ACADEMIC PERFORMANCE IN SENIOR SECONDARY SCHOOL MATHEMATICS AMONG STUDENTS WITH HIGH, MEDIUM AND LOW ABILITY LEVELS

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Abstract

The study compared academic achievement in mathematics of high, medium, and low ability levels of senior secondary school III students in homogeneous and heterogeneous ability groupings in Kogi Central, Kogi State. Survey research design was used. One research question and three hypotheses were formulated to direct the study. The sample consisted of one hundred and eighty (180) SS III students from four classes in two schools selected via cluster sampling technique. Mathematics Achievement Test (MAT) was used for data collection. Data collected were analyzed using t-test, at $p \leq 0.05$. *The result indicated no significant difference in mean achievement scores in mathematics between high ability level students in homogeneous and heterogeneous ability groupings and between medium ability level students in homogeneous and heterogeneous ability groupings. Though, there is significant difference in the mean achievement score in mathematics between low ability level students in homogeneous and heterogeneous ability groupings. It was concluded that the high and medium ability level students were comfortable in the two grouping systems in terms of achievement in mathematics while the low ability level students excel academically higher in heterogeneous ability grouping as they performed significantly better in the grouping mode than in homogeneous ability groupings. It is therefore recommended among others that mathematics teachers in secondary schools should use more of heterogeneous ability mode of grouping for teaching mathematics to enhance low ability level students' achievement.*

Keywords*:* Academic Achievement, Ability levels, Homogeneous Ability Grouping, Heterogeneous Ability Grouping and Mathematics.

Introduction

Ability grouping is the practice of dividing students for instruction on the basis of their perceived capacities for learning. Advocates of ability grouping hold that grouping for instruction, regardless of type of instruction, results in across-the-board increase in student positive attitude, achievement, and self-concept compared to classes without groupings (Lou et al., 2017). Research according to Kimberly (2019), found that students learning in small groups achieved significantly more than students not learning in small groups. There are two ways to group students by ability. Homogeneous ability grouping (same-ability) is a grouping mode that involve dividing students into similar ability levels which is, creating

separate groups of high, medium, and low ability level students. Heterogeneous grouping (mixed-ability) is the mixing of high, medium, and low ability level students together in a group that is, every group contain the three ability level students.

Moreover, Kimberly (2019) points out that homogeneous ability groupings can be organized by forming classrooms that contain students of similar ability level where the high, medium, and low ability level students stay in different (separate) classroom for instruction, refer to as between-class ability groupings. It can also be organized by forming groups of students of similar ability level together within a single classroom where every group is a mono ability level, referred to as within-class ability groupings. Though, both within-class homogeneous groupings and heterogeneous groupings are organized within a single classroom but every group in the former is a mono ability level while every group in the later contains the three ability level students (high, medium, and low). Within-class ability groupings is the mode of homogeneous groupings used in this study. In any of the grouping mode, the students' prior academic achievement according to Archbald, Glutting and Qian (2019) is usually the determining factor in whether students are placed in the higher achieving group or the lower ones.

Talca (2007) in Idris (2020) categorized students into three achieving groups called ability levels in relation to teaching-learning situation. This was done using students' previous test or examination scores as index of categorization. These are: low ability level learners (L) whose test score ranges from 0 to 49; medium ability level learners (M) with test score ranges from 50 to 64; high ability level learners (H) whose test scores ranges from 65 to 100. However, it is an acknowledged fact that classrooms are becoming increasingly diverse. Students have a broad range of goals, backgrounds, abilities, and needs. It has always been difficult for teachers to meet those needs, and increasing diversity and larger class sizes make the challenge even more difficult. In order to meet that challenge, teachers are constantly looking for ways to better meet the educational needs of their students. While ability grouping has been tried many times over the years, there have been enough positive outcomes to keep trying. Combining ability grouping with small-group instruction allows teachers to more specifically address the different issues their students face (Kimberly, 2019). To this effect the study compared mathematics achievement of students of different ability level in homogeneous ability grouping implemented in school A with their counterparts in heterogeneous ability grouping implemented in school B to determine which grouping system is more viable for teaching mathematics.

Literature reviews express different views about the effects of homogeneous and heterogeneous ability grouping on student learning outcome. For instance, Slavin (2016), in a study titled 'achievement effects of ability grouping in secondary schools' found that high and medium ability level students showed long-term benefits from being placed in a homogeneous ability grouped class while there was no significant difference between the low ability level students' achievement in mathematics in the two groups. Also, the

findings of Newbold (2017) pointed out that the high ability level students were performing equally well in the two grouping systems although the medium and low ability level students made significant gains in the heterogeneous ability grouped classes. Similarly, Christy and Claudia (2019) indicated that high ability level students did equally well in the two groups whereas medium ability level students did better in homogeneous group and low ability students did better in heterogeneous group. A study conducted by Kulik and Kulik (2020) found that high ability level students did better in homogeneous than in heterogeneous ability grouping while the medium and low ability level students did better in heterogeneous than in homogeneous ability grouping. However, the investigation carried out by Adodo and Agbayewa (2021) on the effect of homogenous and heterogeneous ability grouping class teaching on student's interest, attitude and achievement revealed that the high, medium, and low ability level students all achieved significantly higher in mathematics in homogeneous than in heterogeneous ability grouping. This study focused on which of the two grouping systems did the high, medium, and low ability level senior secondary III students achieve better academically in mathematics.

Research Question

To guide the study, one research question was formulated.

What is the difference between the mean achievement score of low, medium and high ability level students taught mathematics in homogeneous and those taught in heterogeneous ability groupings?

Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 levels of significance:

Ho_1: There is no significant difference in the mean achievement scores between high ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Ho_2: There is no significant difference in the mean achievement scores between medium ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Ho_3: There is no significant difference in the mean achievement scores between low ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Research Method

This study used survey design which according to Nworgu (1991) in Idris (2021) involves collection of data at current status for description of phenomena, without deliberate effort to control the variables. Data collected in respect of the study were Students' mathematics score from a test after teaching session executed by the researcher. Students' previous mathematics examination scores were used to classify them into High (H), Medium (M) and Low (L) ability levels. The sampled classes (containing high, medium, and low ability level students) in the selected schools were organized into groupings for instruction (within-class homogeneous grouping arrangement in the two classes in

school A and heterogeneous grouping arrangement in that of school B). Students were taught some selected SS III Mathematics topics such as simplification of surds, solution of quadratic equation, length of circular arc, area of sector and segment of a circle. This was done to control the influence of extraneous variables such as teachers' teaching method and qualification from one school to the other. They were then tested to determine which of the two mode of grouping compared is more viable for each ability level in the teaching of mathematics.

The population of this study consisted of all the Public Senior Secondary three (SSIII) students with a population of 14, 411 from 42 established public senior secondary schools in Central senatorial zone of Kogi State for 2023/2024 academic session. Four classes (two for homogeneous ability grouping and two for heterogeneous ability grouping from two randomly selected secondary schools in Kogi Central using balloting method were used, these included 86 students (H = 18, M = 28, L = 40) from School A, where homogeneous ability grouping was implemented; 94 students (H = 20, M = 30, L = 44) from School B, where heterogeneous ability grouping was implemented making a total of 180 students that constituted the sample for the study. The sample technique adopted to select the study subjects was cluster. This was done by randomly selecting two classes each from the cluster arm of classes available in the two randomly sampled schools from the population.

Data collection was carried out through the use of a 40-item multiple choice test tagged Mathematics Achievement Test (MAT) to determine which of the grouping mode compared is more viable for teaching mathematics for each ability level than the other. Marking scheme was prepared to guide the scoring of the test items. Table of specification was constructed for the development of this instrument.

The content of MAT was assessed and corrected by two mathematics Lecturers who are both Professors in mathematics education, two PhD mathematics science lecturers both who are senior Lecturers and two mathematics teachers at the secondary school level who are graduates and have 10 and 13 years teaching experience respectively. About 45 multiple choice questions were sent out to the experts but were scaled down to 40 test items. Five of the questions were not selected because their levels of difficulties were either too low or too high. Final copy of the instrument was produced with strict adherence to the observations made by the experts. The MAT was field tested on a sample of 35 SSIII students in a school that was not part of the study whose students' demographic features in terms of age and class level were similar to the students involved in the main study. The instrument had reliability coefficient of 0.66 using test retest procedure and Pearson Product Moment Correlation for data analysis. The result showed that the instrument was reliable.

The researchers with the help of the regular mathematics teachers in the selected schools administered the MAT to the subjects. The answer scripts collected from the two groups and marked and scored in percentages. The data were pooled together but segregated according to groupings (homogeneous ability

group and heterogeneous ability group). Mean and standard deviation were used to answer the research question, while the three hypotheses were tested using t-test independence because data were at interval scale.

Result

The data obtained from the study were analyzed using version 20 of the Statistical Packages for Social Sciences (SPSS) as follow:

***RQ*:** What is the difference between the mean achievement score of low, medium and high ability level students taught mathematics in homogeneous and heterogeneous ability groupings?

To analyse data to answer this research question, mean and standard deviation of students' test scores of each ability level in homogeneous ability and heterogeneous ability grouping were calculated as presented in Table 1.

Table 1: Summary of Mean Achievement and Standard Deviation of Students Scores in Different Ability Level with respect to Ability Grouping

Ability Level	Grouping	N	($\bar{x}$)	δ	Mean Diff.
High	Homogeneous	18	60.01	3.25	0.04
	Heterogeneous	20	59.97	3.89	
Medium	Homogeneous	28	49.10	2.32	2.12
	Heterogeneous	30	46.98	2.92	
Low	Homogeneous	40	29.85	5.16	-6.74
	Heterogeneous	44	36.59	4.29	

Table 1 shows that high ability level students did equally well in the two groups with mean score (homogeneous group = 60.01 and heterogeneous group = 59.97) and a slight mean difference of 0.04, but the medium ability level students with mean score in homogeneous group (Mean ($\bar{x}$) = 49.10) and heterogeneous group (Mean ($\bar{x}$) = 46.98) did better in homogeneous group with a mean difference of 2.12 while low ability level students with mean score in homogeneous group (Mean ($\bar{x}$) = 29.85) and heterogeneous group (Mean ($\bar{x}$) = 36.59) did better in heterogeneous group with a mean difference of -6.74. In order to establish if the mean differences were statistically significant, inferential statistics was used to test the null hypotheses.

To test the formulated null hypotheses Ho_1, Ho_2 and Ho_3, t-test independent was used as presented in Tables 2, 3 and 4.

Ho_1: There is no significant difference in the mean achievement scores between high ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Table 2: t-test Independent Analysis of High Ability Level Students' Mean Achievement Score with respect to Grouping

AbilityLevel	Grouping	N	$(\bar{x})$	δ	df	t-value	P-value	Remark.
High	Homogeneous	18	60.01	3.25	36	1.69	.186	**
	Heterogeneous	20	59.97	3.89				

** Not Significant at $P \geq 0.05$

Table 2 shows no significant difference $P = 0.186 > 0.05$ level of significance. The null hypothesis$Ho_1$is therefore retained. This implies that there was no significant difference in mean achievement scores between high ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Ho_2: There is no significant difference in the mean achievement score between medium level students taught mathematics in homogeneous and ability heterogeneous ability groupings.

Table 3: t-test Independent Analysis of Medium Ability Level Students' Mean Achievement Score with respect to Grouping

AbilityLevel	Grouping	N	$(\bar{x})$	δ	df	t-value	P-value	Remark.
Medium	Homogeneous	28	49.10	2.32	56	1.15	.381	**
	Heterogeneous	30	46.98	2.92				

** Not Significant at $P \geq 0.05$

Table 3 shows no significant difference $P = 0.381 > 0.05$level of significance. The null hypothesis Ho_2 is therefore retained. This implies that there was no significant difference in the mean achievement scores between medium ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Ho_3: There is no significant difference in the mean achievement score between low ability level students taught mathematics in homogeneous and heterogeneous ability groupings.

Table 4: t-test Independent Analysis of Low Ability Level Students' Mean Achievement Score with respect to Grouping

Ability Level	Grouping	N	$(\bar{x})$	δ	df	t-value	P-value	Remark.
Low	Homogeneous	40	29.85	5.16	82	3.48	.023	*
	Heterogeneous	44	36.59	4.29				

* Significant at $P < 0.05$

Table 4 shows significant outcome p = $0.023 < 0.05$ level of significance. The null hypothesis Ho_3 is therefore rejected. This implies that there was significant difference in the mean achievement scores between low ability level students taught mathematics in homogeneous and heterogeneous ability groupings in favour of low ability level students in heterogeneous grouping.

Discussion

The result showed that the high ability level students achieved equally well in mathematics in the two mode of grouping. This was due to the fact that significant difference was not established between the mean achievement scores of high ability level students in homogeneous and heterogeneous ability grouping in mathematics. However, the homogeneous high ability level students were slightly ahead in mean achievement score. The little upper hand gained by the homogeneous grouping high ability level students might be attributed to the absence of the lower ability level students in the group who rather served as a burden on high ability level students in terms of rendering assistance. This result agrees with the outcome of what is obtained in the study of Christy and Claudia (2019) but contradicts the finding of Adodo and Agbayewa (2021) who reported that the mean achievement score difference between homogeneous and heterogeneous grouping of high ability level students differed significantly in favour of homogeneous grouping of high ability level students.

Moreover, the no significant difference in the mean achievement score in mathematics established in Table 3 between homogeneous and heterogeneous medium ability level students signifies the effectiveness of the two modes of ability grouping in providing equivalent platform for communicating mathematics instruction to medium ability level students. The result is at variance with the findings of Slavin (2016) and Kulik and Kulik (2020) that revealed existence of significant difference between the mean achievement score of homogeneous and heterogeneous medium ability level students.

However, the result revealed a significant outcome in mathematics between homogeneous and heterogeneous low ability level students in favour of heterogeneous low ability level students. This finding could be attributed to the assistance, wealth of knowledge and experience the heterogeneous low ability level students gained in their interaction with high and medium ability levels students who were part of the group. The finding is inconsistent with the result obtained by Slavin (2016) whose study showed no significant difference in the mean achievement scores between homogeneous and heterogeneous low ability level students but in accord with the finding of Newbold (2017) that revealed the same results.

Conclusion

It was concluded based on the findings of the study that both the high and medium ability level students were comfortable in the two modes of grouping (Heterogeneous and homogeneous ability grouping) in terms of achievement in mathematics. Heterogeneous ability grouping is a more viable classroom arrangement for low ability level students than homogeneous ability grouping in terms of better academic achievement in mathematics.

Recommendations

It was recommended based on the findings from the study that:

1. Mathematics teachers in our secondary schools should use more of heterogeneous ability grouping for teaching mathematics to enhance low ability level students' achievement.
2. A mixture of homogeneous and heterogeneous ability grouping should be adopted for teaching mathematics in secondary schools for high and medium ability level students as it was revealed by the study that the two ability levels of students were comfortable in the two modes of grouping.

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