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HOLIDAY RURAL TEACHERS' SKILL DEVELOPMENT PROGRAMME AND THEIR GEOMETRY KNOWLEDGE

By

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Abstract.

Geometry being an important aspect of Mathematics at all levels of education demands in – depth knowledge from mathematics teachers for effectiveness of its teaching. Since knowledge is dynamic, rural teachers need to up – date their knowledge both on the subject they teach and the pedagogy found to be effective. This study therefore, investigated the impact of skill development programme organized for rural Primary School teachers on their Geometry context knowledge. The effects of years of teaching and highest qualification on Geometry content knowledge of the teachers were also investigated. The study being an experimental study adopted single group pretest-posttest research design. Two hundred and forty one rural public schools participated in the study. A teacher was randomly selected from each of the two hundred and forty one public primary schools existing in the three selected Rural Local Government Areas in Oyo State. The instrument used for data collection was Geometry Content Test (KR20=). The data collected was analysed using paired t – test and analysis of covariance. It was found in the study that the skill development programme has significant main effect on rural primary school teachers' knowledge of Geometry content (P<0.05). Teacher's years of teaching and highest educational qualification were found not to have significant effect on Geometry Content knowledge. Adequate knowledge of Geometry is needed to promote effective mathematics teaching in public primary schools. Such adequacy can only be ensured through periodic skill development training programme for teachers. It is therefore imperative to equip all rural public primary school teachers with adequate Geometry Content Knowledge via skill development programme and until this is done, inadequacy found in Geometry teaching in primary schools will remain a menace.

Introduction

Geometry is an essential part of primary school mathematics. It serves as a strong foundation for many mathematics topics at secondary and tertiary levels. Unfortunately, past evaluation of mathematics learning such as the National Assessment of Educational Progress {NAEP}(1983), reported that learners fail to understand basic geometric concepts. They also fail to display geometric problem solving skills (Kouba, Vicky, Catherine, Brown, Thomas, carpenter, Mary, Lindquist, Edward, Silver, Jane, and Swafford, 1988). This poor

performance may be due, partly to the lack of deep content –area knowledge of the teachers in Geometry (Monk, 1994). A review of past researches by the education commission of the states in America presented by Allen (2003) revealed that teachers that are well versed in their subject are likely to impact positively on their pupils' achievement in mathematics. He suggested that periodic training on how best to teach a particular subject may contribute to effective teaching.

According to Eggen and Kauchak (2001),concrete operational thinkers have made important development strides, their thinking is still tied to available experiences. They further said that learners need to solve problems, such as the one with the three sticks and concrete objects; many mathematics teachers often mistakenly believe that if their students are using manipulatives, then learning is taking place. Ball (1992), cited in Adeleke (2007), opposed their belief. He said unless connections between manipulations and the abstract concept and symbols that represent them are specifically made, pupils learning Geometry are left uncertain and may even view using the manipulative and the descriptions of the concept and symbols as two different lessons. Pupils do not automatically form links between concrete materials and abstract numerals. Seeing the relationship is difficult for pupils, but it is critical if they are to comprehend the connection between the abstractions the teachers want them to learn and the experiences provided (Eggen and Kauchak 2001). They further said that if the link is missing, learning of Geometry will be incomplete, with manipulatives and abstract concepts remaining unrelated in pupils' mind. These form a teaching task that calls for training and retraining of Mathematics teachers for effective dissemination of instruction on Geometry to learners.

Mathematics teachers' ability to sequence geometry instructional content is a fundamental issue in mathematics teaching. A team of Dutch educators, Pierre Van Hiele and Dina Van Hiele – Geldof, cited in (Mason, 2005), took note of the difficulties that their pupils had in learning geometry. These observations led them to develop a theory involving levels of instruction in geometry that pupils pass through as they progress from merely recognizing a figure to being able to write a formal geometric proof. Their theory explains why many pupils encounter difficulty in geometry as an important aspect of primary school mathematics. Mason (2005) believed that geometry requires thinking at a comparatively high level. Implicit in this is that teachers who teach geometry effectively must posses adequate knowledge of five hierarchical levels of geometry. These five levels as stated by Mason (2005) are:

Level 1 (Visualization): Mathematics teachers must be able to recognize figures by appearance alone, often by comparing them to a known prototype.

Level 2 (Analysis): Mathematics teachers should see figures as collections of properties. They can recognize and name properties of geometric figures, and they should see relationships between these properties. When describing an object to the pupils, they should be able to list all properties of the object.

Level 3 (Abstraction): Mathematics teachers should perceive relationships between properties and between figures. They should be able to create meaningful definitions, present logical implications and class inclusions (e.g. squares being a type of rectangle) to their pupils.

Level 4 (Deduction): Mathematics teachers should understand the role of axioms and definitions, and know the meaning of necessary and sufficient conditions.

Level 5 (Rigor): Mathematics teachers should understand the formal aspects of deduction, such as establishing and comparing mathematics systems. They should understand the use of indirect proof, proof by contrapositive, and can understand non – Euclidean Systems.

These heavy demands on primary school mathematics teachers call for training and re – training to update their content – area knowledge especially on geometry. Teaching experience of teachers seems to have impact on student achievement in mathematics. Those with less years of teaching, according to Fetler (1999), are likely to be less effective compared with those with many years of teaching. Level of certification of teachers seems to impact on their knowledge of the subject matter and the teaching gain. Abell – Foundation (2001) reported that highly certified teachers are no better in practice and knowledge of subject than the less certified ones. Darling – Hammond, (2002), on the other hand, asserted that certification is an important factor in predicting knowledge of subject and quality teaching. The assertion of Darling – Hammond (2002) was supported by Wayne and Youngs (2003) that, high level of certification in a particular subject area, within the context of the study mathematics, may result in high knowledge of the subject and more effective teaching. Based on the above presented background, this study investigated the effect of holiday training organized for rural primary school teachers on their knowledge of geometry. The effects of two-teacher factors (years of teaching and highest educational qualification) on their geometry knowledge were also investigated.

Research Questions

The following research hypotheses were tested in this study:

H_{O1} There is no significant effect of the skill development training programme on the rural primary school teachers' geometry knowledge.

H_{O2} Rural teachers' years of teaching do not have any significant effect on their geometry knowledge.

H_{O3} Rural teachers' highest educational qualifications do not have any significant effect on their geometry knowledge.

Research Design

This study being an experimental type used a single group pretest – posttest experimental research design.

Sample

Three Rural Local Government Areas (LGAS) in Oyo State, Nigeria were selected for this study using purposive sampling technique. Two hundred and forty one rural public primary schools in existence in the selected three LGAs as of the time this study was carried out. A

teacher each was randomly selected from each of the selected schools. Two hundred and forty – one rural primary school teachers participated in the study.

Instrument

Geometry Content Test (GCT) was used for data collection in this study. The instrument was developed by the researcher to measure the geometry content knowledge of rural primary school teachers. It comprised to sections, sections A sought information on the personal characteristics of the teachers and Section B presents ten fill – in the gaps items on Geometry Content. The items were developed using the training modules prepared by mathematics experts. This ensured the content validity of the instrument. The Kuder Richardson Reliability Coefficient estimated on GCT was 0.79. GCT was used as both the pretest and Posttest in the study.

Procedure

The researcher was one of the resource persons for mathematics teaching during the Holiday Skill development programme organized by the Federal Government of Nigeria through National Teacher Institute. GCT was administered before and after the training. Marking scheme was prepared and used for scoring the responses of the participants.

Data Analysis.

Paired t – test and Analysis of Covariance (ANCOVA) were used to analyse the data collected for the study.

Results

Hypothesis One

There is no significant effect of the skill development training programme on the rural primary school teachers' geometry knowledge.

Table 1: Paired t – test: Difference between pretest and posttest score of rural teachers in Geometry Content Knowledge.

	Mean	N	Std.Dev	t_{obs}	df	P	Remark
Pretest	2.09	241	2.04	28.746	240	.000	Significant
Posttest	6.43	241	2.80				

Table 1 shows that the t_{240} indicating the difference between pretest and posttest scores of rural teachers in geometry knowledge is 28.746; $P<0.05$. Thus, the null hypothesis one is therefore rejected. Hence there is a significant effect of the holiday skill development training programme on the rural primary school teachers' geometry knowledge.

Hypothesis Two

Rural Teachers' years of teaching do not have significant effect on their Geometry Knowledge.

Table 2: ANCOVA – Effect of Years of Teaching on Geometry Knowledge.

	Sum of Squares	df	Mean Score	F	P	Remark
Covariates – Pretest	598.832	1	598.832	112.119	.000	
Main effect – years of teaching	6.626	2	3.313	.620	.539	Not
Model	620.111	3	206.704	38.701	.000	Significant
Residual	1265.826	237	5.341			
Total	1885.938	240	7.858			

Table 2 shows that the $F_{(2,237)}$ produced by ANCOVA indicating the effect of years of teaching on teachers' geometry knowledge is 0.620; P>0.05. This implies that the null hypothesis two is not rejected. Thus, rural teachers' years of teaching do not have any significant effect on their geometry knowledge.

Hypothesis Three

Rural teachers' highest educational qualifications do not have significant effect on their geometry knowledge.

Table 3: ANCOVA – Effect of Rural Teachers' Highest Educational Qualification on their Geometry Knowledge.

	Sum of Squares	df	Mean Square	F	P	Remark
Covariates – Pretest	611.428	1	611.428	111.336	.000	
Main effect – Highest Educational Qualification	5.018	1	5.018	.938	.334	Not Significant
Model	616.484	2	308.242	57.641	.000	
Residual	1267.390	237	5.348			
Total	1883.874	239	7.882			

Table 3 shows that the $F_{(1,237)}$ produced by ANCOVA indicating the effect of highest educational qualification on rural teachers' geometry knowledge is 0.938; P>0.05, the null hypothesis three is therefore not rejected. Hence, rural teachers' highest education qualifications do not have any significant effect on their geometry content knowledge.

Discussion

Geometry knowledge of rural primary school teachers was found to be very low before their training. The reason for this might be one teacher per class policy that is in operation in most of the rural public primary schools. Areas of specialization of many of these teachers differ from mathematics. It is obvious from the finding of this study that many of them may not be able to teach some Geometry topics.

Teachers, who l teach such topics effectively should be able to comprehend the connection between the abstractions and the experiences provided during teaching as viewed by Eggen and Kauchak (2001). Such topics also demand from teachers ability to connect between manipulations and the abstract concept and symbols that represent them which Ball (1992) emphasized to be important.

Geometry knowledge acquired during the training programme was significant. Implicit in this is the fact that teachers who are well – versed in their subjects are likely to impact positively on their pupils' achievement in mathematics in general and geometry in particular. The need for periodic skill training programme as suggested by Allen (2003) becomes imperative for teachers.

Teachers' years of teaching do not significantly affect geometry knowledge of rural public primary school teachers. Knowledge acquired in the training programme by a teacher might be due to(i) the willingness and openness to new information and not necessarily the number of years such teacher has put into teaching. This finding contradicts that of Fetler (1999) that years of teaching impact on(ii) knowledge of the subject and quality of teaching.

Teachers' highest educational qualification was also found not to affect geometry knowledge of the rural public primary(iii) school teachers significantly. This finding supports that of Abell – foundation (2001) that highly certified teachers are no better in practice and knowledge of subject than(iv) the less certified ones. This finding, however, contradicts that of Darling – Hammond, (2002) and Wayne and Youngs (2003) that level of certification in a particular subject especially mathematics may affect the knowledge of the subject and quality of teaching. Majority of teachers teaching mathematics in the rural pubic primary schools specialize in other subjects. They became victims of the policy of one teacher per class. This might be the reason for the finding.

Conclusion

Efforts to improve teacher quality is important, meaningful attention however should be given to their skill development especially in their subject area. This study looked at the impact skill development training has on teacher's knowledge of Geometry. The hope is high on the participants, that effective teaching with sufficient learning gains will be the results of their experience.

Recommendations

Based on the findings of this study, the following recommendations are made:

Federal government of each country should make skill development training for teachers an annual programme which a teacher benefits from at least once in three years.

The effort of the Federal government should be corroborated by the two other tiers of government in bringing the skill development training for teachers to the grass-root.

Follow up strategy should be put in place to ensure the application of the skill gained by the teachers to classroom teaching – learning experience.

The training should also involve inspectors who would later visit schools to assess various pedagogies employ by the teachers.

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