were used consistently during treatment and instrument administration to ensure uniformity. Data analysis involved descriptive statistics, including means and standard deviations, to answer research questions, and inferential statistics using ANCOVA to test hypotheses at a 0.05 level of significance. Partial eta squared was used to determine effect size, categorized according to Cohen's criteria as small (0.2), moderate (0.5), and large (0.8).

Results

Table 1: Mean and Standard deviation on Mathematics interest scores of pupils exposed to hands-on activities and those exposed to the conventional method

Groups	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Experimental (hands-on activity)	53	26.38	3.96	58.25	4.99	31.87	
Control	50	28.92	5.13	31.96	7.18	3.04	28.83

Data in table 1 reveals the pre-test mean and standard deviation scores ($M=26.38$; $SD=3.96$) of the experiment group and post-test mean and standard deviation scores ($M= 58.25$; $SD= 4.99$) of the same group with mean gain of 31.87. Also, the pre-test mean and standard deviation scores ($M=24.92$; $SD=5.13$) of the control group and post-test mean and standard deviation scores ($M=31.96$; $SD=7.18$) of the same group with mean gain of 3.04. The low standard deviation scores revealed that the responses did not vary widely. Also, the mean difference of the two groups of 28.83 showed that pupils' mathematics interest was improved more for those exposed to hands-on activities than those not exposed.

H₀₁: There is no significant difference in the mean Mathematics interest scores of pupils exposed to hands-on activities and those exposed to the conventional method.

Table 2: ANCOVA on Mathematics interest scores of pupils exposed to hands-on activities and those exposed to the conventional method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18684.926 ^a	2	9342.463	320.518	.000	.865
Intercept	1944.262	1	1944.262	66.703	.000	.400
Pretest	908.929	1	908.929	31.183	.000	.238
Methods	18635.030	1	18635.030	639.324	.000	.865
Error	2914.802	100	29.148			
Total	234699.000	103				
Corrected Total	21599.728	102				

a. R Squared = .865 (Adjusted R Squared = .862)

0.2 (small effect), 0.5 (moderate effect) and 0.8 (large effect) (Cohen 1998)

Data in table 2 shows $F(2, 100) = 639.324$, $p=.00 < 0.05$ level of significance. This shows that the

hypothesis was significant. Therefore, there is a significant difference in the mean Mathematics interest scores of pupils exposed to hands-on activities and those exposed to the conventional method. The effect size of hands-on activities on the Mathematics interest scores of pupils is large with Eta value of 0.865 based on Cohen's D categorization.

Research question 2: What is the difference between mean Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed to the conventional method?

Table 3: Mean and Standard deviation on Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed to the conventional method

Groups	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Experimental (hands-on activity)	53	23.75	3.36	50.66	4.61	26.91	
Control	50	25.00	4.64	27.94	4.45	2.94	23.97

Data in table 3 reveals the pre-test mean and standard deviation scores ($M=23.75$; $SD=3.36$) of the experiment group and post-test mean and standard deviation scores ($M= 50.66$; $SD= 4.61$) of the same group with mean gain of 26.91. Also, the pre-test mean and standard deviation scores ($M=25.00$; $SD=4.64$) of the control group and post-test mean and standard deviation scores ($M=27.94$; $SD=4.45$) of the same group with mean gain of 2.94. The low standard deviation scores revealed that the responses did not vary widely. Also, the mean difference of the two groups of 23.97 showed that pupils' mathematics task persistence was improved more for those exposed to hands-on activities than those not exposed.

H_{02} : There is no significant difference in the mean Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed the conventional method.

Table 4: ANCOVA on Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed to the conventional method

Source	Type III Squares	Sum of df	Mean Square	F	Partial Sig.	Squared	Eta
Corrected Model	13681.959 ^a	2	6840.979	408.655	.000	.891	
Intercept	1995.558	1	1995.558	119.207	.000	.544	
Pretest	400.685	1	400.685	23.935	.000	.193	
Methods	13677.892	1	13677.892	817.068	.000	.891	
Error	1674.022	100	16.740				
Total	177130.000	103					
Corrected Total	15355.981	102					

a. R Squared = .891 (Adjusted R Squared = .889)

Data in table 4 shows $F(2, 100) = 817.068$, $p=.00 < 0.05$ level of significance. This shows that the hypothesis was significant. Therefore, there is a significant difference in the mean Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed to the conventional method. The effect size of hands-on activities on the Mathematics task persistence scores of pupils is large with Eta value of 0.891 based on Cohen's D categorization.

Research question 3: What is the difference between mean Mathematics achievement scores of pupils exposed to hands-on activities and those exposed to the conventional method?

Table 5: Mean and Standard deviation on Mathematics achievement scores of pupils exposed to hands-on activities and those exposed to the conventional method

Groups	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Experimental (hands-on activity)	53	7.94	1.46	16.43	1.62	8.49	
Control	50	8.04	1.38	11.84	1.46	3.80	4.69

Data in table 5 reveals the pre-test mean and standard deviation scores ($M=7.94$; $SD=1.46$) of the experiment group and post-test mean and standard deviation scores ($M= 16.43$; $SD= 1.62$) of the same group with mean gain of 8.49. Also, the pre-test mean and standard deviation scores ($M=8.04$; $SD=1.38$) of the control group and post-test mean and standard deviation scores ($M=11.84$; $SD=1.46$) of the same group with mean gain of 3.80. The low standard deviation scores revealed that the responses did not vary widely. Also, the mean difference of the two groups of 4.69 showed that pupils' achievement in mathematics was improved more for those exposed to hands-on activities than those not exposed.

H_{03} : There is no significant difference in the mean Mathematics achievement scores of pupils exposed to hands-on activities and those not exposed to conventional method.

Table 6: ANCOVA on Mathematics achievement scores of pupils exposed to hands-on activities and those exposed to the conventional method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	588.576 ^a	2	294.288	150.037	.000	.750
Intercept	334.057	1	334.057	170.313	.000	.630
Pretest	45.596	1	45.596	23.246	.000	.189
Methods	553.161	1	553.161	282.019	.000	.738
Error	196.143	100	1.961			
Total	21565.000	103				
Corrected Total	784.718	102				

a. R Squared = .750 (Adjusted R Squared = .745)

Data in table 6 shows $F(2, 100) = 282.019$, $p=.00 < 0.05$ level of significance. This shows that the hypothesis was significant. Therefore, there is a significant difference in the mean Mathematics achievement scores of pupils exposed to hands-on activities and those exposed to the conventional method. The effect size of hands-on activities on the Mathematics achievement scores of pupils is moderate with Eta value of 0.738 based on Cohen's D categorization.

Research question 4: What is the difference between mean interest scores of male and female pupils in mathematics?

Table 7: Mean and Standard deviation interest scores of male and female pupils in mathematics

Gender	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Male	57	27.68	.63	46.35	1.94	18.67	
Female	46	44.41	2.14	56.09	1.65	11.68	6.99

Data in table 7 shows the pre-test mean and standard deviation scores ($M=27.68$; $SD=0.63$) of the male group and post-test mean and standard deviation scores ($M=46.35$; $SD=1.94$) of the same male group with a mean gain of 18.67. Also, it was found that the pre-test mean and standard deviation scores ($M=44.41$; $SD=2.14$) of the female group and post-test mean and standard deviation scores ($M =56.09$; $SD=1.65$) of the same group with mean difference of 11.68. Therefore, the mean gain of 6.99 for the two groups shows that male pupils' experienced improvement in Mathematics interest more than their female counterparts.

H_{04} : There is no significant difference in the mean interest scores of male and female pupils in mathematics.

Table 8: ANCOVA on the interest scores of male and female pupils in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	589.184 ^a	4	147.296	73.824	.000	.751
Intercept	331.168	1	331.168	165.979	.000	.629
Pretest	45.895	1	45.895	23.002	.000	.190
Methods	542.984	1	542.984	272.139	.000	.735
Gender	.082	1	.082	.041	.839	.000
methods * gender	.516	1	.516	.259	.612	.003
Error	195.534	98	1.995			
Total	21565.000	103				

Corrected Total 784.718 102
 a. R Squared = .751 (Adjusted R Squared = .741)

Data in table 8 shows $F(1,98) = 0.041$, $p=0.839 > 0.05$ level of significance. Therefore, the null hypothesis which states that there is no significant difference in the mean interest scores of male and female pupils in mathematics holds true. Therefore, there is no significant difference in the mean interest scores of male and female pupils in mathematics.

Research Question 5: What is the difference between mean task persistence scores of male and female pupils in mathematics?

Table 9: Mean and Standard deviation score on the task persistence scores of male and female pupils in mathematics

Gender	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Male	57	24.53	.58	40.02	1.67	15.49	
Female	46	24.15	.54	39.15	1.77	15.00	0.49

Data in table 9 shows the pre-test mean and standard deviation scores ($M=24.53$; $SD=0.58$) of the male group and post-test mean and standard deviation scores ($M=40.02$; $SD=1.67$) of the same male group with a mean gain of 15.49. Also, it was found that the pre-test mean and standard deviation scores ($M=24.15$; $SD=0.54$) of the female group and post-test mean and standard deviation scores ($M=39.15$; $SD=1.77$) of the same group with mean gain of 15.00. Therefore, the mean difference of .49 for the two groups shows that male pupils' experienced slight improvement in Mathematics task persistence more than their female counterparts.

H_{05} : There is no significant difference in the mean task persistence scores of male and female pupils in mathematics.

Table 10: ANCOVA on the task persistence scores of male and female pupils in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13682.173 ^a	4	3420.543	200.270	.000	.891
Intercept	1992.329	1	1992.329	116.649	.000	.543
Pretest	398.999	1	398.999	23.361	.000	.192
Methods	13506.126	1	13506.126	790.772	.000	.890
Gender	.117	1	.117	.007	.934	.000
methods * gender	.102	1	.102	.006	.938	.000
Error	1673.807	98	17.080			
Total	177130.000	103				
Corrected Total	15355.981	102				

a. R Squared = .891 (Adjusted R Squared = .887)

Data in table 10 shows $F(1,98) = 0.007$, $p=0.938 > 0.05$ level of significance. Therefore, the null hypothesis which states that there is no significant difference in the mean task persistence scores of male and female pupils in mathematics holds true. Therefore, there is no significant difference in the mean task persistence scores of male and female pupils in mathematics.

Discussion,

The findings revealed that pupils' mathematics interest was improved more for those exposed to hands-on activities than those exposed to the conventional. The hypothesis showed that there is a significant difference in the mean Mathematics interest scores of pupils exposed to hands-on activities and those exposed to the conventional method. Interest is a construct that needs activities that are enticing especially in the educational sector. The finding of this study showed that hands-on activities are capable of arousing pupils' interest in Mathematics. This is because the more academic activities is enriching, the more interested the process of learning would be. These hands-on activities could be the reason for the improvement in pupils' interest in mathematics. The finding of this study buttressed that of Holstermann, Grube, and Bögeholz (2009) which reported that hands-on activities can influence pupils' interest. Furthermore, Holstermann, Grube, and Bögeholz concluded that hands-on activities have a positive effect on interest. In the same vain, this study corroborated that of Zhang, Tucker, and Stigler (2022) which reported that hands-on activities can improve pupils' interest and understanding. Moreso, the finding of this study is in line with that of Okeke, et al (2022) which found that spaced learning had a significant

positive effect on pupils' interest as well as retention in mathematics. In the light of the foregoing discussion, it is deduced that hands-on learning activities can impact on pupils' interest in Mathematics.

The finding of this study shows that pupils' mathematics task persistence was improved more for those exposed to hands-on activities than those not exposed. This confirms the hypothesis that there was a significant difference in the mean Mathematics task persistence scores of pupils exposed to hands-on activities and those exposed to the conventional method. Hands-on learning activities are practical activities programmed in a manner that can sustain pupils' interest which can lead to task persistence in Mathematics. This implied that the more the learning activities is enriching and rewarding, the more engaging pupils' would be in the learning process irrespective of the level of difficulty of the task. Thus leading to task persistence until the task is accomplished. The finding of this study supported that of Hashmi, Seok and Halik (2017) which showed a significant gain score difference between the experimental and control groups on task persistence for puzzles but not for shape sorters, cause and effect toys, and mastery pleasure. In the same vein, the finding of this study concurred with that of Onyishi, Onah, Onuigbo and Eze (2020) which reported that task-persistence of students with learning disability as well as students without disabilities in general education settings improved over their counterparts in the control group who were exposed to conventional teaching method. More so, Kehinde, Saddiq, and Sabitu (2021) in their study found that there is a significant effect of hands-on activities in pupils' achievement and retention in fraction than the conventional method. Furthermore, the finding of this study aligns with that of Torgrimson, Tan, and Grammer (2021) which revealed that task persistence becomes far effective as the pupils are motivated through rewarding instructional process.

The finding of this study shows that pupils' achievement in mathematics was improved more for those exposed to hands-on activities than those not exposed. This confirms the hypothesis that there is a significant difference in the mean Mathematics achievement scores of pupils exposed to hands-on activities and those exposed to the conventional method. The result of this study showed that effectiveness of hands-on learning activities on academic achievement of pupils as a pointer that at this age bracket, pupils like exploration and probing in order to inquire and acquire more knowledge about issue at hand especially in Mathematics. This is because Mathematics concepts are better understood through practical and concrete methods of learning. Thus, using hands-on learning activities has helped to improve pupils' interests which invariably lead to improved academic achievement in mathematics as these activities makes the pupils involved in the learning process. The finding of this study also aligns with that of Oludipe, Ojediran and Kareem (2020) which reported the effectiveness of hands-on and minds-on activities on students' learning outcomes. The finding of this study also supports that of Adeyinka, Khalid and Abiodun (2021) which showed that there is a significant difference between hands-on activities and conventional methods of teaching in favour of hands-on activities especially in academic outcomes. In the same vein, this study is in agreement with that of Munir and Mumtaz (2013) which showed that there was a significant difference between the means of the students' achievement in favour of the experimental group. In addition, study conducted by Ekwueme, Ekon and Ezenwa-Nebife (2015) showed a positive improvement on both the students' performance and participation in mathematics and basic science activities and willingness on the part of the teachers to use Hands-on-approach in communicating mathematical and scientific concepts to their students.

The present study found that male pupils' experienced improvement in Mathematics interest more than their female counterparts. This is in contrast with the hypothesis that there was no significant difference in the mean interest scores of male and female pupils in mathematics. This result of male and female pupils having improved mathematics interest than females could be attributed to societal factors where science oriented subjects like Mathematics are regarded as more male oriented and languages and Arts regarded as female oriented. This could also be attributed to the high expectations placed on males than females which helps to amplify their interest in the subject. The finding of this study agrees with Allahnana, Akande, Vintseh, Alaku, and Monica (2018) which revealed that male students performed more than their female counterparts in mathematics. More so, it was reported by Unwaba and Nworgu (2021) that students' gender significantly predicts their interest. Godpower-Echie and Ihenko (2017) also found that gender posed a significant influence on students' interest as well as their achievement. Corroborating the findings of this study, Eriksson (2020) reported that male students significantly have more interest in mathematics than their female counterparts.

The finding of this study shows that male pupils' experienced slight improvement in Mathematics task persistence more than their female counterparts. A hypothesis is that there is no significant difference in the mean task persistence scores of male and female pupils in mathematics. The slight difference in the task persistence of male and female pupils in favour of males shows that they demonstrated almost the same resolve in the achievement and engagement in Mathematics. However males are seen to have more task persistence because of their nature of not giving up easily no matter the circumstances or task involved unlike the females who are not as strong as their counterparts. This could be linked to boys' love for activities that has to do with leaving by active participation. This finding did not support that of Torgrimson, Tan and Grammer (2021) which revealed that gender differences in task persistence among

elementary school children existed in the favour of girls more than males. More so, the finding of this study did not agree with that of Masaudi (2019) which reported that there is a significant difference between gender and academic perseverance in the sampled schools.

Conclusions

Conclusively, the results showed that hands-on activities were an effective teaching method that enhanced pupils' interest in Mathematics, task persistence in Mathematics, and achievement in Mathematics. It was further concluded that the effectiveness of hands-on activities on pupils' interest, task persistence, and achievement in Mathematics occurred irrespective of the moderating influence of gender.

Contributions to Knowledge

The study contributed to knowledge in several ways. It empirically demonstrated that hands-on activities were valid and effective teaching methods that consistently enhanced pupils' interest in Mathematics, their task persistence, and their overall achievement in the subject. The study also showed that the positive effects of hands-on activities on interest, task persistence, and achievement occurred regardless of pupils' gender, providing evidence that such learner-centered strategies could be applied universally in primary school Mathematics classrooms. Furthermore, the findings reinforced the importance of active, experiential learning approaches in improving academic outcomes, offering practical insights for educators, curriculum planners, and policymakers seeking to raise pupils' engagement and performance in Mathematics. These contributions help bridge the gap between theory and practice in teaching Mathematics and provide a foundation for future research on innovative instructional strategies in primary education.

Educational Implications of the Findings

The findings of this study had several educational implications for pupils, primary school teachers, and school administrators. For pupils, the study highlighted the potential to improve their interest, task persistence, and academic achievement in Mathematics. These improvements could translate into higher engagement and better performance in both internal and external Mathematics assessments, fostering a more positive attitude toward learning the subject. For primary school teachers, the findings emphasized the importance of incorporating first-hand experiences and hands-on activities into instructional practices. Teachers were made aware that active, experiential learning strategies could significantly enhance pupils' interest, sustain their effort in tasks, and improve their achievement in Mathematics. Finally, the study carried implications for school administrators, who were positioned to support the effective implementation of hands-on activities. By understanding the value of such learner-centered approaches, administrators could provide the necessary resources, facilities, and supportive environment to facilitate the use of hands-on activities, thereby promoting improved interest, task persistence, and achievement among pupils in the school system.

Recommendations

1. Following the findings of this present study, the following recommendations were made:
2. Head-teachers should avail the teachers opportunities through seminars, conferences and workshops on capacity development that can enhance the application of hands-on activities in Mathematics classes so as to improve on pupils' interest in Mathematics.
3. The teachers should provide varieties of hands-on activities that can properly engage the pupils for a long period of time in order to improve their task persistence in Mathematics.
4. Teachers and school administrators should ensure that all the units in Mathematics are thought through hands-on activities for improved achievement in Mathematics in internal and external examinations.
5. Male and female pupils should form groups of hands-on activities in Mathematics classes in order to improve on their Mathematics interest.
6. Male and female pupils should be matched in various groups of hands-activities in order to encourage their resolve in solving Mathematics.

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