



EFFECT OF DIFFERENTIATED INSTRUCTION ON THE ACADEMIC ACHIEVEMENT OF PUPILS IN MATHEMATICS IN ILORIN WEST LOCAL GOVERNMENT AREA, KWARA STATE

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Abstract

Mathematics as a school subject serves as a foundation for technical education which is the bedrock of technological advancement of any nation. Research efforts to improve pupils' performance in the subject are very rare. Therefore, this study examined the effect of differentiated Instruction on pupils' academic achievement in mathematics in Ilorin West Local Government Area of Kwara State. The study adopted a pretest posttest control group quasi-experimental research design. One validated and reliably tested research instrument titled Mathematics Achievement Test (BSTAT) was used. The reliability index of SSAT ($r = 0.79$) was determined using Pearson Product Moment Correlation (PPMC). Seven research hypotheses were formulated and tested at 0.05 level of significance. The hypotheses were tested with inferential statistics of Analysis of Covariance (ANCOVA). The findings of the study revealed that treatment had significant effect on pupils' academic achievement ($F_{(1; 78)} = 64.888, P < 0.05$) in mathematics. However, gender ($F_{(1; 78)} = .437; P > 0.05$) and school type ($F_{(1; 78)} = .192; P > 0.05$) did not have significant effect on pupils' academic achievement in mathematics. Based on the findings, it was concluded that differentiated instruction can improve academic achievement of pupils in Mathematics. Based on the conclusion, it is recommended that differentiated instruction should be used in teaching mathematics in primary school. Also, government and private school owners should organize or sponsor teachers to attend workshop or conference on the use of differentiated instruction as a teaching strategy.

Keywords: Differentiated instruction, pupils' academic achievement, Basic Science and Technology

Word Count: 242

Introduction

Mathematics is the base for all technologies in the world. In Nigeria, mathematics is compulsory at primary and secondary school levels. As a matter of fact, a credit pass in mathematics is required to get admission into any prestigious university in Nigeria. Mathematics plays a significant practical role in the lives of individuals and the world of

society as a whole. It enhances problem solving and analysis skills in that it enhances students' logical, functional and aesthetic skills. Mathematics is applied in daily life in that it compels the human brain to formulate problems, theories and their solutions. Mathematics also prepares children to face a variety of simple to multifaceted challenges every human being encounters on daily basis. There is a general agreement in any society that every child should study mathematics at school to acquire skills for adult life (Njagi, 2015).

It is not surprising that mathematics teaching is more at the forefront compared to other problems in the education system. It is because mathematics, which transforms the human mind into an unlimited tool of calculation, has always kept its importance and priority due to their contribution to scientific developments as well as facilitating people's daily life. However, new job and career opportunities depend on the information and communication technologies that require mathematical skills (Karali & Aydemir, 2018). Therefore, mathematics is the key to problem solving and to bringing a way of thinking that deals with knowledge and skills required by daily life (Altun, 2013).

Today, mathematical methods are applied in most areas of human endeavour and as such mathematics learning plays a fundamental role in economic development of a country. In her march towards scientific and technological advancement, Nigeria needs good performance in mathematics for students at all levels of schooling. Therefore, all hands must be on deck to ensure improvement in the academic achievement of pupils in mathematics at primary school level where solid foundation for further studies could be laid. This is why a study of this nature is pretty important and necessary.

Technology is the mainstay of any societal development and mathematics has been recognized as the bedrock of technology and sciences (Rasheed, 2008). In fact, the world is at an age where no human endeavour could survive or develop without the application of mathematics and/or technology since almost all kinds of job have been computerized. Apart from this, the subject develops the computational skills of the pupils to solving the day-to-day problems that require mathematical knowledge. It forms the basis for further education in almost all fields of study in all higher institutions (Tella, 2009).

Despite the importance of Mathematics, it has been noted with displeasure that students' academic achievement in Mathematics has not been encouraging. The academic achievements of learners in external examination of West African Examinations Council (WAEC) in the years 2017 and 2018 were not heartening because students who had credit pass in Mathematics were not up to 50% of the learners who sat for the examination in Kwara state (National Bureau of Statistics, 2019). The percentage of learners who had pass marked in mathematics in 2017 and 2018 were 49% and 46% respectively. Considering the status and the importance of mathematics in various spheres of our national life, this poor learning situation should not be allowed to continue. This raises a serious concern since if the trend is unchecked it will undermine national development.

Isa, Mammam, Badar and Bala (2020) opined that improvement in the academic achievement of pupils is dependent on method of teaching. That is why the poor academic achievement of pupils in mathematics has been partly attributed to lecture method often used by some teachers. Hence, Olawole (2019) recommended the use of differentiated



instruction as a method of teaching to bring about improvement in the academic achievement of pupils.

According to Tomlinson (2003), differentiated instruction is modified instruction that helps students with diverse academic needs and learning styles master the same challenging academic content. While it is accepted that the common basis for all student is a need for acceptance, nurturing and respect, attending to differences, assist each student in experiencing a degree of triumph by encouraging them to be all that they can be as individuals. The use of the one-size-fits-all curriculum no longer meets the needs of the majority of learners (McBride, 2004). In addition, addressing students' differences and interests appears to enhance their motivation to learn while encouraging them to be committed and stay positive (Tomlinson, 2004).

A number of studies (Njagi, 2015; Ferrier, 2007; Karadag & Yasar, 2010; Osuafor & Okigbo, 2013) have been carried out on the effectiveness of differentiated instruction on the academic achievement of students in different school subjects other than Mathematics. Aside that studies on differentiated instruction at the primary level of education, to the best knowledge of the researcher, has not been carried out in Ilorin West Local Government Area of Kwara State where this study was carried out and this the research gap the study intend to fill.

Another variable of interest is gender. Many researchers (Pirmohamed, Debowska & Boduszek, 2017; Lori, Michelle, Glenda & Brian, 2019; Nnamani & Oyibe, 2016) have investigated the effect of gender on the academic achievement of students in different subject areas but the findings of these various studies were conflicting. Hence, this necessitated the need to include the variable in this study. Similarly, school type is another variable for consideration in this study. Public secondary schools are neither controlled by individuals, private interest groups, or agencies but by the government. On the other hand, however, Private schools can be referred to the type of educational organizations that are controlled by individuals, interest groups or non- governmental organizations (Babatunde, 2019). A number of researches (Azigwe, Adda, Awuni & Kanyomse, 2016; Munanu, 2016) have been carried out on the effect of school type on the academic achievement of learners in schools but the findings from these studies have suffered inconsistency and contradiction. Hence, that justified the need to include school as a moderator variable in this study.

Statement of the Problem

The low performance of pupils in mathematics particularly in the recent years has not been encouraging. This poor performance of pupils has been partly attributed to the pedagogical methods adopted by teachers. Claims have been made that the lecture method often used by some teachers seems to be partly responsible for the poor performance of pupils. Hence, scholars suggested method of teaching that meet the need of each learner. And one of the methods which consider the interest of each pupil in the classroom is differentiated instructional method of teaching. Studies on differentiated instruction have been conducted but deserved research attention has not been given to the investigation of the effect of differentiated instruction on the academic achievement of pupils in

mathematics particularly in at the primary school level. Also, this kind of study has not been conducted in the Ilorin West Local Area of Kwara State.

Research Hypotheses

Ho1: There is no significant main effect of differentiated instruction on the academic achievement of pupils' in Mathematics.

Ho2: There is no significant main effect of gender on the academic achievement of pupils in Mathematics.

Ho3: There is no significant interaction effect of treatment and gender on the academic achievement of pupils in Mathematics.

Methodology

The study adopted a pretest posttest control group quasi-experimental research design with a factorial design of 2X2. The target population was all primary four (4) pupils in Ilorin West Local Government Area of Kwara State. Simple random sampling technique was used to select two public primary schools. The first school was experimental group while the second school was the control group. Only primary four pupils in each of the selected schools were involved in the study. The research instrument used in the study was researcher-designed achievement test titled 'Mathematics Achievement Test (MAT). The question items of MAT were drawn from the Mathematics scheme of work for primary four, and it consisted of multiple choice questions. Before its adoption for administration, a draft copy of MAT was given to lecturers in the Department of Early Childhood and Primary Education, Kwara State University as well as two mathematics teachers who validated the instrument. To establish the reliability of the MAT, test retest method was used with an interval of two weeks. Afterwards, Pearson Product Moment Correlation (PPMC) was used to determine the reliability coefficient and the coefficient was established at 0.76. The data collected was analyzed using inferential statistics of Analysis of Covariance (ANCOVA). The hypotheses were tested at 0.05 level of significance.

Results

Research Hypothesis One: There is no significant main effect of treatment on the academic achievement of pupils in Mathematics

Table 1: Summary of Analysis of Covariance (ANCOVA) showing the main effect of treatment in pupils' academic achievement in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3192.169 ^a	4	798.042	19.340	.000
Intercept	1626.375	1	1626.375	39.415	.000
Pretest	33.797	1	33.797	.819	.368
Treatment	2677.495	1	2677.495	64.888	.000
Gender	18.039	1	18.039	.437	.510
Treatment * Gender	7.918	1	7.918	.192	.663
Error	3218.529	78	41.263		
Total	66648.000	83			
Corrected Total	6410.699	82			

Table 1 shows the effect of treatment on pupils' academic achievement in Mathematics in Kwara state. There was significant main effect of treatment on pupils' academic achievement in Mathematics in Kwara state ($F_{(1; 78)} = 64.888$, $P < 0.05$). The hypothesis was therefore rejected in the light of the result since the significant value (.000) is less than 0.05. This implies that treatment had significant effect on pupils' academic achievement in Mathematics in Ilorin West Local Government Area of Kwara state.

Table 2: Summary of Bonferroni's Poc Hoc Pairwise Comparison of the scores within the two groups

Treatment	Mean Difference	Experimental	Control Group
Differentiated Instruction	34.54	*	
Conventional Method	22.28		*

Table 2 revealed that the significant main effect exposed by table 1 is as a result the significant difference between differentiated instruction and conventional method. This implies that those exposed to differentiated instruction (Mean = 34.54) performed significantly better than those exposed to conventional method (Mean = 22.28).

Research Hypothesis Two: There is no significant effect of gender on pupils' academic performance in Mathematics in Kwara State

Table 2 also revealed the effect of gender on pupils' academic achievement in Mathematics in Kwara State. There was no significant effect of gender on pupils'

academic achievement in Mathematics in Kwara State ($F_{(1; 78)} = .437$; $P > 0.05$). The hypothesis was therefore not rejected in the light of the result since the significant value (.510) is greater than 0.05. This implies that gender had no significant effect on pupils' academic achievement in Mathematics in Kwara State.

Research Hypothesis Three: There is no significant interaction effect of treatment and gender on pupils' academic achievement in Mathematics in Kwara State

Table 1 also revealed the interaction effect of treatment and gender on pupils' academic achievement in Mathematics in Kwara State. There was no significant interaction effect of treatment and gender on pupils' academic achievement in Mathematics in Kwara State ($F_{(1; 78)} = .192$; $P > 0.05$). The hypothesis was therefore not rejected in the light of the result since the significant value (.663) is greater than 0.05. This implies that interaction of treatment and gender had no significant effect on pupils' academic achievement in Mathematics in Kwara State.

Discussion of Findings

The findings of the study revealed that there was significant main effect of differentiated instruction on pupils' academic achievement in Mathematics. This implies that pupils taught Mathematics using differentiated instructions performed significantly better than their counterparts taught with conventional method. This finding is in tandem with the earlier study by Bailey and Williams-Black (2008). This finding further gave support to the study by McAdmin (2001) who reported significant improvement in the test scores of low-scoring pupils in the Rockwood School District (Missouri), following the use of differentiated instruction.

Another finding of the study revealed that gender had no significant effect on the academic achievement of pupils in Mathematics in Ilorin West Local Government Area of Kwara State. This finding corroborated the finding of Tijani (2017) who discovered that there was no significant main effect of gender on the academic achievement of pupils in Mathematics in Moro Local Government Area of Kwara State. Similarly, the finding supported the finding of Rafiu (2018) which revealed that gender had no significant effect on the academic achievement of pupils in mathematics in Ilorin West Local Government Area of Kwara State.

The findings of the study further revealed that there was no significant main effect of school type on the academic achievement of pupils in Mathematics in Ilorin West Local Government Area of Kwara State. This finding supported the finding of Yusuf (2019) who reported that school type had no significant main effect on the academic achievement of pupils. Similarly, Tijani (2017) discovered that the type of school attended by pupils did not affect their academic achievement in mathematics.



Conclusion

Based on the findings of the study, it can be concluded that differentiated instruction has effect on the academic achievement of pupils in Mathematics regardless of gender and the type of school.

Recommendations

Based on the above conclusion, the following recommendations were made:

- Teachers should adopt the use of differentiated instruction in their classroom.
- Seminars, workshops and conferences should be organized for teachers on how to use Differentiated Instruction.
- Differentiated instruction should be incorporated in teacher training programme.
- Differentiated instruction should be included in the curriculum of Mathematics.

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