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## GENDER DIFFERENCES AND THE INTERACTION OF TEACHING METHODS ON PUPILS' INTEREST, TASK PERSISTENCE, AND ACADEMIC ACHIEVEMENT IN MATHEMATICS

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### Abstract

This study investigated the gender differences and the interaction of teaching methods on pupils' interest, task persistence, and academic achievement in mathematics. Four research questions and four 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 Nuka 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 0.75 using Kuder-Richardson<sub>20</sub> formula (KR-20). 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 revealed that male pupils experienced slightly greater improvement in Mathematics achievement compared to female pupils. The findings also revealed that no significant interaction effect between gender and teaching method on pupils' interest in Mathematics. It was recommended, among other things, that Head-teachers should motivate pupils by recognizing and rewarding improved performance resulting from the effective use of hands-on activities

**Keywords:** Gender differences, teaching methods, pupils' interest, task persistence, academic achievement

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### Introduction

Education is universally acknowledged as a critical instrument for individual, societal, and national development. It equips individuals with the knowledge, skills, and attitudes necessary to function effectively within society and contributes to social, economic, and technological progress. In this context, primary education represents the foundational stage of formal education, typically catering to children aged 6 to 12 years (Dewey, 2017). In Nigeria, the Federal Republic of Nigeria (2014) defines primary education as the level of education administered to children within this age bracket, aimed at fostering literacy, numeracy, and moral development. Globally, primary education is

recognized as a stage that lays the groundwork for lifelong learning, equipping children with critical thinking, creativity, and problem-solving abilities that influence their success in later educational pursuits (Aboritoli, 2021; Bethany, Becker, Torre & Smerdon, 2016; Ministry of Education Singapore, 2022). The objectives of primary education in Nigeria, as articulated in the National Policy on Education, include the inculcation of literacy and numeracy, the development of critical and reflective thinking, the promotion of patriotism and national unity, the fostering of social and moral values, and the provision of opportunities for life skill development (FRN, 2013). Achieving these objectives requires the implementation of teaching methods that are not only effective but also capable of actively engaging pupils in the learning process. The quality of primary education has far-reaching implications for individual development, national productivity, and technological advancement (Lancehgs, 2022; Sahberg & Pallas, 2022).

Among all subjects in primary education, Mathematics is regarded as fundamental due to its role in developing logical reasoning, analytical thinking, problem-solving abilities, and foundational knowledge for science and technology (Aye bale, Habassa & Twehevo, 2020; Lutfuzzaman, 2014). Mathematics permeates every aspect of human life, from daily decision-making and financial literacy to engineering, architecture, and technological innovation (Elaine & Gordon, 2021; Kele, 2018). Consequently, proficiency in Mathematics at the primary level is essential for pupils' future academic success and the socio-economic development of the nation. Despite the importance of Mathematics, pupils often demonstrate low interest, poor task persistence, and suboptimal academic achievement in the subject. Studies have attributed these challenges to factors such as traditional teacher-centered methods, inadequate instructional materials, negative attitudes toward the subject, and insufficient engagement in the learning process (Adeyinka, Khalid & Abiodu, 2021; Walkington & Bernack, 2014). Interest and task persistence are particularly critical. Interest refers to a pupil's positive disposition toward a subject, which fuels curiosity, attention, and motivation during learning activities (Ogunjimi, Salami & Oyedare, 2015). Pupils who demonstrate high interest are more likely to engage actively in lessons, sustain attention, and achieve higher academic outcomes (Yu & Singh, 2016; Tambunan, 2021). Task persistence, on the other hand, refers to a learner's capacity to continue working on a task or problem despite difficulties or repeated failures (Tinto, 2017; Hashmi, Seok & Halik, 2017). Pupils with low task persistence are prone to behavioral withdrawal and poor academic outcomes, highlighting the need for instructional strategies that encourage sustained engagement.

However, hands-on activities, a learner-centered teaching approach, have emerged as an effective method for enhancing pupils' understanding, engagement, and academic performance. This approach allows pupils to learn by doing, manipulating objects, conducting experiments, and participating actively in problem-solving tasks (Ekwueme, Ekon & Ezenwa-Nebife, 2015; Ukonu, Sababa & Filgona, 2017). Unlike traditional "chalk-and-talk" methods, which are often teacher-centered and passive, hands-on activities enable pupils to directly experience and interact with learning materials, making abstract concepts more concrete and understandable. Research shows that pupils retain up to 75% of information learned through activity-oriented approaches compared to only 5% retention from passive lecture methods (Ekwueme, Ekon & Ezenwa-Nebife, 2015). Hands-on activities also foster critical thinking, creativity, collaboration, and problem-solving skills, aligning with 21st-century educational goals (Ukonu, Sababa & Filgona, 2017; Frugal, 2022). Examples of such activities in Mathematics include number card games, fraction modeling with Lego, play-dough

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exercises for addition and subtraction, and manipulatives for skip counting and problem solving.

Gender has been identified as another factor that may influence pupils' academic outcomes in Mathematics. While some studies suggest that male pupils outperform females in specific areas, others indicate no significant differences, highlighting inconsistencies in the literature (Ajai & Imoko, 2015; Oluyemi et al., 2022). Gender may influence pupils' attitudes, interest, motivation, and task persistence, and understanding these dynamics is essential for designing teaching methods that are inclusive and effective. Empirical studies have shown varied results, with some suggesting that girls exhibit higher task persistence while boys demonstrate higher confidence and interest in Mathematics-related tasks (Torgrimson, Tan & Grammer, 2021; Rodríguez et al., 2022). Despite the growing body of research on hands-on activities and their effects on learning outcomes, most studies have focused on secondary school students or science subjects, leaving a significant gap concerning primary school pupils, particularly in the Nsukka Education Area of Enugu State (Mbonu-Adigwe, Oguezie & Nwankwo, 2021). Few studies have examined the combined effects of hands-on activities on interest, task persistence, and academic achievement in primary Mathematics while considering gender as a moderating factor. This gap underscores the need for research that investigates whether the use of hands-on activities can enhance Mathematics learning outcomes for both male and female pupils in primary schools.

However, in view of these challenges and gaps, the present study seeks to investigate the effect of hands-on activities on pupils' interest, task persistence, and academic achievement in primary school Mathematics in Nsukka Local Government Area of Enugu State, Nigeria. Specifically, the study explores whether hands-on activities can improve learning outcomes in Mathematics and whether the effectiveness of these activities differs based on pupils' gender. The findings of this study are expected to inform teaching practices, curriculum design, and policy decisions aimed at improving Mathematics education at the foundational level, thereby contributing to national development goals.

### **Statement of the Problem**

Mathematics plays a central role in the school curriculum and is a compulsory subject required for pupils' academic progression, regardless of gender. Competence in mathematics equips learners with problem-solving skills that are essential for personal development and for addressing societal challenges. Pupils who attain adequate mathematical understanding are expected to become confident, autonomous, and self-reliant individuals in their educational and future pursuits. However, despite the recognized importance of mathematics, pupils' performance in the subject has remained persistently poor in many schools. Reports from Federal Unity Schools indicate that pupils' achievement in mathematics in the Common Entrance Certificate Examination (CECE) is generally low. This situation raises serious concern among educators, parents, and policymakers. Evidence suggests that many pupils are unable to apply mathematical knowledge acquired in school to real-life situations, pointing to deficiencies in interest, task persistence, and overall achievement in mathematics. Several factors have been identified as contributing to this problem, including gender differences and the teaching methods commonly employed in mathematics classrooms. Pupils' low interest in mathematics and poor task persistence may be linked to instructional approaches that rely heavily on conventional, teacher-centred methods, which often limit pupils' active participation in learning. Such approaches may not adequately address the diverse

learning needs of pupils or sustain their engagement in mathematical tasks. Although innovative teaching methods, such as activity-based and learner-centred approaches, have been reported in previous studies to improve pupils' interest, task persistence, and academic achievement in mathematics, there is limited empirical evidence on how gender differences interact with teaching methods to shape these learning outcomes. This gap in knowledge makes it necessary to examine how gender and teaching methods jointly relate to pupils' interest, task persistence, and academic achievement in mathematics. Therefore, the problem of this study is to examine gender differences and the interaction of teaching methods on pupils' interest, task persistence, and academic achievement in mathematics.

### **Purpose of the Study**

The general purpose of this study is to determine the gender differences and the interaction of teaching methods on pupils' interest, task persistence, and academic achievement in mathematics. To be specific, this study sought to:

1. ascertain the difference in mean achievement scores of female and male pupils in mathematics.
2. establish the interaction effects of gender and teaching methods on pupils' interest in mathematics.
3. determine the interaction effect of gender and teaching method on pupils' task persistence in mathematics.
4. determine the interaction effect of teaching ender on pupils' academic achievement in mathematics.

### **Research Questions**

The following research questions were raised to guide the study:

1. What is the effect of gender influence on academic achievement of pupils in mathematics.
2. What is the interaction effect of gender and teaching method on interest of pupils in mathematics?
3. What is the interaction effect of gender and teaching method on task persistence of pupils in mathematics?
4. What is the interaction effect of gender and teaching method on pupils' academic achievement in mathematics?

### **Hypotheses**

The following hypotheses were tested at 0.05 level of significant

**H<sub>01</sub>:** There is no substantial difference in mean achievement scores of female and male pupils in mathematics.

**H<sub>02</sub>:** There is no substantial interaction effect of gender and teaching method on interest of pupils in mathematics.

**H<sub>03</sub>:** There is no substantial interaction effect of gender and teaching method on task persistence of pupils in mathematics.

**H<sub>04</sub>:** There is no substantial interaction effect of gender and teaching method on pupils' academic achievement in mathematics.

### **Methods**

This study adopted quasi-experimental research design, specifically the pre-test–post-test non-equivalent control group design. Intact primary five classes were used as experimental and control groups due to the non-random nature of school settings. The experimental group was taught using hands-on activity-based teaching methods, while

the control group received instruction through the conventional demonstration method. The study was conducted in Nsukka Local Government Area of Enugu State, Nigeria. The population comprised 2,674 primary five pupils drawn from 114 primary schools in the area. A sample of 103 pupils (57 males and 46 females) was selected using simple random sampling to choose two schools, after which intact primary five classes were purposively used. One school served as the experimental group (53 pupils), while the other served as the control group (50 pupils).

Three researcher-developed instruments were used for data collection: the Pupils' Mathematics Interest Scale (PMIS), the Mathematics Task Persistence Scale (MTPS), and the Mathematics Achievement Test (MAT). The PMIS consisted of 16 items measuring pupils' interest in mathematics, while the MTPS contained 14 items assessing pupils' task persistence. Both instruments employed a four-point Likert response format. The MAT was a 20-item multiple-choice test designed to measure pupils' achievement in mathematics. The instruments were validated by experts in Early Childhood and Primary Education, Educational Psychology, and Measurement and Evaluation. Construct validity of the PMIS and MTPS was established through factor analysis, while content validity of the MAT was ensured using a table of specification. Reliability indices were established through trial testing, yielding Cronbach alpha coefficients of 0.793 for PMIS and 0.865 for MTPS, while the MAT recorded a Kuder–Richardson (KR-20) reliability coefficient of 0.748. The experimental procedure lasted six weeks and involved pre-treatment, treatment, and post-treatment stages. Pre-tests were administered to both groups before the intervention. The treatment phase spanned four weeks, during which the experimental group received instruction using hands-on activities and instructional materials, while the control group was taught using the conventional method. Post-tests were administered to both groups after the intervention. Measures were taken to control extraneous variables, including standardization of instructional procedures, training of research assistants, confidentiality of group assignment, and statistical control of pre-test differences using Analysis of Covariance (ANCOVA). Data were analyzed using mean and standard deviation to answer the research questions, while ANCOVA was used to test the null hypotheses at the 0.05 level of significance. Effect sizes were determined using partial eta squared.

## Results

**Table 1: Mean and Standard deviation scores on achievement score of male and female pupils in mathematics**

Gender	N	Pre-test		Post-test		Mean gain	Mean difference
		Mean	Std	Mean	Std		
Male	57	8.02	.19	14.29	.37	6.27	
Female	46	7.96	.20	14.09	.42	6.13	0.14

Data in table 1 shows the pre-test mean and standard deviation scores ( $M=8.02$ ;  $SD=0.19$ ) of the male group and post-test mean and standard deviation scores ( $M=14.29$ ;  $SD=0.37$ ) of the same male group with a mean gain of 6.27. Also, it was found that the pre-test mean and standard deviation scores ( $M=7.96$ ;  $SD=0.20$ ) of the female group and post-test mean and standard deviation scores ( $M=14.09$ ;  $SD=0.42$ ) of the same group with mean gain of 6.13. Therefore, the mean difference of .14 for the two groups shows that male pupils' experienced slight improvement in Mathematics achievement more than their female counterparts.

**H<sub>01</sub>:** There is on significant difference in mean achievement scores of male and female pupils in mathematics.

**Table 2: ANCOVA on achievement score 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 <sup>a</sup>	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 2 shows  $F(1,98) = 0.082$ ,  $p=0.041 > 0.05$  level of significance. Therefore, the null hypothesis which states that there is no significant difference in the mean achievement scores of male and female pupils in mathematics holds true. Therefore, there is no significant difference in the mean achievement scores of male and female pupils in mathematics.

**Table 3: Mean and Standard deviation scores on interaction effect of teaching method and gender on interest of pupils in mathematics**

Methods	Gender	N	Pretest		Posttest		Mean gain
			Mean	Std. Deviation	Mean	Std. Deviation	
Experimental group	Male	30	26.20	.69	58.47	.96	32.27
	Female	23	26.61	.88	57.96	.99	31.35
Control group	Male	27	29.33	1.00	32.89	1.67	3.56
	Female	23	28.43	1.06	30.87	1.01	2.44

Data in table 3 reveals the pretest mean and standard deviation interest score of pupils in mathematics ( $M = 26.20$ ;  $SD = 0.69$ ) of male pupils in experimental group and post-test mean and standard deviation scores ( $M = 58.47$ ;  $SD = 0.96$ ) of the same group with mean gain score of 32.27. Also, the table reveals the pretest mean and standard deviation interest score of pupils in mathematics ( $M = 26.61$ ;  $SD = 0.88$ ) of female pupils in the control group and post-test mean and standard deviation scores ( $M = 57.96$   $SD = 0.99$ ) of the same group with mean gain score of 31.35. Similarly, the table shows that the pretest mean and standard deviation interest score of pupils in mathematics ( $M = 29.33$ ;  $SD = 1.00$ ) of pupils in control group and post-test mean and standard deviation scores ( $M = 32.89$ ;  $SD = 1.67$ ) of the same group with mean gain score of 3.56. More so, the table reveals the pretest mean and standard deviation interest score of pupils in mathematics ( $M = 28.43$ ;  $SD = 1.06$ ) of male pupils in the experimental group and post-test mean and standard deviation scores ( $M = 30.87$ ;  $SD = 1.01$ ) of the same group with mean gain score of 2.44. The mean differences across gender and the methods showed that there is no interaction effect between the methods used and gender on pupils' interest score in

mathematics.

**H<sub>02</sub>:** There is no significant interaction effect of teaching method and gender on interest of pupils in mathematics.

**Table 4: ANCOVA on interaction effect of teaching method and gender on interest of pupils in mathematics**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	589.184 <sup>a</sup>	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 4 shows  $F(1,98) = 0.516$ ,  $p=0.612 > 0.05$  level of significance. Therefore, the null hypothesis which states that there is no significant interaction effect of teaching method and gender on interest of pupils in mathematics holds true. Therefore, there is no significant interaction effect of teaching method and gender on interest of pupils in mathematics. See figure 2 below for more graphical interpretation on the interaction effect of methods and gender on interest in Mathematics.

**Table 5: Mean and Standard deviation scores on interaction effect of teaching method and gender on task persistence of pupils in mathematics**

Methods	Gender	N	Pretest		Posttest		Mean gain
			Mean	Std. Deviation	Mean	Std. Deviation	
Experimental group	Male	30	24.0333	.71194	50.8000	1.01642	26.77
	Female	23	23.3913	.52502	50.4783	.63765	27.09
Control group	Male	27	25.0741	.94118	28.0370	.93443	2.97
	Female	23	24.9130	.92380	27.8261	.83796	3.97

Data in table 5 reveals the pretest mean and standard deviation task persistence score of pupils in mathematics ( $M = 24.03$ ;  $SD=0.71$ ) of male pupils in experimental group and post-test mean and standard deviation scores ( $M = 50.80$ ;  $SD= 1.02$ ) of the same group with mean gain score of 26.77. Also, the table reveals the pretest mean and standard deviation task persistence score of pupils in mathematics ( $M = 23.39$ ;  $SD=0.53$ ) of female pupils in the control group and post-test mean and standard deviation scores ( $M = 50.48$   $SD= 0.64$ ) of the same group with mean gain score of 27.09. Similarly, the table shows that the pretest mean and standard deviation task persistence score of pupils in mathematics ( $M = 25.07$ ;  $SD=0.84$ ) of pupils in control group and post-test mean and standard deviation scores ( $M = 28.04$ ;  $SD= 0.93$ ) of the same group with mean gain score of 2.97. More so, the table reveals the pretest mean and standard deviation task persistence score of pupils in mathematics ( $M = 24.91$ ;  $SD=0.92$ ) of male pupils in the

experimental group and post-test mean and standard deviation scores ( $M = 27.83$ ;  $SD = 0.84$ ) of the same group with mean gain score of 3.97. The mean differences across gender and the methods showed that there is interaction effect between the methods used and gender on pupils' task persistence score in mathematics.

**H<sub>03</sub>:** There is no significant interaction effect of teaching method and gender on task persistence of pupils in mathematics.

**Table 6: ANCOVA on interaction effect of teaching method and gender on task persistence of pupils in mathematics**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13682.173 <sup>a</sup>	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 on table 6 shows  $F(1,98) = 0.006$ ,  $p = 0.938 > 0.05$  level of significance. Therefore, the null hypothesis which states that there is no significant interaction effect of teaching method and gender on task persistence of pupils in mathematics holds true. Therefore, there is no significant interaction effect of teaching method and gender on task persistence of pupils in mathematics. See figure 3 below for more graphical interpretation on the interaction effect of methods and gender on interest in Mathematics.

**Table 7: Mean and Standard deviation scores on interaction effect of teaching method and gender on pupils academic achievement in mathematics**

Methods	Gender	N	Pretest		Posttest		Mean gain
			Mean	Std. Deviation	Mean	Std. Deviation	
Experimental group	Male	30	7.90	.25	16.50	.27	8.60
	Female	23	8.00	.33	16.35	.38	8.35
Control group	Male	27	8.15	.31	11.85	.28	3.70
	Female	23	7.91	.23	11.83	.31	3.92

Data on table 7 reveals the pretest mean and standard deviation scores of pupils in mathematics achievement ( $M = 7.90$ ;  $SD = 0.25$ ) of male pupils in experimental group and post-test mean and standard deviation scores ( $M = 16.50$ ;  $SD = 0.27$ ) of the same group with mean gain score of 8.60. Also, the table reveals the pretest mean and standard deviation of pupils in mathematics achievement ( $M = 8.00$ ;  $SD = 0.33$ ) of female pupils in the control group and post-test mean and standard deviation scores ( $M = 16.35$ ;  $SD = 0.38$ ) of the same group with mean gain score of 8.35. Similarly, the table shows that the pretest mean and standard deviation of pupils in mathematics achievement ( $M = 8.15$ ;  $SD = 0.31$ ) of pupils in control group and post-test mean and standard deviation scores ( $M = 11.85$ ;

SD= 0.28) of the same group with mean gain score of 3.70. More so, the table reveals the pretest mean and standard deviation scores of pupils in mathematics achievement ( $M = 7.91$ ;  $SD = 0.23$ ) of male pupils in the experimental group and post-test mean and standard deviation scores ( $M = 11.83$ ;  $SD = 0.31$ ) of the same group with mean gain score of 3.92. The mean differences across gender and the methods showed that there is interaction effect between the methods used and gender on pupils' mathematics achievement. Ho9: There is no significant interaction effect of teaching method and gender on pupils' academic achievement in mathematics.

**Table 8: ANOVA on interaction effect of teaching method and gender on pupils academic achievement in mathematics**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	589.184 <sup>a</sup>	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 on table 8 shows  $F(1,98) = 0.516$ ,  $p = 0.259 > 0.05$  level of significance. Therefore, the null hypothesis which states that there is no significant interaction effect of teaching method and gender on pupils' achievement in mathematics holds true. Therefore, there is no significant interaction effect of teaching method and gender on achievement in mathematics. See figure 4 below for more graphical interpretation on the interaction effect of methods and gender on pupils' achievement in mathematics.

**Discussion**

The findings of the study reviewed that male pupils experienced slightly greater improvement in Mathematics achievement compared to female pupils. The hypothesis tested stated that there is no significant difference in the mean achievement scores of male and female pupils in Mathematics. The observed difference, where males improved more than females, could be attributed to socio-economic factors, such as some females engaging in household or labour activities that reduce time available for study, thereby potentially affecting their academic achievement in Mathematics. This finding aligns with the study of Ajai and Imoko (2015), which revealed that male and female students did not differ significantly in their Mathematics achievement. Similarly, Oluyemi, Musbahu, Kukwile, Anikweze, and Shaluko (2022) reported that gender differences do not significantly determine Mathematics achievement. Furthermore, the findings support Ukonu, Sababa, and Filgona (2022), who showed that the use of hands-on learning activities enhanced students' achievement regardless of gender. However, the finding

contrasts with some studies that suggest females achieve better than males in Mathematics (Tarig, Ali & Ahmad, 2012).

The present study also found no significant interaction effect between gender and teaching method on pupils' interest in Mathematics. Since hands-on learning activities are not gender-specific, they did not favor the interest of one gender over the other. This outcome is consistent with Ukonu, Sababa, and Filgona (2022), who found that the use of instructional materials improved students' achievement without significant gender differences. Similarly, Oluyemi et al. (2022) observed that while male students excelled slightly more, alternative teaching methods improved learning outcomes for both genders. Regarding task persistence, the study found no significant interaction effect between gender and teaching methods. It is suggested that mixing male and female pupils in learning activities can enhance engagement and persistence. Males may demonstrate greater persistence when faced with challenges, whereas females might be more likely to disengage. Nevertheless, the present findings support Ukonu, Sababa, and Filgona (2022), showing that hands-on activities improve engagement and task persistence in both genders, even if minor differences exist.

Interestingly, the study revealed a significant interaction effect between teaching methods and gender on Mathematics achievement. Hands-on activities, being creative and innovative, may build self-confidence in pupils and enhance their academic performance, benefiting both genders. This could also relate to societal perceptions of gender roles, where Mathematics is often viewed as male-oriented, influencing learning patterns and engagement. While this study's finding differs from that of Mbonu-Adigwe, Oguezie, and Nwankwo (2022), who reported significant gender differences in achievement, it supports the general view that hands-on methods can enhance performance across genders. Finally, the present study's findings are partially consistent with Filgona, Filgona, and Sababa (2016), who reported a significant effect of hands-on learning strategies on student achievement but no significant gender effect. Both studies indicate that while teaching methods impact achievement, gender alone does not consistently predict outcomes.

### **Contributions to Knowledge**

This study contributes to existing knowledge by providing empirical evidence on the role of teaching methods in shaping pupils' interest, task persistence, and academic achievement in mathematics. Specifically, the findings demonstrate that learner-centred teaching methods, such as hands-on activities, are effective in promoting sustained interest, improved task persistence, and higher achievement among pupils in mathematics. In addition, the study advances understanding of gender issues in mathematics education by showing that the effectiveness of teaching methods on pupils' interest, task persistence, and academic achievement is consistent across gender. This indicates that well-designed instructional strategies can support positive learning outcomes for both male and female pupils, thereby contributing to equitable and inclusive mathematics instruction.

### **Educational Implications of the Findings**

The findings of this study have important implications for pupils, teachers, and school administrators. For pupils, the use of appropriate teaching methods can enhance interest in mathematics, promote sustained task persistence, and improve academic achievement, leading to better performance in examinations and increased confidence in learning mathematics. For teachers, the findings emphasize the value of learner-centred

instructional strategies, such as hands-on activities, in promoting active participation and improving pupils' learning outcomes in mathematics. School administrators, on the other hand, are encouraged to support the implementation of effective teaching methods by providing adequate instructional materials and creating enabling learning environments that foster pupils' interest, task persistence, and academic achievement.

### **Conclusion**

Based on the findings of the study, teaching methods play a significant role in shaping pupils' interest, task persistence, and academic achievement in mathematics. The results further reveal that while gender differences exist in pupils' mathematics achievement, the interaction between gender and teaching methods does not significantly alter pupils' interest, task persistence, or academic achievement in mathematics. This indicates that effective teaching methods can enhance learning outcomes for pupils irrespective of gender. Consequently, the use of appropriate and engaging instructional approaches is essential for promoting sustained interest, persistence, and improved achievement in mathematics among pupils.

### **Recommendations**

Based on the findings of this study, the following recommendations are made:

1. Encourage male and female pupils to participate collaboratively in hands-on mathematics activities to enhance interest in the subject.
2. Group pupils in mixed-gender hands-on activity sessions to promote cooperation and strengthen task persistence.
3. Motivate pupils by recognizing and rewarding improved performance resulting from effective use of hands-on activities.

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