Impact of NCE Mathematics Trainee and Graduate Teachers on JSSII Students' Achievement in Geometry in Katsina-Ala of Benue State, Nigeria: A Comparative Analysis.

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Abstract
The study sampled 320 JSSII students from 8 secondary schools in Katsina-Ala local Government Area through random sampling technique. Geometry Achievement Test (GAT) was used for data collection. A pre-test, post-test non-equivalent control group design was adopted for the study where intact classes were randomly assigned to trainee and graduate treatments. Mean and standard deviations were used to answer the research questions while hypotheses were analyzed using Analysis of Covariance (ANCOVA). The study found that students taught by NCE trained teachers achieved higher in Geometry than those taught by NCE trainee teachers irrespective of gender. The finding also revealed that female students achieved at the same level in geometry as their male counterparts as intra instruction performance recorded from either NCE trainee or NCE graduate teachers. It was therefore recommended that the government should pay special attention to teachers' education especially NCE trainee teachers. The NCE trainee teachers were also required to give in-depth attention to female students while teaching geometry.
Key Words: Mathematics, Education, Geometry, NCE Trainee Teachers, NCE graduate Teachers, Gender, Achievement in Mathematics.

Background to the study:
Mathematics is one of the core subjects in primary and secondary levels of education in Nigeria and is used to determine those qualified or not to enter the tertiary level of education (Kurumeh, 2009). Despite this, students tend to perform poorly in mathematical concepts especially geometry. WAEC (2002) and (2008) for example, consistently observe that among all the topics in secondary school mathematics, the one towards which students have shown negative attitude is geometry.

Previous research reports have indicated that the dislike and downward trend of students' performance in mathematics, particularly geometry could be attributed to inadequate knowledge of mathematics teachers who may be charged to teach mathematics irrespective of such teachers' background in mathematics and the ill-preparation by teachers to explore all forms of instructional skills (Arung, 2009). Because of the faulty foundation, some students grow to perceive mathematics as a difficult, tedious and brain stressing exercise. For this reason, The WAEC Chief Examiner's Report (2009) suggests that teachers should help students improve their achievement in mathematics by reducing its abstraction, and remove their apathy and fear of the subject. It is therefore, necessary to explore the quality of interventions that could be applied; such as qualification and experience in order to ascertain their effects on geometry achievement.

This implies that students taught by NCE trainee teachers may record poor performance compared to those taught by NCE graduate teachers at secondary level or vice-versa. Vigdor (2007) for instance, asserted that teachers with professional background are more effective than those without professional background. One is therefore, tempted to link the poor students performance in geometry to the qualification of the teacher. The forgoing therefore, prompted the researcher to investigate the impact of NCE mathematics trainee and graduate teachers on the achievement of students in geometry at the junior secondary II level.

More so, differences in male and female students' achievement in mathematics have worried scholars in the field of mathematics. Obodo (1991) blamed the discrepancy of the sex achievement in mathematics on parental upbringing when he wrote, "Parents in early stage of life socialize the females out of mathematics achievement". Emelone (1993) inferred in her work on factorization of algebraic expressions that under the same conditions, males tend generally to achieve better than females. Thus, the gender dimension of geometry achievement when

taught by NCE trainee and graduate teachers is also ascertained.

Theoretical /Conceptual Issues

Piaget's equilibrium theory propounded by Jean Piaget (1896-1980) states that an organization attempts to maintain itself in a state of equilibrium. When it takes in (assimilates) food, there is a corresponding adjustment to the ingested substance; the substance is accommodated. The central theme of Piaget's theory of cognitive development is the process of equilibrium. It occurs when the organism tries to resolve the discrepancies in adaptation. The theory adequately relates to the present study because it emphasizes innovation in learning through interest to maintain equilibrium, implying that any improvement in the teaching of mathematical concepts such as geometry will cause a proportionate improvement in students' achievement in the concept. This correlation potential therefore entails that if NCE trainee and graduate teachers would sufficiently arouse the interest of their students in geometry, such students will record high achievement in these concepts.

Conceptually, Abah (2007), defined a qualified teacher as one who posses professionally based knowledge in the theory and practice of education and who find job satisfaction in the belief that he is making an important contribution to social, cultural and economic development of his country. Teachers that are qualified to teach mathematics at the junior school level are therefore, holders of NCE, B.Ed/B.Sc(Ed) and M.Ed in Mathematics education. Teachers' experience is measured in terms of the number of teachers in a district with five or more years of employment as a classroom instructor (Abdullahi, 1991). According to Telima (2011), geometry is an aspect of mathematics which deals with the study of different shapes. The shapes may be plane or solid. A plane shape is a geometrical form such that the straight line joining two points on it wholly lies in the surface. A solid shape on the other hand is bound by surfaces which may not wholly be represented on a plane surface. Geometry is one of the core parts of mathematics and often claimed to be amongst the most feared and hated by students.

Empirical Studies

Achor, Imoko & Ajai (2010) in their study titled "sex differentials in student's achievement and interest in geometry using Games and Simulation technique", used simple random sampling of hat and draw to sample 287 SS1 students comprising 158 boys and 129 girls from Gwer-West LGA of Benue State. The study adopted a quasi-experimental design, data generated using Geometry Achievement Test (GAT) and Geometry Interest Inventory (GII) were analyzed using ANCOVA. Findings reveal that, Games and Simulation arouses students' interest and enhance achievement in geometry, however with no gender difference. This study relates to the present study due to its focus on sex differentials in students' achievement and interest in geometry. One of the objectives of the present study is to determine if there are any gender differences on students' achievement when taught by NCE trainee teachers.

Nsuh (2001) studies the contribution of teachers of forms two and three levels to the poor performance of students in mathematics, to find out why a drop in performance starts at these levels and suggest possible measures for averting the poor performance at these forms. With 96 teachers as sample, questionnaire as instrument of data collection, and analysis by frequency count and Chi-square, it was found that teachers of these forms were not exposed to in-service training or workshops, did not cover all the topics in the scheme and did not make assignments compulsory. It was recommended that teachers with long teaching experiences should be assigned to teach forms with teaching aids to make their lesson lively. This study has direct nexus with the present study since both are focused on the teacher as a variable and his influence on students' performance in mathematics.

In his study titled teachers qualification as a factor in mathematics achievement of male and female secondary school students to determine whether qualification plays a major role in the achievement of male and female students, Gwanyama (2005) randomly sampled 160 students by simple balloting. Using an instrument consisting of 25 structured response test items and analyzing with ANOVA and t-test, it was found that mathematics teachers with professional background were more effective in teaching than those without professional background and that male and female students benefited from the trained mathematics teachers. Both the focus of this study and the present study are on teacher qualification hence their close linkage.

Arung (2009) carried on his study on The Effects of Teachers Qualification on Students Achievement in Senior Secondary School Certificate Examination in Mathematics". Using 15-item Likert Scale as an instrument for data collection, he distributed two hundred and eighty six (286) questionnaires to two hundred and fifty (250) students and thirty six (36) teachers from five secondary schools in Zango Kataf Local Government Area of Kaduna State. The data which was analyzed using simple percentages revealed that unqualified teachers do not cover their syllabus and this has negative effects on the students. It however found out that unqualified teachers motivate their students to understand the topic they teach. Arung's (2009) study is relevant to the present study

since both are interested in determining the impact of teacher qualification on secondary school students' performance in mathematics.

Adeyemi (2008) conducted a study on teachers teaching experience and students learning outcomes in secondary schools in Ondo State, using a correlational survey design. A stratified sampling technique was used to sample 180 schools. An inventory and a semi-structured interview schedule were instruments used to collect data for the study. The data collected were analyzed using chi-square test, correlation analysis and t-test. The semi structured interview was conducted with selected principals and responses analyzed through content analysis. The findings revealed that teachers teaching experience was significant with students learning outcome as measured by their performance in the SSCE examinations. It was recommended that government should encourage experienced teachers to stay on the job by providing them with more incentives and better promotional prospects.

Although a plethora of studies have been conducted on teacher qualification/ experience and students' achievement in Geometry as shown in the review of empirical literature, none of these studies attempted a comparative analysis of the impact of NCE trainee and graduate teachers on students' achievement in Geometry, even though most researchers emphasized the significance of qualification and experience to students' achievement. This study is therefore, undertaken to bridge this gap.

Methodology

The study utilized a quasi-experimental study design since it is not possible to have complete randomization of the subjects. Therefore, to indicate their equivalence, pre-test was used.   Intact classes were randomly assigned to NCE trainee and graduate teachers by hart and draw. Both the NCE trainee and graduate teachers were given the same pre-test and a post-test after the treatment. A sample size of three hundred and twenty (320) students; 160 each taught by NCE trainee and graduate teachers, was drawn from the target 3823 JSSII students through the simple random sampling technique by balloting.

An instrument, Geometry Achievement Test (GAT) was used for data collection. GAT was a binary (dichotomous) test developed by the researcher and validated by experts from Mathematics Education in Benue State University Makurdi. It had thirty items each with four options, but marks allocated on binary ground (right/wrong), developed from the unit of geometry taught at junior secondary school II. These topics included: polygons and their properties; Pythagoras theorem and its application; angles of elevation and depression; calculation of lengths and areas of triangles, rectangles, circles and sectors; and calculation of volumes of cuboids, cylinder and cone. The instrument was administered after six weeks of the experiment.

A total of eight (8) schools were used for the study out of which four (4) schools were randomly selected where the JSS II students' were taught by NCE trainee teachers, while in the remaining four (4) schools where the JSS II students' were taught by NCE graduate teachers.. The NCE trainee and graduate teachers were assigned to different schools so as to avoid leakage of information from students' interactions.

Data Presentation and Analysis

Table 1 shows the mean and standard deviation for students taught by NCE trainee teachers and those taught by NCE graduate teachers using Geometry Achievement Test (GAT). The mean scores of JSSII students taught by NCE trainee and graduate teachers are 55.5 and 13.49, while their standard deviations are 1.06 and 3.71, respectively, leaving a mean difference of 7.94. This shows that JSSII students taught by NCE graduate teachers recorded higher mean achievement scores, and their scores deviated less significantly from the mean scores than their counterparts who were taught by NCE trainee teachers.

In Table 2, the mean scores of males and female students taught by NCE trainee teachers using GAT are 18.52 and 7.46 resulting to a mean difference of 11.06, while their standard deviations are 3.60 and 7.14, respectively. This implies a wide disparity in the mean achievement scores of male and female students taught geometry by NCE trainee teachers. Also, the mean scores of male and female students taught by NCE graduate teachers are 24.73 and 13.18 resulting to a mean difference of 11.55, while their standard deviation are 5.06 and 11.49 respectively, leaving a mean difference of 6.43. This implies that a wide disparity exists in the mean achievement scores of male and female students taught Geometry by NCE trainee and graduate teachers. The mean achievement scores of the students tend to be higher when taught by NCE graduate teachers for both male and female students, than when taught by NCE trainee teachers.

Hypothesis Testing

HO_1: There is no significant difference between the mean achievement scores of JSS II students in geometry taught by NCE trainee teachers and those taught by NCE graduate teachers.

From table 3 above the difference observed between mean achievement scores of NCE trainee and graduate

teachers is significant in favour of the graduate teachers (p=.017<.05) and high effect size (Eta-squared=.832).The null hypothesis is therefore, rejected and an alternative hypothesis is adopted , that there exists significant difference between the mean achievement scores of JSS II students in geometry taught by NCE trainee teachers and those taught by practicing NCE teachers.

HO$_2$: There exists significant difference in the mean achievement scores of male and female students taught by NCE trainee and graduate teachers in Katsina-Ala local government area of Benue state.

In moderating the effect of sex on method using sex as the moderator, the result showed that the difference observed in the mean achievement scores of male and female students taught by NCE trainee and graduate teachers is statistically significant, (p=.037<.05) and low effect size (eta squared =.017). Thus the null hypothesis is rejected.

Discussion of Findings

The two-way analysis of covariance (ANCOVA) conducted to test the significance of the difference in JSS II students' achievement scores in Geometry shows that JSS II students taught by NCE graduate teachers had higher mean achievement scores in geometry than those taught by NCE trainee teachers. This is because students taught by graduate teachers achieved significantly higher in geometry than their counterparts taught by NCE trainee teachers. This finding is consistent with Gwanyama (2005) who found that mathematics teachers with professional background were more effective than those without professional background.

Another finding from the study is that there exists significant difference in the mean achievement scores of male and female students taught by NCE trainee and graduate teachers. This means that the male students taught by NCE trainee and graduate teachers attain higher level of achievement in geometry than their female counterparts.

Conclusion

There exists significant difference between the mean achievement scores of JSS II students in geometry taught by NCE trainee teachers and those taught by NCE graduate teachers in Katsina-Ala local government area of Benue state. Similarly, there exists significant difference in the mean achievement scores of male and female students taught by NCE trainee and graduate teachers in Katsina-Ala local government area of Benue state.

Recommendations

The Nigerian government in collaboration with Benue state government, should embark on a deliberate programme of action to encourage the learning of mathematical concepts, especially those perceived by students as difficult such as geometry, by giving special attention to teachers' education. This is a guide to the stakeholders to ensure that only qualified teachers are allowed to teach in both levels of education. The government can do this by embarking on nationwide/state-wide screening of the teachers to fish-out the unqualified teachers in public schools; ensuring that NCE trainee teachers who are on teaching practice undergo intensive supervision and guidance on-the-field training by assigning graduate teachers as supervisors for each trainee. This will cushion the negative impact that the influence of NCE trainee teachers would have exerted on the students, especially via their inability to produce effective results in geometry.

Benue State government and Secondary Schools should be provided financial and material incentives to NCE trainee teachers to assist them while on teaching practice. This is required because the trainees always fend for themselves and since they are students who hardly have any source of income to cater for their needs, an incentive from the government can spur them to put more commitment to ensure that students get higher achievement especially in mathematics concepts like geometry.

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Table 1: Mean and Standard Deviation (SD) of JSSII students taught by NCE Trainee and Graduate Teachers

Teacher Qualification	Mean	Standard Deviation
NCE Trainee	5.55	1.06
NCE Graduate	13.49	3.71
Difference	**7.94**	**2.65**

Table 2: Mean and Standard Deviation (S.D) of male and female JSSII students taught by NCE Trainee and Graduate Teachers in GAT.

Gender	Mean		Standard Deviation	
	Trainee	Graduate	Trainee	Graduate
Male	18.52	24.73	3.60	5.06
Female	7.46	13.18	7.14	11.49
Difference	**11.06**	**11.55**	**3.54**	**6.43**

Table 3: Results of Two-way ANCOVA Results of Post-GAT

Sources of Variation	Sum of Squares	df	Mean Square	F	Sig	Eta Squared
Corrected Model	12188.150	4	424.759	4.860	.010*	.596
Intercept	19362.703	1	24014.733	175.490	.010*	.620
Pre-test	22.560	1	108.541	1.600	.051**	.745
Group	29452.197	**1**	408.841	3.316	0.017*	0.832
Sex	6348.633	1	298.611	21.352	0.037*	0.017
Sex* Group	2063.967	**1**	185.620	1.3745	0.022*	0.209
Error	161937.086	158	64.878			
Total	730991.529	162				
Corrected Total	156381.506	161				

** = Not Significant' *= Significant