

Effect of Mental Mathematics Instructions on Primary Pupils' Mathematics Achievement and Retention in South -Eastern Nigeria.

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Abstract

The study investigated the effects of mental mathematics instruction on learners retention and achievement in primary mathematics in South-Eastern Nigeria for present business World. The study was a quasi - experimental which adopted pre-test, post-test experimental groups where two intact classes received treatment. The population of the study was 870 , which comprised all primary four learners from Government owned schools . The purposive and simple random sampling techniques were used to select schools and intact classes for the study .The sample was 87 which is 10% of the entire population. The instrument for data collection was Researcher made mental mathematics test (RMMMT) which was duly validated and reliability coefficient of 0.83 established from Crombach Alpha. The data obtained were analysed using the Mean, Probability Analysis and Analysis of covariance (ANCOVA) F-test ,tested at 0.05 level of significance. The major findings of the study are :Teacher conventional instruction and Mental mathematics instruction have influence on learners achievement in mental mathematics prolonged retention ,but the two approaches combined yielded a more positive result. Recommendations are made, among which is that Education stake holders , Administrators of schools and Ministry of Education should include mental mathematics text books in their list of recommended text book for primary school pupils and also assign time to mental mathematics teaching in their school time table.

Key words : Mental Mathematics Instruction ,Retention , Achievement And Business Education.

1.0 Introduction

This 21st Century termed Global Era has greatly recorded massive use of Calculators as part of classroom instructions even at the primary level of education. It is evident that the use of Calculators help both teachers and learners to carry out hard and complicated mathematical operations quickly and more accurately.

(Nwachukwu ,2016) emphasized that use of Calculators make tasks easy for both teachers and learners, help them to understand problems at hand, find out best methods to solve the problems and make them to spend less time in calculations. Despite the above observations, teachers and researchers like Marvel, (2021), Ekenma, (2018)

and Nwoke ,(2015) still maintain that mental Mathematics is very important and helpful in understanding mathematical skills and concepts and generally in the teaching and learning of mathematics especially at the primary level. The is true in the sense that the brain needs activities to help it's Dendrite grow into forest and mental mathematics is one of such activities. Mental mathematics which is also known as Mental calculation is the ability of an individual to perform mathematical calculations in his / her head without using any helping aid like Calculator. (Onyewu, 2019) , defined Mental Mathematics as the ability to calculate mentally without the use of memory help. One of the major benefits of mental mathematics according to Marvel (2021) is that mental mathematics take shorter time to complete a task than calculator and mental mathematics help in computing answers to questions and also help in checking the correctness of answers obtained. For instance, learning to multiply 7 by 3 is easily done by putting 7 together into 3 places. The objectives of teaching and learning mental mathematics according to Reye & Reye (1998) as cited in Sani, (2015) include the following

- i. It is a prerequisite for successful development of all written arithmetic algorithm.
- ii. It promotes greater understanding of the structure of numbers and their properties.
- iii. It promotes creative and independent thinking and encourage students to create ingenious ways of handling number
- iv. It contributes to the development of better problem solving skills.

It is the basis for development of computation and estimation skills. Mental Mathematics is needed in daily life transactions. It is highly needed in Business Education, Science and Technology. Mathematics has been identified as one of the major bedrock subjects for the transformation of our nation's economy and hence must be accorded adequate attention. Science and technical education are the factory for the production of the needed technologists, technicians and craftsmen as well as skilled artisans and professionals who are required to turn the nation's economy around and usher in the desired technological advancement. Mathematics at the primary level is

the solid foundation on which other subjects are built. It is one subject that has a lot of relevance in the life of everyone and in the study of all other subjects and the entire business world. It contributes immensely to all human endeavours. It is seen as the science of counting, measuring, and describing the shape of objects. It deals with logical reasoning and quantitative calculations. (Akakpo, 2016). (Al-Takhynah, 2018) indicated that mathematics is one of the most important subjects in the field of education , business , science and technology where develop the ability to think, solve problems, and develop the skills of arithmetic and engineering principles, analysis, induction, and the use of mathematical rules in various areas of knowledge, such as trade, technology, engineering, and other natural sciences. Mathematics as a subject is seen as the queen of all sciences and the fulcrum on which all science subjects revolve. It is very useful in the development of creative thinking and self-confidence.

Retention which is defined by Bright, (2021) as the ability to store learned materials in the long term memory of the brain is also an important psychological concept that must be put into consideration during the teaching and learning process. If there is no retention, it means teaching and learning was not effective and this affects achievement and every other aspect of life. The measurement of retention is possible by the use of explicit and implicit measures. Explicit measures require that a learner must remember some given information that is stored in the long term memory. The learner makes deliberate efforts to recall the details of the previously experienced events or materials. This is a direct measure of retention. The implicit measure of retention is one in which the learner has to perform some tasks in which no deliberate or intentional effort is made to retrieve information from the memory.

Achievement is a very important psychological variable that must be put into consideration anytime teaching and learning process are into play. Achievement is a complex and dynamic concept that extends far beyond mere accomplishment. It's a testament to human capacity for growth, perseverance, and aspiration.

Achievement motivation is a driving force that propels individuals to set objectives, overcome challenges, and persist in the face of adversity. Some of the key Elements of Achievement are - Effort: Dedication and hard work required to pursue a goal, involving consistent application of skills, knowledge, and resources. - Aspiration: The desire or ambition that motivates an individual to strive for something better, fuelling necessary effort.- Resilience: The ability to bounce back from setbacks and failures, crucial for maintaining momentum when faced with challenges.

Understanding Gender: Male and Female Gender is a complex and multifaceted concept that encompasses various aspects of an individual's identity, experience, and social interaction. Typically, individuals are assigned a biological sex at birth based on their physical characteristics, such as chromosomes, genitalia, and reproductive anatomy and gender identity which refers to an individual's internal sense of being male, female, or something else. Nbisike (2020). Research suggests that gender differences in mathematics achievements among learners in Nigerian are subtle, with some studies indicating that the gap is disappearing. Some researchers like (Nwachukwu , 2016) and (Marvel, 2021), pointed out the following as key finding - that male and female students perform similarly in mathematics, with no significant differences in achievement , that the gender gap in mathematics achievement is dissipating, even at the subscale level, suggesting that female students are catching up with their male counterparts. They therefore said that the following strategies can help in the Improvement of mathematics achievement - Multimedia Instructional Approach: Using multimedia instructional approaches can promote gender equity in mathematics achievements, - Promoting Mathematical Proficiency: Fostering mathematical proficiency, including conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition, can improve achievement in mathematics.

Business education is designed to equip students with the knowledge, skills, and competencies required to succeed in the present

business world. It encompasses various aspects of business, including daily buying and selling, management, marketing, finance, and accounting e.t.c. The goal of business education among others is to prepare learners for everyday buying and selling transactions. The importance of mental mathematics to business education for the present business world can never be over emphasised .Some of the importance are - Mental mathematics skills are essential for business professionals to perform quick calculations, such as calculating profits, losses, and percentages, Business professionals need to estimate costs, revenues, and profits, which requires mental mathematics skills, Entrepreneurs need to calculate prices, discounts, and profit margins, which requires mental mathematics skills. Mental mathematics skills enhance problem-solving abilities, which are essential for the present business world ,Mental mathematics skills help business people to analyse data, identify trends, and make informed decisions. Developing mental mathematics skills can increase confidence in business, enabling people to tackle complex business problems. Giving special attention to mental mathematics especially at the primary level, will help develop essential skills for success in science and technology and also in the business world.

Objectives of the Study: The objectives of the study are to

- i. Ascertain the effects of combined mental mathematics instruction (MMI) and teacher conventional instruction (TCI) on Learners achievements in primary mathematics.
- ii. Determine the comparative effects of the two treatments on Learner's retention in mathematics after treatment.
- iii. Ascertain the mean scores of male and female learners taught mathematics with combined mental mathematics instruction and teacher conventional instruction (TCI/MMI)

Research Questions

The following research questions were used in the conduct of this study

- i. What difference exists in the Pre-test and Post- test mean of learners taught

mathematics with TCI and combined TCI/MMI

- ii. What differences exist in the mean in mathematics retention test of learners taught with combined mental mathematics instruction and teacher conventional instruction.(MMI/TCI)
- iii. What is the mean achievement scores of male and female learners taught Mathematics with combined TCI/MMI.

Hypotheses

The hypotheses, below were formulated based on the above research question to guide this study.

The hypotheses were tested at 0.05 level of significance

- i. There is no significant difference in the Pre-test and Post- test mean of learners taught with combined TCI/MMI
- ii. There is no significant differences in the mean in mathematics retention test of learners taught with combined mental mathematics instruction and teacher conventional instruction.
- iii. There is no significant difference in the mean achievement scores of male and female learners taught Mathematics with combined mental mathematics instruction and teacher conventional instruction.

Research Method

Two intact classes of primary 4 were classified into Two groups; group A and group B Experimental groups and they were taught the selected learning contents using combined mental mathematics instruction / teacher conventional instruction and Teacher conventional instruction respectively. Prior to the teaching, Pre-Test Was administered to both groups to ascertain their background knowledge while the Mental Mathematics Test (MMT) was administered after

the teaching to ascertain the students' achievement in both groups. Teaching experiments lasted for 4 weeks. Each teaching group met 4 times, in a week in a single period of one hour. One Mathematics teacher and the researcher engaged in the exercise. The first week of the period was used to acquaint the participating teachers and students with the methods of their groups. It was also used to administer the pre-test and was rearranged for post -test and retention. The participating teachers who were the Mathematics teachers of the school of the study acted as research assistants while the researcher was the main teacher. During the study, the researcher assistant performed some roles which include, minding and supervising the groups and helping to administer the different tests. The researcher wrote the lesson notes and produced copies for the participating teachers. All the tests were conducted by both teachers i.e. the Mathematics teachers and the researcher and were marked and secured.

Instrumentation

A Mental mathematics text book for elementary schools book 4 was used as the course text for the lesson while the pre- test, post- test and retention tests were NAPPS centrally set paper third term examination questions for primary 4 2024.The test items were rearranged and were printed out for the post –test and retention tests. The instrument was given to experts in Mathematics Education and experts in measurement and evaluation for validation. The Cronbach Alpha was used to establish a reliability coefficient of 0.83.

Results and Discussion of Findings

Research Question 1.

What difference exists in the Pre-test and Post-test mean of learners taught mathematics with TCI and combined TCI/MMI

Table 1 : Mean scores in Mental Mathematics learner's pre-test scores and their scores at post-test when taught through TCI, and combined TCI/MMI

TCI Group	Means	SD	Mean Difference
Pre-test	16.10	3.48	42.94
Post-test	58.04	8.70	
TCI/MMI Group	Means	SD	Mean Difference
Pre-test	17.03	4.37	50.73
Post-test	67.76	10.60	

Table 1 shows that the mean scores of the pretest and posttest mean when learners are taught with TCI are 16.10 and 58.04 respectively, and that the difference in the means is 42.94. It can be therefore inferred that there is a difference in mean scores of the pretest and posttest when used TCI and posttest group achieved higher than the pretest group meaning that using TCI was effective by gaining a mean of 42.94

Also that the mean scores of the pretest and posttest when used TCI/MMI are 17.03 and 67.76 respectively and that the difference in the means is 50.73. It can be therefore inferred that there is a difference in mean scores of the pretest and

posttest when used TCI/MMI and posttest group achieved higher than the pretest group. This means that using TI/PI there was effective by gaining a mean of 50.73. The results above show that the mean-gain of the methods TCI/MMI and TI are 50.73 and 42.94, respectively. Meaning that TCI is effective but TCI/MMI is most effective in this experiment.

Hypothesis One: There is no significant difference in the pre-test and post- test mean taught with TCI, and MMI at post-test.

Table 2: Mean and probability analysis of the pre-test and post-test mean of Learners taught with TCI, and TCI/MMI at post-test.

GROUP	Means	Mean Difference	Probability Y	Significant ($p < 0.05$)?
TCI Group Pre-test	16.10	42.94	0.00	Yes
Post-test	58.04			
TCI/MMI Group				
Pre-test	17.03			
Post-test	67.76	50.73	0.00	Yes

Table 2 shows that for TCI pretest and TCI posttest groups, probability (0.00) is less than the level of significance (0.05). This implies that TCI teaching method at ($p > 0.05$) achieves significant learning outcome in Learners Mathematics.

Table 2 shows that for TCI/MMI pretest and TCI/MMI posttest groups, probability (0.00) is less than the level of significance (0.05). This implies that TI/PI teaching method at ($p > 0.05$)

achieves significant learning outcome in Learners' Mental Mathematics.

Research Question 2

What differences exist in the mean in Mental mathematics retention test of learners taught with combined mental mathematics instruction and teacher conventional instruction.(MMI/TCI).

Table 3: Mean in Mental Mathematics Retention Test of learners taught with combined mental mathematics instruction and teacher conventional instruction. (MMI/TCI).

GROUP	Retention test means	SD	mean Difference
TCI	70.80	9.74	10.08
TCI	70.80	9.74	7.21
TCI/MMI	78.01	8.26	

Table 3 shows that The mean scores of the TCI and TCI/MMI groups at retention test are 70.80 and 78.01 respectively. The difference in the means is 7.21 It can therefore be inferred that there is a difference in the mean scores of the TCI and TCI/MMI , TCI/MMI group achieved higher than the TCI group at retention test.

Hypothesis 2: There is no significant differences in the mean in Mental mathematics retention test of Learners taught with TCI and combined TCI/MMI.

Table 4: Analysis of Covariance (ANCOVA) F-test on the mean scores of the two treated groups in the researcher made retention test.

Source	Sum of Squares	df	Mean Square	Com-F	Cri-F	L s	Probability
Corrected Model	1031.80	2	1111.75				
Intercept	25429.20	1	25429.20				
Pretest	52.31	1	52.31				
Group	117.52	2	578.61	4.03	3.80	0.05	.021
Error	14185.52	115	128.01				
Total	5590871.00	120					
Correct total	17488.70	117					

Table 4 shows that the F-computed (4.03) is greater than F-critical (3.80) and the level of significance (0.05) is greater than the probability (0.021). This result rejects the null hypothesis that there are no significant differences in the mean scores of the two treated groups. Therefore there

are significant differences in the mean scores of the two treated groups in the retention test.

Research Question 3 : What is the mean achievement scores of male and female learners taught Mathematics with combined TCI/MMI.

Table 5 : Mean Achievement Scores of Male and Female Learners in the Group taught with combined TCI/MMI.

Sex	N	Pretest Mean	Mean Score	Achievement	Std. Deviation	Mean Gain
Male	17	16.15	55.19		11.143	39.04
Female	29	16.29	52.14		14.559	35.85

The numerical strength of the data collected, in table 5 indicates that the male and female students have equivalent mean scores 55. 19 and 52.14 as well as equivalent mean gain of 39.04 and 35.85respectively, which shows that male students have 3.05 higher than the female

students. However, the difference is subject to ANCOVA result tested at 0.05 level significance.

Hypothesis 3: There is no significant difference in the mean achievement scores of male and female learners taught Mental Mathematics with combined TCI/MMI

Table 6 : ANCOVA of Male and Female learners Post-Test of the Group taught with combined TCI/MMI

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	7463.741	4	1865.935	13.475	.000	.418	
Intercept	8246.255	1	8246.255	59.553	.000	.443	
Pre-test	3942.316	1	3942.316	28.471	.000	.275	
Method	5510.788	1	5510.788	39.798	.000	.347	
Gender	158.005	1	158.005	1.141	.289	.015	
Method Gender	1.663	1	1.663	.012	.913	.000	
Error	10385.246	75	138.470				
Total	199205.000	80					
Corrected Total	17848.988	79					
a. R Squared 418 (Adjusted R Squared = .387)							

Decision: Null hypothesis accepted

The summary table 6 shows that p-value (Sig.) is .913 while the result was tested at 0.05 level of significance. Hence, the null hypothesis was accepted and the alternative hypothesis rejected. Since the p-value is greater than 0.05, the researcher therefore, upholds that there is no significant difference between the mean scores of male and female students in terms of Mental Mathematics achievement of group taught with combined TCI/MMI in the post-test. This implies that the mean difference between male and female students in the post test is not significant. Hence the method of combined TCI/MMI is not gender biased as it is favorable to both gender.

The findings of this study agrees with that of Suleiman & Hammed (2019) which says that the reason why most students fail to learn mathematics well is due to their poor mastery of mental computational skills at the lower level. (Guskov ,2004) as cited in Sani, (2015).concluded that if a child completed primary school without sound mastery of elementary mental computational skills, the child has no chance of learning higher mathematics.

Conclusion

This study from it's findings has established that Mental Mathematics instruction enhances achievement, facilitates the acquisition of Mental mathematics skills which enhances problem-

solving abilities needed for the present business world , Mental mathematics skills increase self-confidence and retention and it is gender friendly. Giving special attention to mental mathematics especially at the primary level is a welcome development because it will help learners develop essential skills for success in science and technology and also in the business world. A lot of people especially authors, parents and teachers do not really see the need of mental mathematics and this may be the reason for very few mental mathematics text books available for use in South-Eastern Nigerian schools, libraries and book shops and negligence to the teaching of mental mathematics in this part of the world. Teachers focus more on paper and pen work whereas mental mathematics is the type of mathematics used most often in our everyday real life situations and mental mathematics is also used to check the correctness of answers obtained from paper and pen work and also the answers obtained from calculators. Mental mathematics lessons help teachers to revisit what they have already taught learners.

Recommendations

Based on the findings and conclusions drawn from the study, the following recommendations were made.

- i. Education stake holders , Administrators of schools and Ministry of Education should include mental mathematics text books in their list of recommended text book for primary school pupils and also assign time to mental mathematics teaching in their school time table.
- ii. Primary school teachers and the learners should be encouraged to participate actively in mental mathematics activities in the classroom.
- iii. Regular seminars and workshops on the importance of mental mathematics should be organized for primary school teachers and sponsored by Government for massive attendance.

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