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Mental Mathematics: An Enhancing Strategy for Better Performance in Post-Covid Primary Schools

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Abstract:

This study investigated mental mathematics: an enhancing strategy for better performance in post-COVID primary schools. It examined how mental mathematics could influence the performance of students in lower levels positively to bridge the gap created by COVID 19 on the teaching and learning of mathematics. The study found out teachers' observation about the use of mental mathematics. Quasi experimental of pretest and posttest control group design was adopted. The population comprised all the primary six pupils in public primary schools in Ado and Ido/Osi Local Government Areas, both in Ekiti State. Two schools were selected from the public primary schools in each of the selected Local Government Areas, making four schools that were used for the study. Three schools were used for experimental while the remaining school was for control. 160 Primary six pupils were selected as sample for the study. Hypotheses were tested at 0.05 level of significance and analysed using t-test and Analysis of Covariance (ANCOVA). Mathematics test administered on the pupils at the beginning of the study showed no significant difference among the schools, this showed that the groups were homogeneous at the beginning of the study. The same test was administered as posttest after treatment on the two groups. It was observed that there was significant difference between the post test of the experimental and the control groups. The results showed that pupils exposed to mental mathematics had improved performance in mathematics. Teachers' observation about the use of mental mathematics was sought after treatment using questionnaire.

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Teachers discovered that the use of mental mathematics made their teaching easy. Based on the findings of the study, it was recommended that Mathematics teachers should encourage and engage their pupils in mental mathematics.

Keywords: Mental Mathematics, Mental Computation, performance, Experimental Control,

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Introduction

Effect of COVID-19 on education is viral (Agbele & Oyelade, 2020). Educators and concerned stake holders sought for means by which learners would reach to their sources of learning. Virtual learning was adopted through the use of zoom, Google meet, Webinar, join.me, go-to-meeting, and adobe connect in some states. Government such as; Kaduna State, Ekiti States, and Kogi State went as far as involving radio programs for audio teaching. Personal observation showed that pupils in basic schools could not benefit much from all these arrangements because of numerous reasons. Very limited number of pupils can boast of having phones or the ability to manipulate audio visual gargets unavailability of electricity especially in local areas is a major constraint to visual, audio, audio victual or online learning. Also, going by the characteristics of children within the age range of pupils in these basic schools, they cannot sit down for a long period of time listening to radio, they prefer seeing the teacher, asking questions and even imitating the teacher at will.

Consequently, there would have been a deprivation on the part of these pupils and peradventure unfinished topics in terms of curriculum content. In mathematics curriculum, topics are built upon, for instance, we have 'Fraction' as a topic in elementary classes, so we have 'Fraction' as a topic in Senior Secondary School classes. When a child is not taught this topic in Senior School, it will be a difficult task for such a child to understand 'Fraction' when he gets to tertiary institution. This brake in trend happened to some topics during the COVID-19 lock down. To bridge the gap that might have been created during the time of COVID-19 lockdown, teachers of mathematics should adopt the use of rewarding teaching method that will not only foster the performance of the learners, but will also trigger them to elicit positive attitude towards the learning of mathematics. Considering the importance of mathematics, and its position as the core of any primary or secondary school curriculum, students' performance is expected to be far above what we are having in both internal and external examinations today in our schools.

Students' results in mathematics generally are not satisfying as confirmed by researchers (Popoola, 2013; Kolawole, 2014; Kiwanuka, Damme, Noortgate, Anumendem & Namusisi; 2015; Akinwamide, 2019). Much work had been centered on the secondary schools students while the primary schools have been neglected. The primary section is the foundational stage on which the future academic aspiration is built. These set of students should be given attention not only because they are tender and could be manipulated away from the subject, they are not exposed to the use of technology such as calculator (in Nigeria) which is a basic tool for the students in the secondary schools. Observation showed that pupils' performance in mathematics is always low compared with their performances in other subjects such as social studies, basic science and English language. This had been a point of concern for educators especially those of us in the field of mathematics. Tables1&2 below show the analysis of placement examination in Ado Local Government Area and Ido/Osi Local Government Area from the years 2017 to 2019.

Analyses of Primary Six Placement Results from 2017 to 2019

YEAR	SUBJECT	NO. REG	NO PASSED (50%-100%)	NO FAILED (49%-0%)	% PASSED	%FAILED
2017	English	1591	456	1135	28.66%	71.34%

	Mathematics	1591	355	1236	22.31%	77.69%
	Yoruba	1591	1544	47	97.05%	2.95%
	Social Stu.	1591	1584	07	99.56%	0.44%
	Basic Science	1591	1509	82	94.85%	5.15%
2018	English	1482	505	977	34.08%	65.92%
	Mathematics	1482	324	1158	21.86%	78.14%
	Yoruba	1482	1294	188	87.31%	12.69%
	Social Stu.	1482	1247	235	84.14%	15.86%
	Basic Science	1482	1220	262	82.32%	17.68%
2019	English	1559	1093	466	70.11%	29.89%
	Mathematics	1559	1025	534	65.75%	34.25%
	Yoruba	1559	1336	223	85.70%	14.30%
	Social Stu.	1559	1233	326	79.09%	20.91%
	Basic Science	1559	1269	290	81.40%	18.60%

Source: Ido Ekiti Area Education Office (AEO)

Analyses of Primary Six Placement Results 2019/2020 (Ado LGA)

YEAR	SUBJECT	NO. REG	NO PASSED (50%-100%)	NO FAILED (49%-0%)	% PASSED	%FAILED
2019/2020	English	3209	2300	909	71.67%	28.33%
	Mathematics	3209	2,140	1,069	66.69%	33.31%
	Yoruba	3209	3203	06	99.81%	0.19%
	Social Stu.	3209	2570	639	80.09%	19.91%
	Basic Science	3209	2922	287	91.06%	8.94%

Source: Ado Ekiti Area Education Offices (AEO)

From table 1, the percentage failed in mathematics top the lists in all the three years while the percentage passed of mathematics was the least in each of the three years. The gap between the numbers failed in each year in every other subject compared with that of mathematics was very wide. For instance, in the 2017, the percentage of pupils that passed social studies was very high compared with the percentage of pupils that passed mathematics. Despite the fact that it seemed pupils performed generally well in the year 2019, mathematics was still the least.

Table 2 shows the result of common entrance examination of pupils in Ado Local Government Area for2019/ 2020 session. This result could be termed wonderful. The percentage failed in

mathematics was the highest. The fact that many pupils passed mathematics does not rule out the area of concern that the number of pupils that passed all other subjects are more than those that passed mathematics. The two tables above clarify and emphasis the need for improvement in the pupils' performance in mathematics especially in the elementary schools.

This 'below expectation' performance had made some pupils in the elementary classes developed cold feet concerning the learning of mathematics especially when they begin to compare their performances in other subjects with that of mathematics. Many reasons have been attributed to the low performance in mathematics especially in elementary schools. Observation showed that a teacher allocated to an arm of a class handles every subject of that class. This is very vivid in case of public primary schools. A teacher whose area of discipline is language, say French, is made to teach mathematics in a primary six class which is a certificate class simply because he is the teacher of the class. Evidently, his methodology and knowledge of teaching mathematics may not be thorough compared with an expert in the field of mathematics education. The result of the research carried out by Ojo O.O et al, (2012), titled 'Primary School Teachers' Comfortability with Generalized Teaching in Public schools in Osun State, Nigeria showed that teachers in public primary schools are not convenient with the generalized teaching, rather, they preferred specialized teaching. It could be deduced from this result that thorough work might not be done when 'what should to be taught by a teacher is different from what is given to be taught'. One of the characteristics of a good job is that it must be interesting. When public primary school teachers are not interested in the teaching of all subjects in a particular class individually, this will definitely affect a subject like mathematics that many people believed that it is abstract in nature. Better performance builds positive disposition towards academic work. Nothing frustrates like failure and good work output opens the vistas of future success. When students perform well in a subject, they will love to do more in such subject, but when every effort of having fine grade proves abortive, the morale is affected and this culminates in negative disposition.

Whatever gives them satisfaction gains the attention of their minds. They are willing to continue in such activity rather than anything that bores them. When they are given the opportunity of participating actively in a learning activity, it usually engages their curiosity and stimulates their interest especially when their efforts yield positive results. The quest for a way of capturing their interest and channel it towards mathematics individually led to the consideration of the engagement of mental mathematics in this research to see what effect it will have on the learning outcomes of the pupils at this elementary school level.

Mental mathematics has to do with the ability of a child to calculate numbers without the use of learning aids such as calculator, tables or mathematical sets. This involves the use of memory and mind. Brendan (2020) defined mental mathematics as a group of skills that allows people to do mathematics in "their head" without using pencil and paper or a calculator. The importance of mental mathematics cannot be overestimated especially to the learners in basic levels. Mental mathematics is useful in schools and in everyday life. Mental mathematics can greatly assist a pupil in understanding mathematics concepts better and gets to the answer fast. Using and practicing mental mathematics regularly helps kids improve their number sense and the training of the mind Brendan, (2020). This has to do with the ability of a child to quickly differentiate or compare two or more numbers and know the one that favour what he/she wants. Mental mathematics reveals the ability of each child to learn fast and also helps each learner to learn at his/her own pace since it does not involve two or more pupils working together at the same time on the same tasks. It also helps in the

development of mathematical skills. A child who is a slow learner needs to be supervised and encouraged by the facilitator so that his/her interest could be arose towards mental mathematics. Hence, the mathematics instructor must not go along with the fast kids and neglect the slow learners. This is one of the advantages of mental mathematics; it helps the teacher to identify the slow learners, their areas of weaknesses and the way-out to help them. What it entails to be effective in mental mathematics includes; strong memory skills, regular practicing and facilitator's support. The issue of facilitator's support will make this study checkup the areas of disciplines of the mathematics teachers that will be used in this study.

Mathematics is a subject that requires critical thinking, the ability of a pupil to participate in mental mathematics is a way of having a bedrock foundation that can withstand the hard rock of mathematics at any level in academics. Mental mathematics is an important skill that anyone could have, it is not only for mathematics students since every human being practice mathematics either consciously or otherwise. Better mental mathematics skills lead to higher scores tests, greater perceived intelligence, and greater confidence. This boosts the positive disposition of the learner and leads him/her in having positive attitude towards the subject. Mental mathematics practices can appear inform of playing yet bringing reasonable answers. Mental computation can be in form of: quantitative reasoning, Estimations and number tricks.

1. Quantitative reasoning: Quantitative reasoning is simply the use of figures in the real-life situations. In the elementary level, objects or materials can be arranged and a child is expected to do some calculations without using aids such as calculator or writing materials. For example; A bag containing twenty oranges is given to a class of ten pupils to be shared equally, how many oranges would be shared to a pupil?. In this case, a child can count his/her fingers and toes, and get the answer to be two. His/her fingers stand as the objects. Another example is: What is 47+65? It is easier to do this in your head if u break the numbers down into their digit values, 40+60 = 100 and 7+5=12 add those two totals and you get the answer of 112. It can also be in form of having content in boxes. E.g. Five boxes contain cherry seeds. The first box contains 9, the second box contains 7, the third box contains 5 while the last box contains 1. What will be the number of seeds in the 4 box?. A pupil can use the knowledge of mental mathematics to answer this.

2. Number tricks: examples (i) Think of a number and keep it secret. Double the number and multiply by 4. Remove the last digit of your answer, you will have the number you kept secret. (ii) Write the year you were born. Add the number of your year, the result will be the present year we are. e.g. I was born in the year 1970, now, I am 50 years old. 1970+50 = 2020. We are in the year 2020. (iii). Multiply an even number by 6, the answer will end with the digit multiplied. e. g 6x8=48. The first digit of the answer is half of the last digit. (iv). Multiplication of numbers 1 to 12 by 9. Fold one finger, count the remaining, that is the answer for 9x1. Fold two fingers, count the remaining, it gives 8, put1 before the digit, that is 9x2= 18. For 3, fold three fingers, count the remaining, it will give 7, put 2 in front of 7 to have 27. For 4, put 3 in front of 6 to have 36, for 10, fold 10fingers, remaining 0, put 9 before 0, it gives90, for 11, start another 10 fingers. Fold 1, remaining 9, put 9 to have 99. For 12, fold 2 fingers, count the remaining and add to the answer for 11, you will have 108.

3. Estimations (approximations). This has to do with writing numbers in a specified value. Example is writing numbers to the nearest tenth, tens, hundredths, hundreds, decimal places and whole numbers.

The principles of efficiently and successfully teaching and learning mental mathematics are to 'Talking with' and 'practicing it'. To 'talk with', the instructor has to discuss with the learner

how to solve a problem. The teacher explains the steps it may involve in solving the given problem, while the student asks questions where the need be. Another thing is 'practice it' which is done by the learner. Mathematics needs constant practice. The learner should be supervised by the instructor to see that work done are revised and much questions are given for constant practice that make the pupil grounded in mental mathematics. The learner is able to transfer knowledge that is using the technique earlier applied in solving a new problem. The use of real life objects such as tables, chairs, books, seeds, beads, etc while dealing with basic operations in mathematics (addition, subtraction, multiplication and division) familiarize the learner with the environment and makes mathematic real and reduces the fear of sein mathematics as very strange.

Statement of the Problem

In the post COVID era, students of mathematics especially in secondary and tertiary institutions have gained the opportunity of virtual learning which was not so for pupils in the elementary level. There is the need to research into how these pupils in basic schools could be help in the learning of mathematics that even when they are not with their teachers they can work on their own, using their mental abilities. The foundation of formal education and every subject is the elementary school. Observation showed that pupils' placement results of mathematics have not been what it supposed to be in terms of pupils' performance compared with their performance in other subjects such as English Language, Social Studies, Basic Science and the one Nigeria Language. It is assumed that pupils' performance can be improved upon if mental mathematics is introduced to the students of which they will be actively and practically involved. Also, the opinion of teachers would be sought about the use of mental mathematics.

Purpose of the Study:

The purpose of the study was to investigate; mental mathematics: an enhancing strategy for better performance in post COVID primary schools. The study specifically determined the extent to which the application of mental mathematics enhanced better performance of pupils in Mathematics. The study compared the outcome of the effects of mental mathematics on students with another set of students that were taught conventionally.

Hypotheses

1. There is no significant difference in the performance scores of students in the experimental and control groups before treatment.
2. There is no significant difference in the performance scores of students in the experimental and control groups after treatment.

Research Method

This study adopted quasi-experimental of pre-test, post-test, control group design, the effects of the independent variables on the dependent variables were examined. The population comprised all the primary six pupils in public primary schools in Ado Local Government Area and Ido/Osi Local Government Area, both in Ekiti State. The population comprised all the primary six pupils in public primary schools in Ado Local Government Area and Ido/Osi Local Government Area, both in Ekiti State. Multistage sampling technique was adopted in selecting the samples. Two schools were selected from the public primary schools in each of the selected Local Government Areas, making four schools that were used for the study. Three

schools were used for experimental while the remaining school was for control. 160 Primary six pupils were selected as sample for the study. Self-developed instruments were used to collect data; Mathematics Performance Test (MPT) and Students' Attitude Towards Mathematics Questionnaire (SATMQ).
Dada collected was analysed using t-test and Analysis of Covariance. Hypotheses were tested at 0.05 level of significance.

Results and Discussion
Testing of Hypotheses and Discussion of Findings are presented thus:
Hypothesis 1: There is no significant difference in the performance scores of students exposed to mental mathematics and those in control group before treatment. In testing the hypothesis, performance scores of students exposed to mental mathematics and those in the control group before treatment were computed and compared for statistical significance at 0.05 level. The result is presented in Table 3

Table 3: t-test comparison of students' performance scores in the experimental and control groups before treatment

School Location	N	Mean	SD	Df	t-value	p
Experimental	120	10.2667	1.6178	158	.903	.368
Control	40	10.0000	1.6172			

Table 3 reveals that students in the experimental group had performance mean score of 10.2667 and standard deviation of 1.6178 while students in the control group had performance mean score of 10.0000 and standard deviation of 1.6172. The table also shows the t-value as 0.903 at 0.05 significant level: ($t = 0.903$; $df = 158$; $P > 0.05$). Hypothesis 1 is therefore not rejected. This shows that there was no significant difference in the performance scores of students in the experimental and control groups before treatment. This depicts the homogeneity of the groups.

Table 4: t-test comparison of students' performance scores in the experimental and control groups after treatment

School Location	N	Mean	SD	Df	t-value	p
Experimental	120	27.2917	6.2918	158	12.290	.000
Control	40	14.7000	2.6037			

N=Number of pupils per group, SD=Standard Deviation, Df= Degree of freedom.

Table 4 discloses that students in the experimental and control group had performance mean scores of 27.2917 and 14.7000 respectively. The standard deviation of 6.2918 and 2.6037 were shown for the experimental and control group respectively. The table further shows the t-value as 12.290 at 0.05 significant level: ($t = 12.290$; $df = 158$; $P < 0.05$). Hypothesis 2 is therefore rejected. This shows that there was significant difference in the performance scores of students in the experimental and control groups after treatment. The performance means score of the experimental group is higher than that of the control group.

Table 5: ANCOVA of students' performance by treatment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4758.179(a)	2	2379.090	75.101	.000
Intercept	1824.592	1	1824.592	57.597	.000
PRETEST	1.677	1	1.677	.053	.818
GROUP	4744.860	1	4744.860	149.782	.000
Error	4973.515	157	31.678		
Total	102999.000	160			
Corrected Total	9731.694	159			

a R Squared = .489 (Adjusted R Squared = .482)

Table 5 shows that the computed F-value (149.782) obtained for the groups with a p-value <0.05 was significant at 0.05 level. The null hypothesis is rejected; implying that there is significant effect of treatments (mental mathematics and conventional strategies) on the performance of students in Mathematics. In order to determine the magnitude of the effect of treatment on students' performance in Mathematics, the Estimated Marginal Mean was analysed, and the result is presented in table.

Table 6: Estimated Marginal Mean of Performance Score by Treatment

GROUP	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
EXPERIMENTAL	27.296(a)	.514	26.280	28.311
CONTROL	14.687(a)	.892	12.926	16.448

a Covariates appearing in the model are evaluated at the following values: PRETEST= 10.2000.

As shown in Table 6, the Estimated Marginal Mean (EMM) of students' academic performance in Mathematics in the experimental and control group are 27.296 and 14.687 respectively; it is an indication that experimental group has a higher EMM than the control group. This implies that mental mathematics contributes immensely to the difference in students' academic performance between the experimental and control group in Mathematics.

Discussion

The findings of the study showed that the two groups were homogenous before the treatment. The implication of this was that there was no significant difference between the pre-test mean scores of the experimental and the control groups. The investigation revealed significant difference between the posttest mean scores of the experimental and the control groups. This was in line with Brendan (2020). This further showed the effectiveness and reliability of the usefulness of mental mathematics on the increase in the performance of pupils in the learning of mathematics in the basic school level. The aftermath of the study that showed positive effect on the pupils' performance could invariably foster the interest of the learners in mathematics and they can learn on their own. This was in accordance with the submission of (Rens, Haelermans, Groot and Brink, 2018), which observed that children can develop themselves according to their abilities if well guided. After treatment, oral comment of the teachers in the experimental group showed that mental mathematics improved the interest of the pupils in mathematics and geared the interest of the teachers towards the

teaching of the subject since some of the teachers are not certified in the field of mathematics education.

Conclusion

Since the use of virtual teaching may not be available for pupils in basic schools, Mental mathematics has been found to be a helpful tool in promoting better performance in mathematics and in developing personal learning skill. The findings of the study showed that conventional way of teaching cannot yield the expected students 'results in mathematics.

Recommendations

Based on the findings of this study, teachers in basic schools should make use of mental mathematics while teaching mathematics and they should encourage pupils to practice it.

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