



Effects of Touchmath Multisensory Program on ... Olotu, P. O. & Olekanma, J. E. (2025)

Effects Of Touchmath Multisensory Program on Addition and Subtraction Skills Among Selected Public School Pupils In Uyo, Akwa Ibom State, Nigeria

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Abstract

The study examined the effect of the TouchMath multisensory program on addition and subtraction skills of primary two pupils in mathematics in selected public schools in Uyo, Akwa Ibom State Nigeria. Guided by three research questions and three hypotheses, the study employed a quasi-experimental pretest-posttest nonequivalent group design. A sample of 120 pupils from six intact classes was selected through simple random sampling. The Mathematical Computational Skills Achievement Test (MCSAT), validated by experts, was used for data collection, with a reliability coefficient of 0.91 determined using Kuder Richardson Formula 20. Mean and standard deviation were used to answer research questions, while ANCOVA tested hypotheses at a 0.05 significance level. Findings revealed a significant difference in addition and subtraction skills between pupils taught with the TouchMath program and those taught conventionally. However, no significant gender-based differences were found in skills when using TouchMath. The study recommends adopting the TouchMath multisensory program for teaching mathematics in lower basic education to enhance computational skills.

Keyword: Computational Skills, Addition, Subtraction, Mathematics, Touchmath Multisensory Program, Pupils achievement

Introduction

Mathematics is a core subject in Nigeria's primary and secondary education, vital for acquiring skills in science, technology, and nation-building (Ibok & Unoh, 2019). It is essential for daily life, enabling intelligent and efficient functioning across various sectors (Ibok et al., 2019). Mathematics is globally recognized as crucial for developing skills applicable to diverse fields (Ukwueze et al., 2024). Proficiency in basic operations—addition, subtraction, multiplication, and division—underpins scientific reasoning and subjects like physics and chemistry (Okoye, 2021). However, many pupils find mathematics challenging, with high failure rates in the first school leaving certificate examination, raising concerns among researchers and stakeholders about early skill development (Ukwueze, 2024). Basic mathematical skills, including analyzing, problem-solving, addition, subtraction, fractions, and decimals, are taught in primary schools (Hayes, 2005). Primary education, the foundation of formal learning, prepares students for higher academic pursuits (Asodike & Ikpitibo, 2014; Anero, 2014). A strong primary education supports vocational and technical skills acquired later (Mba, 2019). Yet, many children face content beyond their cognitive capacity, leading to long-term deficiencies (Okoye, 2021). Success at secondary and tertiary levels depends on the foundation laid in primary years, prompting many nations, including Nigeria, to make primary education free and compulsory (National Policy on Education, 2013). In lower primary classes, basic mathematical concepts are introduced to support advanced applications in upper primary levels. The National Policy on Education (2013) defines primary education as education for children aged 6–12, aiming to foster permanent literacy, numeracy, critical thinking, and life-



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manipulative skills. The four fundamental operations—addition, subtraction, multiplication, and division—are key concepts taught at this level (Tessema, 2018). Proficiency in these skills enables students to solve complex problems. This study focuses on addition and subtraction skills, as many pupils lack proficiency due to poor teaching methods that present mathematics as abstract and difficult (Ukwueze, 2024). Studies support manipulatives as an effective method for teaching mathematics, with students using manipulatives outperforming those who do not (Alolga & Essel, 2021; Amo-Asante & Bangah, 2023). Items known as manipulatives can be touched, moved, rearranged, and in other ways handled by kids, promoting pupils' achievement in the classroom (Amo-Asante & Bonyah, 2023). Manipulatives, both physical and digital, engage multiple senses (Johnson-Smith, 2022). The National Council of Supervisors of Mathematics (NCSM) states that using tangible and digital manipulatives in lesson plans raises student achievement (Berger, Mackenzie, and Holmes, 2020; Moore, 2014). Despite these findings, pupils in lower primary classes struggle with computational skills, necessitating innovative teaching strategies.

This study investigates the efficacy of the TouchMath multisensory program in teaching addition and subtraction to primary two pupils in Uyo Local Government Area, Akwa Ibom State. TouchMath requires students to use specific points on numerals to add correctly and quickly, engaging visual, tactile, and kinesthetic senses (TouchMath.com, 2014; Bergman, 2014). Research supports TouchMath's effectiveness in improving cardinality, operational algorithms, conceptual understanding, fluency, automaticity, and modeling (Yikmus, 2016). Good mathematics teachers typically use visuals, manipulatives, and motion to enhance students' understanding of math concepts (Boaler, 2018). TouchMath bridges concrete and representational mathematics, addressing pupils' academic and cognitive needs (Yikmus, 2016). No studies on TouchMath have been conducted in Uyo, and this research incorporates gender as a variable. Gender disparities in mathematics performance are a concern, with boys often outperforming girls (Ajai & Imoko, 2015; Kabote, Niboye, and Nombo, 2014). Young children develop implicit gender stereotypes by age six, with girls perceiving boys as more capable in mathematics (Galdi, Cadinu, and Tomasetto, 2014). In Nigeria, cultural factors exacerbate gender inequalities in education, though male superiority in problem-solving is not universal (Abubakar & Adegboyega, 2012). A learner-centered, gender-responsive pedagogy like TouchMath may reduce disparities (Mwakabenga & Komba, 2021). Given the limitations of conventional teaching methods, which fail to engage pupils effectively, this study examines the effect of the TouchMath multisensory program on addition and subtraction skills of primary two pupils in selected public schools in Uyo Local Government Area, aiming to address challenges in mathematics education and gender disparities.

Statement of The Problem

Despite its importance, primary school pupils in Nigeria consistently fail mathematics massively, especially in basic computational skills. By Primary Two and Three, many lack fluency in addition and subtraction—the very foundation required for further learning. This persistent failure stems from ineffective conventional teaching methods that are abstract, teacher-centered, unengaging, and fail to use multisensory or hands-on approaches suitable for young learners. These methods also ignore gender differences in learning preferences, with boys favoring direct instruction and girls performing better in interactive, cooperative settings. Although the need for more effective, engaging, and inclusive strategies is evident, there is little research in Nigeria—particularly in Akwa Ibom State—on the use of multisensory programs like TouchMath to build early computational fluency.



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This study fills that gap by examining the effect of the TouchMath Multisensory Program on the mathematical computational skills of Primary Two pupils in selected public schools in Uyo Local Government Area.

Objectives of the study

The general objective of this study is to examine the effect of TouchMath Multisensory program on addition and subtraction skills among selected public schools in Uyo, Akwa Ibom State Nigeria. Specifically, the objective of the study is;

1. To determine the mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State.
2. To determine mean achievement scores of pupils taught subtraction computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State.
3. To determine mean achievement scores of male and female pupils taught addition computation skills using Touch-Math-Multisensory program in Uyo, Akwa Ibom State.

Research Questions

The study was guided by the following research questions.

1. What is the mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State?
2. What is the mean achievement scores of pupils taught subtraction computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State?
3. What is the mean achievement scores of male and female pupils taught addition computation skills using Touch-Math-Multisensory program in Uyo, Akwa Ibom State?

Hypotheses

The following hypotheses guided the study.

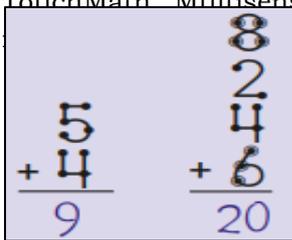
1. There is no significant difference in mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State
2. There is no significant difference in mean achievement scores of pupils taught subtraction computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State
3. There is no significant difference in mean achievement scores of male and female pupils taught addition computation skills using Touch-Math-Multisensory program in Uyo, Akwa Ibom State

Methodology

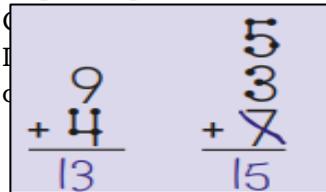
Ethical consideration Permission was granted by the ethical committee of the University of Uyo, Uyo Akwa Ibom State to conduct this study. This study adopted quasi-experimental research specifically, pretest-post-test non-equivalent control group design. According to Ezech (2015), a quasi-experimental design is one in which random assignment of subjects to treatment and control groups is not possible, but rather intact classes were used as experimental and control groups. The population comprised 11,180 primary two pupils (M=5361; F=5819) from 47 public schools in Uyo, Akwa Ibom State. A sample of 120 pupils (M=50; F=70) from six intact classes in six schools—67 in the experimental group (M=32; F=35) and 53 in the control group (M=18; F=35)—was selected via random sampling. The Mathematical Computational Skills Achievement Test (MCSAT), developed by

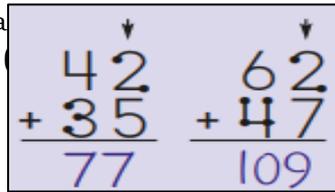
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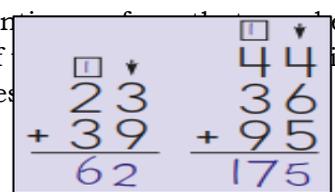
the researcher, included Section A for personal data and Section B with 20 mathematics questions. MCSAT was validated by experts from the Early Childhood and Special Education Department, a primary two teacher, and a head teacher. A pilot test on 24 equivalent pupils yielded a Kuder Richardson formula 20 reliability coefficient of 0.91. Lesson plans served as treatment packages. Permission was obtained from head teachers of sampled schools via introductory letters. Five trained research assistants upheld voluntary and informed consent. MCSAT was administered as a pretest to both groups. The experimental group was taught two-digit addition and subtraction using the TouchMath Multisensory Program. Week one focused on prerequisites: counting, numeral recognition of two-digit numbers, with pupils touching points on numerals for mastery. Week two focused on addition.



Beginning Addition

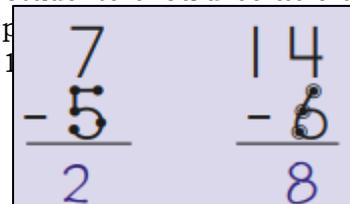


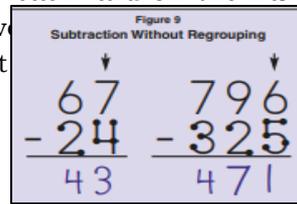


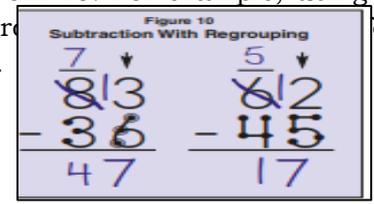


Addition without Regrouping Addition with Continuance Counting Addition with Regrouping

Week three starts with subtraction: the prerequisite to TouchMath subtraction is backward counting. Students should be able to count backward on the number line from 18. For example, using the







Beginning Subtraction Subtraction without Regrouping. Subtraction with Regrouping

Week four consolidated the study with a revision class. Research assistants used lesson plans as a guide for the treatment packages. The control group received the Talk and Chalk method. The treatment lasted four weeks. The Mathematical Computational Skills Achievement Test (MCSAT) was administered as a posttest to both experimental and control groups. SPSS version 20 calculated the mean and standard deviation for research questions. ANCOVA tested hypotheses at a 0.05



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significance level, using pretest scores as covariates for posttest scores. ANCOVA controlled extraneous variables, adjusted for non-randomized groups, ensured equivalent groups with intact classes, and highlighted initial group differences.

Presentation of Results

Participants' Bio-data Variables Category Experimental Group 67 (Males=32; Females=35) and Control Group 53 (Males=18; Females=35)

Research Question 1: What is the mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State?

Table 1: Mean Standard Deviation and mean difference in the addition achievement of pupils taught with TouchMath multisensory program and those taught with conventional teaching method

Groups	n	Pre-test SD	Post-test SD	Mean Difference
TouchMath Multisensory Program	67	2.10	1.18	2.94 1.19 0,84
Conventional Teaching Method	53	1.81	0.92	1.83 1.06 0.02

Table 1 shows the experimental group (TouchMath) with pretest/posttest means of 2.10/2.94 (SD 1.18/1.19) and control group (conventional) with 1.81/1.83 (SD 0.92/1.06). Mean differences indicate better addition achievement for TouchMath pupils.

Hypothesis 1

There is no significant difference in mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State

Table 2: Result of Analysis of Covariance (ANCOVA) of the significant difference in the in the addition achievement of pupils taught with TouchMath multisensory program and those taught with conventional teaching method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	46.899 ^a	2	23.450	19.213	.000
Intercept	92.991	1	92.991	76.190	.000
Pretest	10.432	1	10.432	8.547	.004
Methods of teaching	30.761	1	30.761	25.203	.000
Error	142.801	117	1.221		
Total	910.000	120			
Corrected Total	189.700	119			

a. R Squared = .247 (Adjusted R Squared = .234)

Table 2 reveals an F-ratio of 25.203 ($p = 0.000$) for the difference in addition achievement between pupils taught with the TouchMath multisensory program and those taught conventionally. Since $p < 0.05$, null hypothesis 1, stating no significant difference, was rejected, indicating a significant improvement in addition achievement with TouchMath.

Research Question 2: What is the mean achievement scores of pupils taught subtraction computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwaibom State?



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Table 3: Mean Standard Deviation and mean difference in the subtraction achievement of pupils taught with TouchMath multisensory program and those taught with conventional teaching method

Groups	n	Pre-test		Post-test		Mean Difference
		SD	SD	SD	SD	
TouchMath Multisensory Program	67	1.46	1.34	2.22	1.46	0.76
Conventional Teaching Method	53	1.35	1.21	1.54	1.20	0.19

Table 3 shows the experimental group (TouchMath) with pretest/posttest means of 1.46/2.22 (SD 1.34/1.46) and control group (conventional) with 1.35/1.54 (SD 1.21/1.20). Mean differences indicate better subtraction achievement for TouchMath pupils.

Hypothesis 2

There is no significant difference in mean achievement scores of pupils taught addition computation skills using Touch-Math-Multisensory program and those exposed to lecture teaching method in Uyo, Akwa Ibom State

Table 4: Result of Analysis of Covariance (ANCOVA) of the significant difference in the subtraction achievement of pupils taught with TouchMath multisensory program and those taught with conventional teaching method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16.931 ^a	2	8.466	4.642	.011
Intercept	154.826	1	154.826	84.888	.000
Pretest	3.380	1	3.380	1.853	.176
Methods of teaching	12.986	1	12.986	7.120	.009
Error	213.394	117	1.824		
Total	675.000	120			
Corrected Total	230.325	119			

a. R Squared = .074 (Adjusted R Squared = .058)

Table 4 shows an F-ratio of 7.120 (p = 0.009) for subtraction achievement differences between TouchMath and conventional teaching groups. As p < 0.05, null hypothesis 2, claiming no significant difference, was rejected, confirming superior subtraction achievement with TouchMath.

Research Question 3:What is the mean achievement scores of male and female pupils taught addition computation skills using Touch-Math-Multisensory program in Uyo, Akwa Ibom State?

Table 5:Mean Standard Deviation and mean difference in the addition and subtraction skills of boys and girls taught with TouchMath Multisensory Program

Gender	N	Pre-test		Post-test		Mean Difference
		SD	SD	SD	SD	
Boys	32	7.65	4.89	12.08	4.41	4.43
Girls	35	9.00	4.00	13.12	3.39	4.12

Table 5 shows boys' pretest/posttest means of 7.65/12.08 (SD 4.89/4.41) and girls' means of 9.00/13.12 (SD 4.00/3.39) using TouchMath. Boys' mean difference (4.43) slightly exceeds girls' (4.12), indicating both benefited from the TouchMath multisensory program.

Hypothesis 3



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There is no significant difference in mean achievement scores of male and female pupils taught addition computation skills using Touch-Math-Multisensory program in Uyo, Akwaibom State

Table 6: Result of Analysis of Covariance (ANCOVA) of the significant difference in the addition and subtraction skills achievement of boys and girls taught with TouchMath Multisensory Program

Source	Type Sum Squares	III of	Df	Mean Square	F	Sig.
Corrected Model	318.249		2	159.125	14.143	.000
Intercept	1097.865		1	1097.865	97.581	.000
Pretest	300.193		1	300.193	26.682	.000
Methodsof teaching	2.581		1	2.581	.229	.634
Error	720.049		64	11.251		
Total	11645.000		67			
Corrected Total	1038.299		66			

a. R Squared = .307 (Adjusted R Squared = .285)

Table 6 reports an F-ratio of 0.229 ($p = 0.634$) for the difference in mathematics computational skills achievement between boys and girls taught with the TouchMath Multisensory Program. Since $p > 0.05$, null hypothesis 3, stating no significant difference, was accepted, indicating no gender-based difference in achievement.

Discussion of Findings

The study found that pupils taught with the TouchMath Multisensory Program outperformed those taught with the conventional method in addition achievement, with a significant difference in performance. This aligns with Calik (2010), who found that touch math techniques based on direct instruction effectively teach basic summation skills to students with mild intellectual disabilities. Similarly, Amaal Ahmed Mostafa (2013) reported the effectiveness of the TouchMath program in enhancing addition skills among target children. Yıkmış (2016) also found the touch math technique effective, with all participants showing improved addition skills by the end of teaching sessions compared to baseline, supporting the technique's generalizability and maintenance.

Pupils taught with TouchMath also performed better in subtraction achievement than those taught conventionally, with a significant difference in outcomes. This concurs with Abdallah (2020), who found higher post-test mean scores in addition and subtraction for the experimental group using the TouchMath multisensory program, indicating its effectiveness for young children at risk for computation skill acquisition. This finding supports Jerome Bruner's (1966) theory that mental development progresses through concrete, pictorial, and symbolic stages, with early learning enhanced by manipulative activities. The study revealed that pupils taught with TouchMath outperformed those taught conventionally in multiplication achievement, with a significant difference in performance. This agrees with Khalifa and Saad (2021), who found that TouchMath positively impacts early mathematics ability in kindergarten children with mild to borderline intellectual functioning and their typically developing peers in inclusive classrooms, proving effective, sustainable, and generalizable. Ullrich (2014) also found that TouchMath instruction improved students' ability to add quickly and accurately, regardless of gender, language, or attendance.

No significant gender differences were found in mathematics computational skills achievement among pupils taught with TouchMath, despite boys showing a slightly higher mean difference. This



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supports Kashefi et al. (2018), who found no significant gender differences in mathematics performance in higher-order thinking skills among grade four Malaysian international school students. However, this contrasts with Oribhabor (2020), who found significant gender differences favoring males among senior secondary students in Bayelsa State, and Anjum (2015), who reported differences in mathematics achievement between boys and girls at the upper primary stage. Similarly, no significant gender differences were found in addition and subtraction achievement among pupils taught with TouchMath, despite boys' slightly higher mean difference. This aligns with Kashefi et al. (2018) but contrasts with Oribhabor (2020) and Anjum (2015), who found significant gender differences favoring males.

Limitations included head teachers' reluctance to allow the experimental study and financial constraints for purchasing TouchMath kits. These were overcome by securing permission with an introductory letter and improvising teaching aids. As no prior study in Uyo Local Government Area examined TouchMath, this research contributes to knowledge by demonstrating its effectiveness in improving addition and subtraction skills and adding to literature on computational skills and classroom practices. Since no study explored TouchMath and multiplication achievement, this study highlights its potential in this area. The study focused only on addition and subtraction skills. Further research should investigate other computational skills, such as multiplication and division of two- and three-digit numbers.

Conclusion

Based on the findings of this study, it was concluded that TouchMath Multisensory Program has a significant effect on mathematical computational skills of pupils in Uyo Local Government Area of Akwa Ibom State. There is no significant gender difference on mathematical computational skills that is counting, addition, subtraction and multiplication.

Recommendations

Based on the conclusion of the study the following recommendations were made:

1. The study found the use of TouchMath Multisensory Program effective in enhancing meaningful learning in mathematical addition and subtraction skills, thus teachers should be encouraged to use TouchMath Multisensory Program in teaching addition and subtraction skills.
2. The State Ministry of Education should provide instructional materials, which are needed for the implementation of TouchMath Multisensory Program as a method of teaching
3. Both the State and the Federal Government should organize workshops, seminars and for primary teachers on how to use TouchMath Multisensory Program in the teaching and learning process.

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