EFFECT OF GUIDED DISCOVERY INSTRUCTIONAL STRATEGY ON SENIOR SECONDARY SCHOOLS STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS IN CALABAR EDUCATION OF CROSS RIVER STATE, NIGERIA.

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Abstract

In this study, we aimed to assess the effect of guided discovery instructional strategy on senior secondary schools students' academic achievement in mathematics in Calabar education zone of Cross River State, Nigeria. The study adopt quasi-experimental research design. The population for the study was in a strict sense, all public senior secondary schools students in Calabar education zone. The students were purposively selected using stratified sampling technique with same size of 219 students. 219 students made up sample for the study. The post-test was repeated after four weeks to determine achievement level of each group (experiment and control groups) on the geometrical concepts taught. The research instruments for this study was Mathematics achievement tests. To determine the reliability of the instrument designed by the researcher, a trial testing of the instrument was done using 50 students drawn from the population who did not form part of the sample. The scores obtained from the trial testing was subjected to Kudar – Richardson formula 20 (KR – 20) which give a reliability co-efficient of 0.82. A total of 219 copies of the instrument were administered to the 219 Mathematics students in the four public (government approved) secondary schools in the study area. However, 200 were returned and used for the analysis. To test the hypothesis in the study, Analysis of Covariance (ANCOVA) was used for data analysis. The Statistical Package for Social Sciences (SPSS) was used to carry out the Analysis of Covariance (ANCOVA).The results of this study revealed that, to large extent, the students taught mathematical concepts using guided discovery instructional strategy performed significantly better than students taught with lecture instructional strategy with reference to indicators of location and gender. The finding also suggested that gender has no role to play in the academic achievement of the students. Base on the findings, it was recommended among others that teachers should use many strategies (like guided discovery instructional strategy) while teaching mathematics, for instance geometry, so that all students could gain from the teaching irrespective of the ability levels of the students.

Keywords: Guided Discovery Instructional Strategy, Students' Academic Achievement, Mathematics, Calabar Education Zone**.**

Introduction

Education is the bedrock of national development because good education has the potential of changing the quality of life of people. Through education we gain knowledge of the world we live in and transform it. This transformation can be facilitated through science and technology which can be seen in different aspects of our lives such as medicine, electricity, aviation, infrastructure, automobile, and others. The importance of science and technological education can never be overemphasized. The Federal government of Nigeria in recognition of this importance has invested massively in science education by building science laboratories and equipping them. Biology as a science subject is one of the basic ingredients of technology and the knowledge of biology is also needed for students to successfully study professional courses such as nursing, medicine and pharmacy.

Academic achievement is the outcome of education, that is, the extent to which a student, teacher or institution has achieved their educational goals. According to Jimoh, Idris and Olatunji (2016), academic achievement is the degree of success attained by students after being exposed to one form of learning or the other. Jimoh (2014) corroborates that academic achievement is the level of success attained by students in school subjects. Ezenwosu and Nworgu (2013) noted that academic achievement is commonly measured using classroom exercise, assignment and continuous assessment as well as internal and external examination. It can be used to indicate students' level of success in a particular task previously exposed to and it can also be used as indices for determining students' ability to effectively undertake another task (Jimoh, 2014).

Ezenwosu and Nworgu (2013) noted that most teachers adopted traditional lecture method which is an oral presentation of ideas, concepts, and principles to the students. Jimoh (2014) explained that lecture method is an instructional strategy which affords teacher the opportunity to present a wide content to a large class of students with little or no interaction among students and even the teacher. In the word of Adunfe (2005), lecture method is a teaching strategy where a pre-packaged instructional content is delivered by the teacher to a large audience with minimal students-teacher interaction. To improve on the academic achievements of students in Mathematics, teaching methods that enable the learners to reason, discover facts and develop self-confidence in solving mathematics problems are required. One of such methods is the guided discovery instructional strategy.

Guided discovery instructional strategy is a learning situation in which the principal content of learning is not directly exposed by the teacher but left to be discovered by the learners, making the teacher a guardian and students active participants in the learning process. Matthew and Kenneth (2013) noted that vocational education curriculum demands the adoption of more progressive strategies of discovery, inquiry, discussion, problem solving, dramatization/role

playing, computer-assisted instruction and other relaxed classroom learning and teaching activities. The relevance of guided discovery method to mathematics instruction emanated from the suggestion that learners construct knowledge out of their experiences which is associated with pedagogical approaches that promote learning by doing or active learning (Imawan, 2015).

The teachers' role in guided discovery is to serve as facilitator of learning in which students are encouraged to be responsible, autonomous and construct their own understanding of each concept. Hence, the activities are learner-centered, democratic and interactive. Garuma and Tesfaye (2012) corroborated that discovery learning is an intentional learning through problem solving under teacher supervision. It is a method through which teacher provides illustrative materials for students to study on their own (Akinbobola and Afolabi, 2010). The method is an inductive method of guiding learners to discuss and organize ideas and process it by themselves (Imawan, 2015). During guided discovery, the teacher invites students to initiate discussion and to react to other students (Garuma and Tesfaye, 2012). Learners' background knowledge and understanding of what is expected of them are most important considerations for effective use of this strategy. It can improve understanding of Mathematics because students have background knowledge in Mathematics from secondary school. Self-discovery of more knowledge and better understanding its content can be achieved through guided discovery.

The location of a school has a big role to play in the academic achievement of students at school. School location refers to the place, in relation to other areas in the physical environment (rural or urban), where the school is sited. In Nigeria, rural life is uniform, homogenous and less complex than that of urban centers, with cultural diversity, which often is suspected to affect students' academic achievement. This is because urban centers are better favored with respect to distribution of social amenities such as pipe borne water, electricity, and healthcare facilities while the rural areas are less favored. This is also true in the distribution of educational facilities and teachers. These prevailing conditions imply that learning opportunities in Nigerian schools differ from school to school. It would appear therefore that students in Nigerian urban schools have more educational opportunities than their counterparts in rural schools have.

Akinyele (2011) stated that the immediate environment of a child plays a major role in his socialization. According to him, the area in which a school is located can affect the academic achievement of a student. In the same vein, Ikashi (2015) has stated that school location is one of the major factors that affect students' academic achievements. A school located in a rural area is usually faced with problems like shortage of teachers, lack of laboratories, poorly equipped laboratories, among others in Nigeria. These shortcomings negatively affect both students' motivation and achievement. Evidence abound that the educational aspirations of students who study in rural are weaker than those of their urban counterparts (Macmillan, 2012; Nepal, 2016).

Still on, the present study use gender as moderator variable to find out if it affects academic achievement. Gender is one of the personal variables that have been related to differences found in motivational functioning and academic achievement. Gender involves the psychological and socio-cultural dimensions of being male or female (Abosede, 2007). Gender refers to the characteristics of women, men, girls and boys that are socially constructed. This includes norms, behaviours and roles associated with being a woman, man, girl or boy, as well as relationships with each other. Nguuma, Ityavzua & Onyia (2020) conducted a study to assess gender differences in academic achievement and retention in mathematics among senior secondary students in Nigeria. Empirical reports on effect of gender on students' achievement and retention in mathematics were reviewed. The study concluded that there is more evidence that gender does not determine students' fate in terms of academic achievement and retention in mathematics as most innovative teaching strategies and approaches proved not to be gender sensitive.

However, the previous studies have left several gaps to be filled. First, regarding studies on mathematics achievement using guided discovery instructional strategy relating to students' academic achievement, most of the studies have been conducted in developed countries. In contrast, it appears clear that there have been a limited number of publications reporting on this issue for developing countries, including Nigeria. Second, in the Nigerian context, the previous studies on guided discovery instructional strategy in teaching and learning also had left several gaps. Hence, this study focuses on the assessment of the effect of guided discovery instructional strategy on senior secondary schools' students' academic achievement in mathematics in Calabar education zone of Cross River State, Nigeria with indicators of location and gender.

Contribution of this paper to the literature

- This study provides a critical literature review about guided discovery instructional strategy by combing the students' academic achievement in Mathematics with lecture instructional strategy.
- This study provides a significant contribution in literature, regarding guided discovery instructional strategy in secondary schools mathematics contents.
- It highlights that guided discovery instructional strategy showed a significant positive effect on senior secondary schools students' academic achievement in mathematics. And the results indicated that there is significant influence of integration of guided discovery instructional strategy on students' academic achievement in mathematics as compare to lecture instructional strategy.
- We suggest that guided discovery instructional strategy should be widely used to enhance students' academic achievement in mathematics and to construct knowledge with peers.
- As a developing country that has keen interest in developing its education system in the world, the findings of this study has implications not only for Nigeria but for other

developing countries that are keen to integrate guided discovery instructional strategy in the classroom.

Aims and Research Questions

The aim of this study was to assess the effect of guided discovery instructional strategy on senior secondary schools students' academic achievement in mathematics in Calabar education zone of Cross River State, Nigeria with indicators of location and gender. Specifically, the study seeks to answer the following research questions: What impact does guided discovery instructional strategy have on students' academic achievement in mathematics as compare to lecture instructional strategy? What are the differences in the mean achievement scores of male and female students taught mathematics using guided discovery strategy? And, what are the differences in the mean achievement scores of urban and rural students taught mathematics using guided discovery strategy? Details of the concepts are explained on conceptual framework section below.

Conceptual Framework

Guided Discovery Method is a powerful instructional approach that guide and motivate learners to explore information and concepts in order to construct new ideas, identify new relationships and create new models of thinking and behaviour, Adams & Freeman (2016); O'Neil& Pegrum (2018). Guided Discovery Method is a method that encourages learners to explore the content through the use of concrete experience, Uwameiyi and Ogunbemeru (2005). Therefore, guided discovery method is a method that is characterized by convergent thinking and the method also enables students to make references with limited guidance from the teacher with the opportunity to discover principles or explanations Nguyen (2018) (Spence, Jensen and Shepherd 2004).

Researches on effect of guided-discovery instructional strategy shows a significant correlation with students' academic achievement in Mathematics (Akanmu & Fajemidagba, 2013; Amiyani & Widjajanti, 2018; Suratnoa, Syam & Tonra, 2019; Yuliani & Saragih, 2015; Adeagbo, Okereke, Ademiluyi & Umoru, 2019; Manklik, 2006; Casad & Jawaharlal, 2012; Hong, Van –An & Triet, 2017; Imawan, 2015; In'am & Hajar, 2017; Kartikaningtyas, Kusmayadi & Riyadi, 2017; Martaida, Bukit & Ginting, 2017; Olorode & Jimoh, 2016; Robi, Hobri & Dafik, 2018; Saputra, Fatimah & Priatna, 2016; Wulandari, Budiyono & Slamet, 2016; Yuliani & Saragih, 2015; Andarwati & Hernawati, 2013; Effendi, 2012; Matthew & Kenneth, 2013; Olorode & Jimoh, 2016; Otobo, 2010).

School location refers to the particular place, in relation to other areas in the physical environment (rural or urban), where the school is sited. In Nigeria, rural life is uniform, homogenous and less complex than that of urban centers, with cultural diversity, which often is suspected to affect students' academic achievement. This is because urban centers are better favored with respect to distribution of social amenities such as pipe borne water, electricity, healthcare facilities while the rural areas are less favored. This is also true in the distribution

of educational facilities and teachers. These prevailing conditions imply that learning opportunities in Nigerian schools differ from school to school. It would appear therefore that students in Nigerian urban schools have more educational opportunities than their counterparts in rural schools have. While some studies have shown positive influence, others have shown negative influence of school location on the students' learning outcome or achievement.

Several researches has been carried out on influence of school location on students' academic achievement; some shows no significant difference between rural and urban students' academic achievement (Orim and Opoh 2021; Abamba, 2021; Adebayo, Daniel & Oladipupo, 2018; Ntibi & Edoho, 2017; Essien, 2017; Ella & Ita, 2017; Onoyase, 2015; Ikashi, 2015; Eugene & Ezeh, 2016; Hooda & Devi, 2017; Musibau & Johnson, 2010; Macmillan, 2012; Owoeye & Yara, 2011; Gana, & Levi, 2007; Adepoju, 2001). While, others shows that urban students performed better than rural students (Alordiah, Akpadaka & Oviogbodu, 2015; Akissani, Muntari, & Ahmed, 2019; Eraikhuemen, 2014).

Gender is another moderator variable in this study. Gender and sex are related to but different from gender identity. Gender identity refers to a person's deeply felt, internal and individual experience of gender, which may or may not correspond to the person's physiology or designated sex at birth. Researches on effect of gender on students' academic achievement revealed that there was no significant difference in the mathematics achievement with respect to gender (Amatobi & Amatobi, 2020; Nguuma, Ityavzua & Onyia, 2020; Bassey, Joshua & Asim, 2015; Akissani, Muntari, & Ahmed, 2019; Allahnana, Akande, Vintseh, Alaku & Alaku, 2018; Nepal, 2016; Alordiah, Akpadaka & Oviogbodu, 2015; Alokan, 2010; Akinyele, 2011; Yusuf & Adigun, 2010; Bosede, 2010; Abiem & Odok, 2006; Ahiaba & Igweonwu, 2003; Akinyele, 2004); Ezeudu & Obi, 2013; Idris, 2015).

What is more, this study is anchor on Piaget's Cognitive Constructivist Learning Theory (1973) and Vygotsky's Social Constructivist Learning Theory (1972). Piaget's cognitive constructivist theory was propounded in (1973) and proposed that children progress through a sequence of four stages, assumed to reflect qualitative differences in children's cognitive abilities. To him a child constructs understanding through exploring and experiencing his or her environment. Vygotsky is one amongst those who believe that children actively construct their knowledge. Vygotsky (1962) viewed cognitive development as a result of a dialectical process, where the child learns through shared problem-solving experiences with someone else, such as teachers, parents, siblings and peers. As a social constructivist theorist, Vygotsky emphasizes the social contexts of learning and the fact that knowledge is mutually built and constructed. It also emphasizes the benefits of collaboration in group work and with a more skilled tutor; an individual will facilitate transition from learners' zone of proximal development to new levels of skills and competences.

The above theories plays an important function in education to guide students in learning the skills that are necessary in the culture in which they live. The teacher according should also establish many opportunities for students to learn with the teacher and more skillful peers. In this respect it is evident from this theory that science should be taught in such a way that students will be able to apply the knowledge outside the classroom. Guided discovery instructional strategy can help achieve this.

Research Methodology

This study was quasi-experimental research designed to determine the effect of guided discovery on students' academic achievement in mathematics. The pre-test and post-test control group design was considered appropriate for this study. The pre-test, post-test of 2 x 2 x 3 experimental design was employed. The experimental levels are as follows: Strategies of teaching-learning at 2 levels (guided-discovery and lecture strategies), Gender at 2 levels (male and female) and the scoring levels which is at 3 levels (high, medium and low scorers). 219 students from two purposively selected senior secondary school in Calabar South LGA of Cross River State offering Mathematics participated in the study. The schools were labeled A and B with school A used as experimental and B as the control group respectively.

Research Instrument

The main instrument that was used for data collection was a 20-item multiple choice Mathematics Achievement Test (MAT) on the concept of Geometry drawn from the past West Africa Senior School Certificate Mathematics Examinations (WASSCE) questions. Minimum and maximum scores of 0 and 20 were expected respectively to be the range within which the performance of both groups should fall (0-6 categorized as low scoring, 7-13 categorized as medium scoring and 14-20 as High scoring students). For reliability purpose, the test was administered to an intact class of two non-participating schools. After two (2) weeks, the same test was re-administered to same set of students. Their scores were correlated using Pearson's Product Moment Correlation Coefficient Method and a coefficient of 0.61 was obtained. The instructional instruments were lesson plans drawn on guided-discovery learning strategy and lecture strategy in teaching the experimental and control group respectively. The guided-discovery learning strategy was student–activity centred which required a lot of interaction among the researcher, students and instructional materials. The control group was taught using the non- guided-discovery mode only, that is, the group was exposed only to lecture strategy. Instructions were highly verbalized with minimum interaction between students and instructional materials. The researcher assisted by the research assistant personally taught the experimental group while the regular mathematics teacher assisted in teaching the control group.

Two periods of forty (40) minutes was spent each week throughout the treatment period. The study lasted for six (6) weeks of three (3) weeks teaching while first, second and the last week were used for preparation, pretest and post-testing respectively.

A total of 219 copies of the instrument were administered to the 219 Mathematics students in the four public (government approved) secondary schools in the study area. However, 200 were returned and used for the analysis.

Results

In this section, each hypothesis is re-stated and the result of data analysis carried out to test it is presented. Each hypothesis of the study was tested at 0.05 level of significance. All hypotheses were tested using Analysis of Covariance (ANCOVA). This is because 'ANCOVA' is the appropriate statistic to use when testing hypothesis where effects of more than two independent variables are to be determined.

Ho1:

There is no significant difference in the achievement scores of students taught mathematics using guided discovery strategy and those taught using lecture strategy.

The hypothesis was tested with analysis of covariance (ANCOVA). The summary of result is as presented in table 1

Table 1

Analysis of Co-variance of the difference in Mean Scores of Experimental and Control Groups in the schools of study

Variable	**N**	**X**	**SD**
Experimental group	100	13.14	2.32
Control group	100	6. 40	2.51.
Total	200	9.77	2.42

Source of variation	SS	Df	MS	F-ratio	Sig.
Corrected model	2723.22[a]	2	1332.32	31.456	.000[b]
Intercept	1731.13	1	1731.13		
Experimental/Control	2413.20	1	1132.32	35.21	
Pretest	131.34	1	1371.34	33.72	
Error	122.12	1	3.315	38.37	
Total	2333.02	198		18.12	
Corrected Total	3073.20	200			

*significant at .05; df 1, 1 & 198; critical f –value = 2.33

The above table presents the obtained F-value as 18.12. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1,1 & 198 degree of freedom. The obtained F-value (18.12) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental

and control groups in the schools of study with the use of guided discovery instructional strategies.

Considering the difference in the mean scores of experimental and control groups, the result of data analyzed in Table 1 shows that the mean scores of experimental group is higher than that of the control group. This means that the difference between them is significant. The experimental group makes use of automaticity in learning.

Ho2:
There is no significant difference in the mean achievement scores of male and female students taught mathematics using guided discovery strategy. Analysis of Co-variance was employed to test data collected in respect to this hypothesis. The summary of result is as presented in table 2

Table 2

Analysis of Co-variance of the difference in Mean Scores of Experimental in the schools of study

Variable	**N**	**X**	**SD**
Experimental group	100	23.32	2.33
Control group	100	14.01	3.51
Total	200	18.67	2.92

Source of variation	SS	Df	MS	F-ratio	Sig.
Corrected model	2483.23	2	2132.43	38.21	.000[b]
Intercept	1921.15	1	1974.31		
Experimental/Control	2835.42	1	1713.50	37.31	
Pretest	206.38	1	1537.52	34.82	
Error	1821.02	1	7.3517	36.21	
Total	2831.42	198		21.02	
Corrected Total	2973.42	200			

*significant at .05; df 1, 1 & 198; critical f –value = 2.33

The above table presents the obtained F-value as 21.02. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1, 1 & 198 degree of freedom. The obtained F-value (21.02) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of innovative teaching strategies.

Considering the difference in the mean scores of experimental and control groups, the result of data analyzed in Table 2 shows that the mean scores of experimental group is higher than that of the control group (lecture method). Thus, the null hypothesis which states that there is no significant effect of students taught mathematics with use of guided discovery instructional strategy and with those taught with lecture method as regards to gender was rejected and the alternative hypothesis upheld. Also, the finding revealed that male students performed better than their female counterparts in biology achievement test but that was due to chance factors as the difference was not statistically significant.

Ho3:

There is no significant difference in the mean achievement scores of urban and rural students taught mathematics using guided discovery instructional strategy. Analysis of Co-variance was employed to test data collected in respect to this hypothesis. The hypothesis was tested at 0.05 level of significant. The summary of result is as presented in table 3.

Table 3

Analysis of Co-variance of the difference in Mean Scores of Experimental and Control Groups (lecture method) in the schools of study

Variable	**N**	**X**	**SD**
Experimental group	100	26.12	3.21
Control group	100	16.43	3.31
Total	200	21.28	3.26

Source of variation	SS	Df	MS	F-ratio	Sig.
Corrected model	2247.53	2	3025.21	34.87	.000[b]
Intercept	2205.31	1	2134.57		
Experimental/Control	2685.42	1	1935.32	35.97	
Pretest	369.38	1	1731.56	35.426	
Error	2023.12	1	9.1315	34.87	
Total	2820.60	198		19.64	
Corrected Total	3123.42	200			

*significant at .05; df 1, 1 & 198; critical f –value = 2.33

The above table presents the obtained F-value as 19.64. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1,1 & 198 degree of freedom. The obtained F-value (19.64) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of guided discovery instructional

strategies. Also, the finding revealed that urban students performed better than their rural counterparts in mathematics achievement test but that was due to chance factors as the difference was not statistically significant.

Discussion of Findings

The first hypothesis states that there is no significant difference in the achievement scores of students taught mathematics using guided discovery instructional strategy and those taught using lecture instructional strategy. This null hypothesis was rejected on the ground that the calculated F-values obtained from the analysis of data were statistically greater than the critical F-value at .05 then the null hypothesis was rejected, and this implies that guided discovery instructional strategy have significant influence on mathematics achievement of students. The finding of this hypothesis testing, agree with the earlier finding of Akanmu and Fajemidagba (2013) who conducted a study to investigate the effect of guided-discovery learning strategy on students' performance in Mathematics alongside influence of gender and scoring levels ability of the students. 202 SS2 Students from two selected public co-educational schools in Ejigbo Local Government Area of Osun State constituted the sample of the study. The research was a quasi-experimental one and the main instrument for data collection was a 20-item multiple choice Mathematics Achievement Test drawn from West African Examination Council past questions on Set Theory. Three research questions was raised with three corresponding hypotheses tested. Results revealed a significant difference in favour of those exposed to guided-discovery learning strategy compared to those not taught using guided-discovery learning strategy.

Also, in the same vein, the finding agreed with the earlier finding of Suratnoa, Syam & Tonra (2019) who carried out a study to determine the impact of guided discovery learning on students' ability of mathematical communication. The study was a quasi-experimental research with posttest-only design. Experiment class was taught by guide discovery learning and control class was taught traditionally. The research subjects were thirty six 3rd semester pre-service mathematics teacher from two full classers. Instruments of research were test of prior knowledge and test of mathematical communication ability. Based on the research data it was found that there was effect of learning factor on students' ability of mathematical communication between students who are taught with guided discovery learning and students who are taught traditionally. Students' communication skill in experiment class was higher than control class. Therefore, guide discovery learning is one alternative to improve student communication skill.

The second hypothesis states that there is no significant difference in the mean achievement scores of male and female students taught mathematics using guided discovery instructional strategy. The result indicates that the experimental and control groups differ significantly from each other in academic achievement. Based on this result, therefore, hypothesis 2 was rejected. The finding of this hypothesis agrees with the earlier finding of Bassey, Joshua & Asim (2015)

who conducted a study to empirically verify the existence or otherwise of gender inequality in the mathematics achievement of rural male and female students in Cross River State, Nigeria; and whether parental socio-economic status and school proprietorship, taken independently, are significant factors in the achievement of the students. By stratified and simple random sampling, 2000 students (50% males, 50% female) were selected and a 30-item four option multiple choice mathematics achievement test (MAT) was constructed (KR20 of 0.87 and item difficulty, $0.40 < p < 0.82$) and administered. The independent t-test analysis of significance revealed gender inequality in the entire sample as well as among the low socio economic students and within public schools.

Also, in the same vein, the finding agreed with the earlier finding of Ntibi and Edoho (2017) who conducted a study to investigate "influence of school location on student's attitude towards mathematics and basic science". The study adopted survey design. One research question and one hypothesis was formulated and tested at 0.05 level of significance. One hundred and sixty six (166) students formed the sample of this study, two (2) validated and reliable instruments namely Mathematics and Basic Science Achievement Test (MBSAT) and Students Location Test (SLT) were used to collect data for this study. Analysis of the data results showed that; there was no significant difference in the mean performance scores between urban and rural school students with positive attitude towards mathematics and basic science using the independent t-test analysis.

The third hypothesis states that there is no significant difference in the mean achievement scores of urban and rural students taught mathematics using guided discovery instructional strategy. This null hypothesis was also rejected on the ground that the calculated F-values obtained from the analysis of data were statistically greater than the critical F-value. The implication of this result is that there is a significant relationship between guided discovery instructional strategy and senior secondary schools students' academic achievement in mathematics as regards to school location in the study area. The finding of this hypothesis is in line with the earlier position of Owoeye and Yara (2011) who carried out a study to examine the location of schools as it relates to academic performance of students in Ekiti state of Nigeria between 1990 and 1997. The study population was results of the West African School Certificate Examinations (WASCE) conducted between 1990 and 1997 in 50 secondary schools in both rural and urban areas of the state. One validated instrument "Student Location Questionnaire (SLQ)" was used for data collection. One hypothesis was formulated and answered. Data were analysed using mean and t – test. The results showed that there was a significant differences between students' academic achievement of rural and urban secondary schools in senior school certificate examinations ($t=2.73$, $p<0.05$). The study has proven that students in urban areas had better academic achievement than their rural counterpart.

Conclusion

Evidence abound in the literatures reviewed which showed that students still performed poorly in Mathematics despite its prominent roles in scientific and technological development of a nation. Factors identified for this include poor teaching method, poor foundation and abstract nature of mathematics lessons and individual cognitive style. It is against this backdrop that the present study was carried out with a view to investigating the effects of guided-discovery instructional strategy on senior secondary school students' academic achievement in mathematics. Results from this study have shown that there was a significant difference in the performance of Mathematics students taught using guided discovery instructional strategy over the students taught using lecture instructional strategy. Equally, findings from the present study have also shown that gender has no role to play in the academic achievement of the students. The findings of this study has also shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of guided discovery instructional strategies. Therefore, the study has shown the potency of guided discovery instructional strategy in improving student's academic achievement in Mathematics.

Recommendations

In line with the findings of this study, the following are recommended:

1. Teachers should make the teaching-learning of mathematics an interactive and activity – based one for the students. Teachers should use many strategies while teaching mathematics, for instance geometry, so that all students could gain from the teaching irrespective of the ability levels of the students.
2. Male and females should have roles to play in mathematics class since males are not superior to female in mathematics class as found out in this study.
3. Ministries of Education at both Federal and State levels should periodically asides regular workshops for teachers, develop a mean of reviewing / assessing the impact of teaching strategies.

References

Abamba, I. (2021). The effects of School location on students' academic achievement in senior secondary physics based on the 5E learning cycle in Delta State, Nigeria. LUMAT: International Journal on Math, Science and Technology Education Published by the University of Helsinki, Finland / LUMA Centre Finland, 9(1), 56–76.

Abiem, P.O. & Odok, J.K. (2006). Gender Factor in Students' Achievement in Different Branches of Secondary School Mathematics: Journal of Education and Technology, 1(1), 161–168.

Abosede, M.E. (2007). Correlates of students' academic achievement in senior secondary schools in Ijebu-Ode, Ogun State. *European Scientific Journal* 8(4): 1857-7881.

Adeagbo, S., Okereke, E. C., Ademiluyi, L.F. & Umoru, T.A (2019). Effects of Guided Discovery Teaching Strategy on Academic Performance of Financial Accounting Students in Oyo State, Nigeria. Al-Hikmah Journal of Education, 6(1).

Adebayo, O.O., Daniel, O.O. & Oladipupo, F.C. (2018). Impact of School Location on Academic Performance of Home Economics Students in Junior Secondary School Certificate Examination. IJRAR- International Journal of Research and Analytical Reviews, 1(2), 1585-1590.

Adepoju, T. (2001). Location factors as correlates of private and academic performance of secondary schools in Oyo State. Unpublished Paper, UI, Ibadan.

Adunfe, W. (2005). The heart of teaching. Ibadan: CITADEL Books.

Ahiaba, J. & Igweonwu, R. N. (2003). A comparative Study of the Performance of Boys and Girls in SSCE Science Subjects in Dekina L.G.A. of Kogi State. Unpublished Bachelor of Science Education (B.Sc. Ed) Project. Department of Science Education, Faculty of Education, University of Nigeria, Nsukka.

Akanmu, M. A. and Fajemidagba, O. M. (2013). Guided-discovery Learning Strategy and Senior School Students Performance in Mathematics in Ejigbo, Nigeria. Journal of Education and Practice www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.4, No.12), 82- 90.

Akinbobola, A. O. & Afolabi, F. (2010). Constructivist practices through guided discovery approach: The effect of students' cognitive achievement in Nigerian senior secondary school physics. Eurasian Journal of physics and chemistry education 2, 16–25.

Akinyele O.A. (2011). Gender differences and school location factors as correlate of secondary school students' achievement in physics. The 2011 Maui International Academic Conference, Maui, Hawaii, USA 2011.

Akinyele O.A. (2011). Gender differences and school location factors as correlate of secondary school students' achievement in physics. The 2011 Maui International Academic Conference, Maui, Hawaii, USA 2011.

Akinyele, B. O. (2004). A Study of Sex Difference in Academic achievement of Secondary School Students. Agbor Science Journal of Education, 7(2), 24 – 29.

Akissani, I., Muntari, I. & Ahmed, M. (2019). Effects of Gender and School Location on Mathematics Achievement of Senior Secondary School Students in Katsina Educational Zone, Katsina State, Nigeria. Abacus (Mathematics Education Series) Vol. 44, No 1, Aug. 2019 410

Allahnana, K. M., Akande, M. T., Vintseh, I. M. U., Alaku, E. A. &Alaku, E. M. (2018). Assessment of Gender and Interest in Mathematics Achievement in Keffi Local Government Area of Nasarawa State, Nigeria. International Journal of Operational Research in Management, Social Sciences & Education (IJORMSSE), 4(1), 127 – 140.

Alokan, F.B. (2010). Influence of sex and location on relationship between students problems and academic performance. The social sciences (TSS), 5(4), 340-345. 4

Alordiah, C. O., Akpadaka, G., & Oviogbodu, C. O. (2015). The Influence of Gender, School Location and Socio-Economic Status on Students' Academic Achievement in mathematics. Journal of Education and Practice www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.6, No.17,

Alordiah, O. C., Akpadaka, G. &Oviogbodu, O. C. (2015). The Influence of Gender, School Location and Socio-Economic Status on Students' Academic Achievement in Mathematics. Journal of Education and Practice. 6(17), 130 – 136.

Amatobi, V. E., and Amatobi, D. A. (2020). The influences of gender and attitude differences to students' achievement in mathematics in Nigerian secondary schools: a case study of comprehensive secondary school Amurie-Omanze in South Eastern Nigeria. *American Journal of Research Communication*, 8(2): 1-8.

Amiyani, R. and Widjajanti, J. B. (2018). The Excellence of Guided Discovery Learning on Mathematical Knowledge-Based, Skill-Based, and Attitude. IOP Conf. Series: Journal of Physics: Conf. Series 1097 (2018) 012145 doi:10.1088/1742-6596/1097/1/012145.

Andarwati, D., & Hernawati, K. (2013). Development of Student Activity Sheet (LKS) Based Guided discovery Approach Assisted GeoGebra To Learning Trigonometry Topics in Class X SMA, Proceedings of the National Seminar of Mathematics and Mathematics Education, 165-174.

Bassey, S.W., Joshua, M. T. & Asim, A. E. (2015). Gender differences and mathematics achievement of rural senior secondary students in Cross River State, Nigeria. Proceedings of EPI STEME, 3(5):56-60.

Bosede, A.F. (2010). Influence of Sex and Location on Relationship between Students' Problems and Academic Performance. The Social Science, 5(4), 340 – 345.

Casad, B. J. and Jawaharlal, M., (2012). Learning through guided discovery: An engaging approach to K-12 STEM education in ASEE Annual Conference and Exposition.

Effendi, L. A. (2012). Mathematics Learning with Guided Discovery Method to Improve Representations and Problem Solving Mathematically Ability Students SMP. Journal UPI, 13(2), 1-10.

Ellah, K. E., and Ita, P.M. (2017). Correlational Relationship between school location and Students' academic performance in English Language in Nigerian Secondary Schools. International Journal of Scientific and Research Publications, 7(9), 381-384Enaoha, J. O. (1983). Resources distribution in Nigeria secondary schools. Education Review, 35 (1), 25-34.

Eraikhuemen, O. O. (2014). Influence of teaching facilities on academic achievement of students in secondary schools. Electric Journal of Research in Educational Technology. 18(8), 40-54.

Essien, E. E. (2017). Influence of School Location on Students' Academic Achievement in Social Studies in Colleges of Education in Cross River State, Nigeria. Journal of Research in Science and Technology, Vol, 7, No. 2, 72-82.

Eugene, U. O. & Ezeh, D. N. (2016). Influence of Gender and Location on Students' Achievement in Chemical Bonding. Mediterranean Journal of Social Sciences, 7(3), 309 – 318.

Ezenwosu, S. U & Nworsu, L. N (2013). Efficiency of peer tutoring and gender on students' achievement in Biology. International Journal of scientific research, 4(12), 944-950.

Ezeudu, F. O. & Obi, T. N. (2013). Effect of Gender and Location on Students' Achievement inChemistry in Secondary Schools in Nsukka Local Government Area of Enugu State, Nigeria. Research on Humanities and Social Sciences. 3(15), 50 – 55.

Gana F.O. And Levi S (2007). Location and Resource Factors in the Development of the Nigerian Army Schools 1980-1984. Unpublished Ph.D. Thesis, University of Ibadan

Garuma, A. & Tesfaye G. (2012). The effect of guided discovery on students' Physics achievement. Lat. Am. J. Phys. Educ. Vol. 6, No. 4, Dec. 2012

Hong, N., Van –An, N. T. T. and Triet, L. V. M., (2017). Teaching the Arithmetic Sequence through Guided Discovery Learning : A Pedagogical Experiment in Viet Nam Int. J. Educ. Multi-disciplinary Studies, 6(3), 280–290.

Hooda, M. & Devi, R. (2017).Type of School, Locality and Gender as Determinant of Achievement in Mathematics among Secondary School Students. International Journal of Advanced Research in Management and Social Sciences (IJARMSS). 6(11), 79 – 91.

Idris, I. O. (2015). Influence of Gender and School Location on Mathematics Achievement of Junior Secondary School Students in Kogi State Central, Kogi State, Nigeria. Abacus, Journal of the Mathematical Association of Nigeria (MAN). 40(1), 249 – 256.

Ikashi, S. A. (2015). School location, teachers' marital status and academic performance of informal and adult education in Owerri. Journal of Educational Watch, 2(2), 61-82

Imawan, O. R. (2015). The Comparisons between the Effectiveness of the Guided Discovery Learning Model and Project-Based Learning Model on Solid Geometry Subject (PYTHAGORAS). Journal of Pendidik. Mat., 10 (2), 179–188.

In'am, A. and Hajar, S., (2017). Learning Geometry through Discovery Learning Using a Scientific Approach. International Journal of Instructions, 10(1), 55–70.

Jimoh, A. G, Idris, K & Olatunji, R. I (2016). Effect of cooperative learning method on academic achievement of cost accounting students in colleges of education in Ogun state. International Journal of Educational Development 6(2), 102-100

Jimoh, A. G. (2014). Effect of cooperative learning method on academic achievement of cost accounting students in colleges of education in Ogun State. Unpublished M.Ed thesis, Department of vocational teacher education University of Nigeria, Nnsukka.

Kartikaningtyas, V., Kusmayadi, T. A. & Riyadi, R. (2017). Contextual Approach with Guided Discovery Learning and Brain Based Learning in Geometry Learning Contextual Approach with Guided Discovery Learning and Brain Based Learning in Geometry Learning. Journal of Physics: Conference Series, 895, 012024.

Macmillan, M. J. (2012). School Location versus academic achievement in Physics: Does computer-assisted instruction (CAI) has any effect? Journal of Educational and Social Research, 2(8): 162–168

Manklik, M. (2006). Effects of demonstration and guided discovery method in correcting misconceptions in physics amongst remedial students, University of Jos, Jos. Unpublished Ph.D. Thesis, University of Ilorin.

Martaida, T., Bukit, N. and Ginting, E. M., (2017). The Effect of Discovery Learning Model on Student ' s Critical Thinking and Cognitive Ability in Junior High School IOSR J. Res. Method Educ., 7(6), 1–8.

Matthew, B, & Kenneth I, O. (2013). A Study on the Effects of Guided Inquiry Teaching Method on Students Achievement in Logic. International Researcher (online), 2 (1), 135-140.

Musibau, A. Y. & Johnson T. A. (2010). The Influence of School Sex, Location and Type on Students' Academic Performance. International Journal of Education Science, 2(2): 81 – 85.

Nepal, B. (2016). Impact of Gender and Location on Mathematical Thinking and Mathematics Achievement. Journal of Advanced Academic Research (JAAR), 3(3), 11 – 21.

Nguuma, J., Ityavzua, T. M. & Onyia, M. N. (2020). Assessment of Gender Differences in Academic Achievement and Retention in Mathematics among Senior Secondary Students in Nigeria. *World Journal of Interactive Research (WJIR),* 2(1): 72-96.

Olorode, J. J & Jimoh, A. G (2016). Effectiveness of guided discovery learning strategy and gender sensitivity on students' academic achievement in financial accounting in colleges of education. Retrieved from http//www.Academic research Journal.org/IJARER/Indexhtil.4561182-189

Olorode, J. J. and Jimoh, A. G., (2016). Effectiveness of Guided Discovery Learning Strategy and Gender Sensitivity on Students' Academic Achievement in Financial Accounting in Colleges of Education. Int. J. Acad. Res. Educ. Rev., 4(6), 182–189.

Onoyase, S.O. (2015). The impact of School Management Environment on Students' output quality in Oyo State Secondary Schools. Unpublished Ph.D Thesis, University of Ibadan, Nigeria.

Orim, R. E & Opoh, D.A. (2021). Three social media platforms usage and mathematics academic performance among SS2 secondary School Students in Obudu LGA, CRS, Nigeria. International Journal of Contemporary social science education, 3,(1), 151-160.

Otobo, K. (2010). Effect of guided discovery method of instruction on the achievement of junior secondary school students in computer studies. Unpublished B.Sc.Ed thesis. Ekiti state University.

Owoeye, J.S. & Yara, P.O. (2011). School location and academic Achievement of secondary school in Ekiti State, Nigeria. Journal of Asian Social Science, 7(5). Retrieved from www.ccsenet.org/ass.

Robi, A. A., Hobri, H. and Dafik, D., (2018). The Analysis of Critical Thinking Skill of Version P21 in Solving the Problems of Two Dimensional Arithmetic Derived from the Implementation of Guided Discovery Learning. Int. J. Sci. Res. Manag., 6(1), 6–13.

Saputra, S., Fatimah, S. and Priatna, B. A., (2016). Increasing Junior High School Students' Mathematical Reasoning Ability by Using Guided Discovery Learning in International Conference on Mathematics, Science, and Education 2016 (ICMSE 2016) INCREASING.

Suratnoa, J., Syam, W. & Tonra, A. (2019). The Effect of Guided Discovery Learning on Students' Mathematical Communication Skill. The 2nd International Conference on Science, Mathematics, Environment, and Education AIP Conf. Proc. 2194, 020119-1–020119-6; https://doi.org/10.1063/1.5139851.

Wulandari, S. P., Budiyono, B. and Slamet, I., (2016). The Development of Learning Module with Discovery Learning Approach in Material of Limit Algebra Functions in International Conference on Mathematics, Science, and Education 2016 (ICMSE 2016).

Yuliani, K. and Saragih, S. (2015). The Development of Learning Devices Based Guided Discovery Model to Improve Understanding Concept and Critical Thinking Mathematically Ability of Students at Islamic Junior High School of Medan. Journal of Education and Practice, 6(24), 116–128.

Yusuf, M.A. & Adigun, J.T. (2010). The influence of school sex, location and type on students' academic performance. International Journal of Education Science, 2(2).

APPENDIX: Mathematics Achievement Test (MAT)

	Questions	Answers
1	A triangular prism has (a) 3 edges (b) 9 edges (c) 2 edges (d) 6 edges	6 edges
2	Use $\frac{22}{7}$ for π to calculate the volumes of cones with height of 6cm and base radius of 7cm. (a) 3210cm^3 cm (b) 3015cm^3 cm (c) 2156 cm^3 (d) 145cm^3	V = $\frac{1}{3}\pi r^2$h V = $\frac{1}{3}$ x $\frac{22}{7}$x 7 x 7 x 6 V = 2156 cm^3
3	The volume of a pyramid whose base area is A and height is h is given as (a) V=$\frac{1}{3}Ah$ (b) V= 3Ah (c) V=4Ah(d) V= 2Ah	V=$\frac{1}{3}Ah$
4	A square-based pyramid with sides (60cm) with vertical height 50cm have a volume of (a) 6000cm^3 cm (b) 60000cm^3 cm (c) 600cm^3 (d) 60cm^3	V=$\frac{1}{3}Ah$ V=$\frac{1}{3}$ x60^2 x 50 V = 60000cm^3
5	The capacity of the pyramid in question (23) is (a) 15 litres (b) 30 litres (c) 60 litres (d) 120 litres	Capacity = $\frac{60000}{1000}$ C = 60 litres

6	The area of curved surface of a frustum of radii r and R, slant side s, is (a) πs(r + R) (b) πs(r + R^2) (c) πs(r^2 + r) (d) πs^2(r + R)	A = πs(r + R)
7	An open rectangular box measures 8m by 6m by 8m. Find the cost of polishing the external part of the box if it costs #2.00 to polish one square meter. (a) #544.00 (b) #566.00 (c) #580.00 (d) #556.00	L = 8b =6h 8 Ar = lb + 2bh + 2hl = 8x6 + 2x6x8 + 2x8x8 = 272cm^2 Total cost of painting = 272 x 2 = #544.00
8	A cone of height 10cm is placed on top of a cylinder. The height and base diameter of the cylinder are 40cm and 30cm respectively. Calculate the volume of the composite solid to 3 s.f (take π = 3.14). (a) 10458cm^3 cm (b) 30615cm^3 cm (c) 30200cm^3 (d) 10458cm^3	r = 15cm, H = 40cm, h = 10cm v = $\frac{1}{3}\pi r^2$h + πr^2H v = $\frac{1}{3}$ x 3.14 x 15^2 x 10 + 3.14 x15^2 x 40 v = 2355 + 28260 v = 30615cm^3
9	A solid cube of 8cm is dropped into a cylindrical tank of radius 7cm. Calculate the rise in the water level if the original depth of water was 9cm (use $\pi = \frac{22}{7}$). (a) $3\frac{25}{77}$ (b) $5\frac{25}{77}$ (c) $6\frac{25}{77}$ (d) $2\frac{25}{77}$	Volume of a cube = (8x8x8)cm^3 = 512cm^3 Volume of cylinder = $\frac{22}{7}$ x 7^2 x h 154h = 512 h = $3\frac{25}{77}$
10	The radii of a frustum are 6cm and 10cm respectively and the slant height is 8cm. calculate the area of the surface of the frustum. (a) A = 16 πcm (b) 128 πcm (c) 118 πcm (d) 32 πcm	A = πs(r + R) A = π x 8(6+10)cm^2 = 128 $\pi$$cm^2$
11	The base radius of a cylinder is 7cm while its height is 20cm. Determine the capacity to the nearest litre (take $\pi = \frac{22}{7}$). (a) 4 litres (b) 3 litres (c) 6 litres (d) 12 litres	V = πr^2h = $\frac{22}{7}$ x 7^2 x 20 = 3080cm^3 Capacity (litres) = $\frac{3080}{1000}$ = 3.08 ≈ 3 litres
12	The geometric figure that can be likely found in a cashew fruit is a (a) cone (b) cube (c) pyramid (d) sphere	Cone

13	The base of a cone is _____ (a) a square (b) a circle (c) polygon (d) conical	A circle
	Use the information below to answer questions 33, 34 and 35 (take $\pi = \frac{22}{7}$). A sector of circle with radius 21cm has an area of 280cm^2	
14	Calculate the length of arc. (a) 40.7 cm (b) 26.7 cm (c) 56.7 cm (d) 10.7 cm	Area of sector = $\frac{\theta}{360}$ x πr^2 .: 280 = $\frac{\theta}{360}$ x $\frac{22}{7}$x $(21)^2$ $\theta = 72.73^0$ L = $\frac{\theta}{360}$ x πr L = $\frac{72.73}{360}$ x $\frac{22}{7}$ x 21 L = 26.7cm
15	Calculate the perimeter of the sector (a) 43.7 cm (b) 26.7 cm (c) 38.7 cm (d) 68.7cm	Perimeter = 2r + L P = 2(21) + 26.7 P = 68.7cm
16	If the sector is bent such that its straight edges coincide to form a cone, calculate the vertical angle of the cone. (a) 23^0 (b) 20^0 (c) 15^0 (d) 10^0	If the sector is bent to form a cone, the radius of the sector will become the slant height of the cone and the length of arc will become the base circumference of the cone. .: L = $2\pi r$ 26.7 = 2 x$\frac{22}{7}$ x r r = 4.248 Sin θ = $\frac{4.248}{21}$ = 0.2023 θ = 11.67 Vertical angle = 2 x θ = 2 x 11.67 = 23^0
17	A cylindrical tin 7cm high is closed at one end. If its total surface area is 462cm^2, calculate its radius (take $\pi = \frac{22}{7}$). (a) 7 cm (b) 2 cm (c) 5 cm (d) 10 cm	Total surface area (TSA) = 2 πrh + 2 πr^2 .: 2 πrh + 2 πr^2= 462 πr(2h + r) = 462 $\frac{22}{7}$r(2x7 + r) 462 r = 7cm

18	A cylindrical cup has a circular base of radius 7cm and height of 10cm. Taking the value of $\pi = \frac{22}{7}$, calculate its curved surface area. (a)740cm^2 (b) 440 cm^2 (c) 120 cm^2 (d) 346 cm^2	CSA = 2 πrh = 2 x $\frac{22}{7}$ x 7 x 10 = 440cm^2
19	Calculate the volume of a cylindrical steel bar which is 8cm long and 14 cm in diameter. (a) 1232cm^3 cm (b) 3025cm^3 cm (c) 300cm^3 (d) 1045cm^3	V = πr^2h V = $\frac{22}{7}$ x 7^2 x 8 = 1232 cm^3
20	A cone has a base radius of 5cm and a height of 12cm. Calculate its total surface area. (a) 92π cm^2 (b) 69π cm^2 (c) 70π cm^2 (d) 90π cm^2	Total surface area (TSA) = $\pi rl + \pi r^2$ TSA = π x 5 13 + π x 5^{2}cm^2 TSA = 90π cm^2