
Comparative Study of Students' Achievements in Mathematics Based On Instructional Strategies

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Abstract

This study compared the effectiveness of Lecture method (LM) and Group method (GM) used to teach mathematics to two groups of primary school pupils. The population consisted of eighty one (81) pupils from two arms of primary six (6) pupils of Federal College of Education, Nuring/Primary school, Okene of 2014/2015. The arms were made up of group A and B which consisted of forty one (41) and forty (40) pupils respectively. The sample for the study consisted of thirty (30) pupils from the two arms which is made up of fifteen (15) pupils each from group A and B. Data was collected through administration of pre-test and post-test questions to the two groups of the pupils. Statistical analyses were based on inferential statistics such as t-test, chi-square, and correlation coefficient at 5% level of significance. It was reveal that mathematics performance of the group of pupils taught using LM is not different from the group of pupils taught using GM of teaching mathematics. It was therefore, recommended that mathematics teachers should endeavor to acquire the skills for using all instructional methods involved in mathematics teaching effectively.

In Nigeria, just as in some other countries, there is great concern about the level of education in mathematics. Studies have shown that the mathematics achievement of students in primary and secondary education has declined in the past years. For instance, the international TIMMS (Trends in International Mathematics and Science Study) study compared the mathematics and science results of students in grade 4 (10 years of age) and 8 of many nations. The study showed that in some countries mathematics performance increased from 1995 to 2007. However, in a quarter of the countries – including Nigeria- mathematics scores declined significantly in that period (Mullis, Martin, Gonzalez, & Chrostowski, 2004). Such findings have led to a renewed

interest in effective teaching methods for mathematics and the mathematics education that lead to higher levels of learning. Besides being relevant for educational researchers, information on effective mathematics teaching is also of great interest to teacher education. This is because teachers most often do not know which ways of teaching are most effective for success of their pupils or students. As a result, students are not always well prepared to take standard mathematics examinations. Therefore, more information is needed on practical ways to improve teaching and to secure effective learning of pupils and students in schools.

Singh and Nayak (1997) have described some common methods which are used in the teaching of mathematics and science at elementary level i.e. lecture method, discussion method, project method, heuristic method, discovery, inquiry approach, problem solving, group method etc. All these methods fulfill a specific requirement, which is based on psychological theories or technological facilities.

According to Singh & Nayak (1997) there are many methods of teaching but mathematics and science teachers select a particular method based on the needs of the content, teaching facilities available, ability of the students and the philosophy of the teacher. In addition, mathematics teacher who wish to choose a teaching method must also consider teaching environment, the pupils' background, such as their age, prior knowledge and the type of instructional materials that can be used. Also, the teacher must ensure that the method selected should be mathematically satisfactory, meaningful to the class, meet the demands for a proper teaching procedure and motivate both the teacher and learners for effective learning. In this case, such instructional methods are considered as best practices which implies teaching strategies that can be shown to generate the desired results and promote a deep students' understanding of mathematics.

In many developing countries such as Nigeria, lecturing is the dominant and traditional method of instruction (Druger, 1999; Khan & Akbar, 1997). Lecture method is quite economically and it is possible to handle a large number of students at a time and no laboratory, equipment, aids, and materials are required (Yadav, 1992). Whereas Vedanayagam (1994) is of the view that lecture is largely a one-way process. There is not much interaction between the students and the teacher. It ignores individual differences.

Research is constantly providing new proven methods for educators to use, in mathematics classrooms including group method of teaching. Group work can be very effective way of motivating pupils to learn by encouraging them to think, communicate, exchange ideas and thoughts, and make decisions. In groups, pupils can both teach others and learn from each other in ways that result in a powerful and active form of learning. However, the success of this method depends on the teachers' ability to manage the method skillfully; otherwise, the method can usually result to noisy classroom situation that may not lead to desired goals.

Even though many researchers (Grouws, 2004) agreed that all methods are important and that teachers should strive for procedural fluency that is grounded in conceptual understanding of the students; yet, there are several researches that support some teaching strategies to be of better quality. Hammouri (2004) and Antonijevic (2005) maintained that the quality of teaching method is important for improving students' learning. According to Butty (2001), good instructional practices have positive impact on mathematics achievements as well as attitudes of students toward mathematics. A supportive classroom and suitable teaching method motivate students to become better mathematics learners (House, 2004). It follows therefore that the quality of education that teachers provide to students may depend on the type of instructional method and how the method is used by the teacher. But the extent to which different instructional methods affects mathematics achievements of primary school pupils' with different background still required further study. It is therefore the objective of this study to compare the mathematics achievements of two groups of primary school pupils taught with lecture and group instructional strategies respectively.

Statement of the Problem

There are prevailing poor performances in mathematics right from primary to secondary schools. It can be generalized that the low achievements in secondary schools is likely to be the outcome what needed to be done and achieved well by pupils that failed to take place in primary schools. This poor performance in mathematics by school pupils and students is worrisome to all stake holders in education. As a result, several intervention programmes have been initiated by government through educational agencies in order to improve pupils' mathematics achievements in schools. Thus, in order to talk about the level of achievements of these mathematics interventions, it is particularly important to assess and compare the effectiveness of instructional techniques which were also introduced as part of the interventions in the teaching of the subject. It's therefore the objective of this study to compare the effectiveness of Lecture method (LM) and Group method (GM) used in the teaching of mathematics in primary schools. This is the main problem under study.

Purpose of the Study

Both the lecture and group methods are important and teachers use both the methods while teaching mathematics in primary schools. In view of this importance and usage, the purpose of the study were to:

1. Determine whether there are differences in previous knowledge of primary school pupils in mathematics.
2. Compare mathematics achievements of primary school pupils taught using lecture method and another group taught with group method of teaching.

3. Ascertain if the number of primary school pupils who passed or failed mathematics is dependent on the instructional methods used.
4. Determine whether there exist relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.

Hypotheses

Based on the purpose of the study, the following hypotheses were raised to guide the study:

H₀₁: There is no significant difference in previous knowledge of primary school pupils in mathematics.

H₀₂: There is no significant difference in the mathematics achievement of primary school pupils taught using lecture method and another group taught with group method of teaching.

H₀₃: The number of primary school pupils who passed or failed mathematics is not significantly dependent on instructional methods used.

H₀₄: There exist no significant relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.

Research method

The research study was experimental in nature. Thus, pre-test and post-test design was used for the study. Four null hypotheses were stated to guide the study. The design was preferred as it involved two groups of primary school pupils both of which were sampled out of their population.

Population and sample

The population for the study was all primary six (6) pupils of Federal College of Education (FCE) Nursery/Primary School, Okene in 2014/2015 session. Thus, the target population consisted of total number of eighty one (81) pupils from two arms of the primary six (6). The arms were made up of group A and B which consisted of forty one and forty pupils respectively.

Out of the eighty one (81) pupils from the two arms, fifteen (15) pupils were sampled out each from group A and B, representing 36.59% and 37.50% respectively. Thus the sample for the study consisted of thirty (30) pupils. In selecting the sample size for the study, proportional stratified sampling technique was used since the two groups were almost equal in size and so, each group had to be proportionally represented in the sample. According to Tryfos (1996), proportional stratified sampling technique is unbiased in terms of representation like random sampling.

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Instrument

Data was collected through administration of pre-test and post-test questions to the two groups of the pupils. Both the pre-test and post-test questions consisted of section A and B. Section A is made up of thirty (30) objective questions while section B was theory part of three questions to answer any two. The questions were moderated by other professional mathematicians and the tests were considered adequate for the pupils.

Procedure for data collection

The researcher visited the primary school in order to discuss the importance of the study with the head of the teachers and formally requested for permission to use the pupils for the research work; which was arranged to take place after school hours. This is to ensure that the research work might not disturb the daily school schedule and time. The fifteen (15) pupils selected each from group A and B were introduced to me and asked to maintained their original groups. The pre-test questions were administered to the thirty (30) pupils from the two groups in order to ascertain the previous knowledge of the pupils. Then, group A pupils were taught using lecture method (LM) while group B pupils were taught using group method (GM) of teaching. Both the two groups were taught by the researcher for the period of four weeks; with the co-operation of the Headmaster. At the end of this period, all the pupils from the two groups were made to write the same post-test questions. The answer scripts for both the pre-test and post-test were collected and marked. The scores were recorded which were used for this study.

Data analysis

Data obtained from the tests were organized and then analyzed using inferential statistics such as t-test, chi-square, and correlation coefficient. The inferential statistics were used in making deductions and generalizations about the whole population.

Research Hypothesis 1

There is no significant difference in previous knowledge of primary school pupils in mathematics.

Table 1: Previous knowledge of primary school pupils in mathematics

Group	n	mean	s.d	df	t_{cal}	t_{table}	Remark
A	15	62.2	2.5	28	2.04	2.05	ns
B	15	64.0	2.1				

Here ns implies not significant.

Table 1 revealed that the observed difference between the mean scores of the pre-test for the group A and B is not significant at $\alpha = 0.05$. This is because, the calculated t =

2.04 which is less than the table value of $t = 2.05$. Thus, H_{01} is accepted; and so we can conclude that there exists no significant difference in previous knowledge of the group A and B primary school pupils in mathematics.

Research Hypothesis 2

There is no significant difference in the mathematics achievement of primary school pupils taught using lecture method and another group taught with group method of teaching.

Table II: Mathematics achievement of primary school pupils taught using lecture method and another group taught with group method of teaching.

Group	n	mean	s.d	df	t_{cal}	t_{table}	Remark
Taught using LM	15	75.3	2.0	28	1.92	2.05	ns
Taught using GM	15	76.7	1.8				

Here ns implies not significant.

Table II showed that the difference between the mean achievements of the group of pupils taught using LM and another group taught using GM is not significant at $\alpha = 0.05$; since $t_{cal} = 1.92 < t_{table} = 2.05$. Hence, H_{02} is accepted. We can then conclude that mathematics mean achievements of the group of pupils taught using LM is the same compared with the group of pupils taught using GM of teaching mathematics.

Research Hypothesis 3

The number of primary school pupils who passed or failed mathematics is not significantly dependent on instructional methods used.

Table III: The number of primary school pupils who passed or failed mathematics base on instructional methods

Group	No. Passed	No. Failed	df	X²_C	X²_t	α	Remark
Taught using LM	12	3	1	0.24	5.02	0.05	ns
Taught Using GM	13	2					

Here, S = Significant

Table III indicated that the calculated $\chi^2 = 0.24 < \text{table } \chi^2 = 5.02$. This means that the test value is not significant at $\alpha = 0.05$. Thus, we accept the H_{03} and conclude that the number of pupils who passed or failed mathematics is independent of instructional methods used to teach the pupils.

Research Hypothesis 4

There exist no significant relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.

Table IV: Test of relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.

Categories	N	Mean	r_{cal}	t_{cal}	t_{table}	α	Remark
Taught using LM	15	75.3	0.68	3.34	2.14	0.05	S
Taught using GM	15	76.7					

Here, s = significant

From table IV, it revealed calculated correlation coefficient (r) of 0.68. This implies a positive correlation between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method. The table further revealed that the calculated $t = 3.34$; which is greater than the table value of 2.14. Thus, H_{04} is rejected; and we can conclude that there is significant relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.

Findings

1. The two groups of the primary school pupils have same previous knowledge in mathematics.
2. Mathematics performance of the group of pupils taught using LM is not different from the group of pupils taught using GM of teaching mathematics.
3. The number of pupils who passed or failed mathematics is independent of instructional methods used to teach the pupils.
4. There exist positive relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method.
5. It's possible that all instructional methods are capable of bringing about the same students' achievements in mathematics so far they were both effectively used in the instruction by the teacher.

Discussion

In this study, we have examined the impact of two instructional methods on mathematics achievement of primary school pupils separated into two groups; and each separately taught with one of the two methods. A broad goal of this work is to compare the mean achievements of the two groups with respect to the instructional techniques used for the respective group. The two instructional methods used were LM and GM which LM was used to teach group A and GM was used to teach group B.

The results of this study as revealed in table I – III supported the null hypotheses.

In the first research hypothesis: "There is no significant difference in previous knowledge of primary school pupils in mathematics". It was found that there is no significant difference between pupils' mean achievements for the two groups. The mean achievements of 62.2 and 64.0 for group A and B respectively are indications that

the pupils previous knowledge in mathematics is above average. These results justify the pupils' previous knowledge in mathematics adequate for continuity of this study. Thus, table II showed no significant difference between mean achievements of the group taught with LM when compared with the group taught with GM. However, there were improved mean scores in the post-test for the two groups. This implies that even though the two methods are both important and capable of yielding the same achievements, teachers should strive for procedural fluency that is grounded in conceptual understanding (Grouws, 2004). Therefore, the emphasis as regard to instructional methods should not be what instructional methods to be used but the teacher ability to use the method effectively. This assertion supports the result of table III of this study that the number of pupils who passed or failed mathematics is independent of instructional methods used to teach the pupils. In a similar development, it was revealed in table IV that there exist positive relationship between mathematics achievements of primary school pupils taught using lecture method and another group taught with group method. According to Butty (2001), good instructional practices have positive impact on mathematics achievements as well as attitudes of students toward mathematics. However, this can only be true if there is effective use of the methods by mathematics teachers.

Conclusion

Obviously, several mathematics' instructional methods exist which can be used to teach mathematics. However, the choice of any of these instructional methods by a teacher depends on his/her skills in using the method effectively in order to boost students' achievement. This is because, this study have shown that no instructional method is a better method than the other method. The efficacy of the instructional methods is a function of the mathematics teachers' efficacy in using the method. An instructional method that is better applied in mathematics teaching will surely guarantee a better performance from the students than any other instructional method that is less utilized.

Recommendations

Mathematics teachers should endeavor to acquire the skills for using all instructional methods involved in mathematics teaching effectively.

Mathematics teachers should be encouraged to acquire more skills through seminars, workshops, conferences and/or further studies.

Necessary teaching resource materials should be adequately provided to facilitate the usage of any instructional methods.

Mathematics teachers should avoid using a particular instructional method monotonously as this can bring about lost of interest for both the teacher and his/her students.

Adequate time should be allocated to mathematics on the school time-table, to encourage the usage of some instructional methods that required much time.

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