

EFFECTS OF DISCOVERY TEACHING METHOD ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SECONDARY SCHOOLS IN DELTA NORTH SENATORIAL DISTRICT

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Abstract

The study investigated the effects of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District. Five (5) research questions were raised and five (5) hypotheses were also formulated for the study. A quasi-experiment design was employed for the study. The population of the study is 28,324 Mathematics students in Delta North Senatorial District, Delta State. The sample size of the study consists of 120 Mathematics SSII students selected from the secondary schools in Delta North Senatorial District using random sampling techniques. The instruments used for data collection was Mathematics Achievement Test (MAT). The data collected were subjected to statistical analysis using mean and standard deviation and Paired Sampled t-test. It was found that; there is a significant effect of discovery teaching method on students' achievement in mathematics in secondary schools, there is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in secondary schools, there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method, there is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools and there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools. Based on these findings, it is recommended that teachers should expose their mathematics students to discovery teaching method in order to enhance, promote, motivate and improve students' interest in mathematic as well as their achievement. Again, Government should provide facilities for students and teachers to promote discovery teaching method in the teaching and learning of mathematics in secondary schools.

Keywords: Discovery Teaching Method, Achievement, Mathematics

Introduction

Mathematics is one of the most important school subjects in the curriculum worldwide. It's a subject that directly relates to other subjects, especially science and technological courses. All elementary and high schools are required to take mathematics. According to Umameh (2011), mathematics is fundamental to and an essential instrument for any country's growth in science, technology, and the economy.

In spite of the trivial role mathematics plays, most of the students find it difficult to pass and continue it at graduate levels and one of the most common reasons behind this discontinuance in mathematics is due to mathematical background at the secondary school level. Owolabi (2004) concluded that the students' achievement in ordinary level Mathematics in Nigeria was generally below expectation and poor. Jegede *et al.*, (2002) reported the factors responsible for students' academic achievement in Mathematics as lack of qualified mathematics teachers, lack functional instructional materials, mathematics teaching methods, lack of experienced mathematics teachers and location of school. Among these factors, this study anchored on discovery teaching method.

In this study, discovery method is considered as a teaching method used for teaching and learning of Mathematics. Joolingen (2009) defines the discovery method as a kind of instruction in which students create their own knowledge by experimenting with a subject and deriving rules from the findings of these trials. Discovery method is a method where students are given a chance to observe, think, ask, and discover the material by themselves. The role of teacher is a facilitator and informant.

According to Alfieri *et al.* (2011), discovery learning is a constructivist, inquiry-based theory in which people use their prior knowledge and experiences to explore and comprehend concepts. As stated by Bruner (2011), "Learning to find information on one's own helps one to obtain it in a way that makes it more easily applicable to problem solving." Two types of discovery learning, unassisted and enhanced, were described in the professional literature. In unassisted discovery learning, students receive very little instructional assistance (e.g., direction and feedback) from the classroom teacher. Instead, they are expected to "discover" the knowledge and information required to address their questions and concerns. In contrast, enhanced discovery method provides learners with more direction and feedback regarding what and how well they are learning (Marzano, 2011).

Discovery teaching encourages students to think critically and solve problems independently. Through the use of hands-on activities and real-world problems, students develop essential problem-solving skills. By engaging in meaningful problem-solving activities, students learn how to break down complex problems into smaller more manageable steps, apply logical reasoning, and think creatively to find solutions. These problem-solving skills are not only valuable in mathematics but also can be applied to various other subjects and real-life situations.

Discovery teaching allows for individualized learning and differentiated instruction. By providing students with choice and flexibility in their learning, this method caters to different learning styles and abilities. It enables teachers to adapt their instruction to meet the specific needs and goals of their students. By offering a variety of activities and resources, teachers can engage and challenge students of all levels, promoting their academic growth and achievement in mathematics. Discovery teaching promotes collaboration and communication skills among students. By working in groups and engaging in collaborative activities, students learn how to communicate effectively, listen to their peers, and share

ideas. These skills are not only valuable in mathematics but also in other areas of life. By fostering a supportive and inclusive learning environment, students develop a sense of belonging and are more likely to actively participate in their learning.

Discovery teaching encourages students to take ownership and responsibility for their learning. By involving students in the decision-making process and giving them opportunities to apply their knowledge, this method promotes a sense of ownership and autonomy. When students actively participate in their learning, they are more likely to take ownership of their achievements and strive to reach their full potential.

Discovery method can take many forms in the classroom. Teachers may ask students, for example, to design their own experiment, invent their own strategy for solving a problem, or answer a series of guiding questions. A first grade teacher might challenge students to find the sum of two large numbers, provide ample time for them to discover appropriate responses, and then explain their strategies for getting the answers. In an unassisted discovery learning classroom, students are given problems and they must find their own answers.

In view of the fact that sex and school location of student may have impact on their academic achievement. This study adopts sex and school location as moderator variables. Eryilmaz (2004) observed that sex contributes to poor achievement of students towards Mathematics. Sex according to Yang (2010) refers to the social attributes and opportunities associated with being male and female or girls and boys. These attributes are socially constructed and are learned through socialization processes. The study of Gonzuk and Chargok (2001) opined that sex play a very vital role on students academic achievement towards Mathematics. This difference in the number of females and males in the study of mathematics has created sex disparity in the academic achievement of students in mathematics and science subjects as a whole.

Sex difference was first investigated by sociologist of education. The focus was largely on female under achievement at every level of the educational system. Therefore, there is need to promote the teaching and learning of mathematics in schools especially among female student. The critical belief of biological theorists is that sex differences are natural and therefore unalterable (Olubunmi, 2001). Due to the differences in their innate responsibilities, it would be appropriate and moral to treat boys and girls differently in schools. As a result, arguments were put up suggesting that while women fared better in language-based subjects due to their superior reasoning skills, they underperformed in the sciences due to their lesser intrinsic capacity to manipulate shape and form.

Again, school location has so much influence on academic achievement of students (Ma and Wilkins, 2002). School location, according to Ezeudu (2013), refers to the place where the school is located, which could be in an urban or rural setting. Like with other educational subjects, mathematics is also likely to be influenced by its urban-rural location due to potential psychosocial effects on instructors and students. Their achievement in mathematics may even be determined by this. As a result, a student's academic success may be impacted by the location of a school. A school situated in the centre of a government reserved area (G.R.A.) or housing estate cannot be compared to one that is in an inappropriate location, such as next to a large market, a motor garage, or another noisy area. Conditions for teaching and learning might be negatively impacted by a noisy atmosphere. A long commute to school can be tiresome. The conceptual understanding of the students may be impacted by several factors.

A school located in a rural area, Pascarella and Terenzini (2001) argue, will have all the characteristics of a rural environment. In a similar vein, an urban school will provide activities that are unique to its setting yet distinct from those in a rural one. Thus, academic achievement may vary along with differences in the school environment. The consequence is that, the quality of education may not be even; and the national policy of education for a democratic, egalitarian society cannot be attained un sentimentally. Therefore, this study explores the effects of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District.

Statement of the Problem

The academic achievement of learners in the secondary school system must rise in order to meet the objectives of secondary education in Nigeria. The report from chief examiners of West Africa Examination Council indicated that the general achievement of students in mathematics from May-June 2017 to 2020 examination did not differ significantly from the previous results. However, the chief examiners also reported that candidates (students) achievement is declining and getting worse every year.

Despite the recommendation for use of teaching method for teaching and learning science including Mathematics by the Federal Ministry of Education's 6-3-3-4 curriculum reform, and suggestions by many Educators, reports from educators and researchers indicated that students' achievement in Mathematics has not improved to the level it was supposed to be. The poor achievement of students in mathematics might be associated with the use of poor methods of teaching, sex differences and school location as hindrance for supplies in teaching facilities.

In view of these, researchers in science education have continually sought for better teaching methods that will enhance students' achievement, promote their interest and bridge the gender gap in male and female students' achievement and interest in Mathematics. Discovery method of teaching when fostered in different ways can ultimately and positively affects students understanding, achievement and interest in Mathematics. Some other researchers have also suggested using different forms of teaching methods to improve students understanding, achievement and interest in Mathematics. Hence, the problem which this study is put in question form: What are the effects of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District?

Research Questions

The following questions will be raised to guide the study.

1. What is the effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District?
2. What is the difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in Delta North Senatorial District?
3. What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District?
4. What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District?
5. What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District?

Research Hypotheses

The research hypotheses will be formulated and tested at 0.05 level of significance.

1. There is no significant effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District.
2. There is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in Delta North Senatorial District.
3. There is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District.
4. There is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District.
5. There is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District.

Purpose of the Study

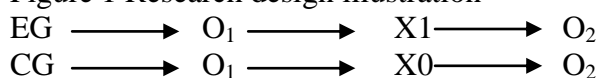
Generally, the purpose of this study is to examine the effects of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District. Specifically, this study will:

- Find out the effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District.
- Find out the difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in Delta North Senatorial District.
- Find out the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District.
- Find out the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District.
- Find out the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District.

Methodology

The study is Quasi experimental in nature involving pre-test and post-test on two groups designated as experimental and control. Ali (2006) noted that quasi-experimental design is an alternative and appropriate to experimental design when randomization of sample is impossible. In quasi-experimental design, the independent variables are manipulated in order to determine its effects on the dependent variables. The experimental group were taught Mathematics concepts using discovery teaching method while the control group were taught same concepts using lecture method for a period of 6 weeks. The two groups was post tested and pretested for achievement. The design is illustrated in figure 1.

Figure 1 Research design illustration



Where: -

EG = Experimental group
CG = Control group

X1	=	Treatment (discovery method)
O ₁	=	Pre-Test
X0	=	No Treatment (lecture method)
O ₂	=	Posttest

28,324 students in Delta North Senatorial District, Delta State as obtained from Ministry Basic and Secondary Education, Asaba, (2021) constituted the population of this study. The sample of the study comprise of 120 SSII students from four (4) public Secondary School in our (4) Local Government Areas in Delta North Senatorial District of Delta State. The instrument used for data collection will be the Mathematics Achievement Test (MAT). The Mathematics Achievement Test (MAT) were used as pre-test and also used as post-test to ascertain achievement. Fifty (50) items of Mathematics Achievement Test were drawn from past West African Examination Council (WAEC) questions on measurement, trigonometry geometry, simultaneous equation, quadratic equation and algebraic fraction.

Treatment Procedure

The treatment procedure will be done in phases as follows:

Phase A: Assignment of Schools into Experimental and Control Groups: The four (4) schools selected for the study will be randomly assigned into two groups namely; the discovery teaching method and the lecture method group.

Phase B: Training of Research Assistant in the Experimental Groups: Before the commencement of treatment, Teachers in experimental group will be trained on how to teach the students with discovery teaching method. Each Teacher will be trained individually in a session of 2 hours and in the course of training, the researcher will make use of the discovery teaching method package. The essence of the training is to enable the Teachers to be conversant with the instructional strategies and to enable them apply the strategies accordingly in teaching the selected mathematics content for the study to the students. The training package consisted of information, briefing and discussion that covered the purpose of the training, instructional strategy (discovery teaching method) under consideration and the lesson plans for the strategy. The trainees will also be requested the present a lesson using the strategy that they have been trained on while the researcher observes to ensure compliance and adherence to the procedures of the strategies.

The Teachers in the Control Group which will use the lecture method will not be trained since it is the conventional method. The researcher will only explain the purpose of the study and provide the lesson plans in a lecture method format on the instructional units to the teachers for use during the treatment.

Phase C: Pre-Testing: The pre-test was administered to all the sampled SS II Mathematics before the actual commencement of treatment. The sampled students constitute Experimental Group and the Control Group. The pre-test is the 50 item Mathematics Achievement Test (MAT). This was done to determine the equivalence of the groups before treatment to be sure that any changes in achievement noticed later was due to the treatment. Their responses were collected, scored and the result was kept.

Phase D: Actual Treatment: The treatment group is Experimental Group which was taught using discovery teaching method. The research assistant of Experimental Group will incorporate the stages of discovery teaching method as specified in the lesson plan. The Control Group on the other hand did not receive any treatment but was taught using the traditional lecture method. However, the lecture method lesson plan with the same

instructional contents/units as those using discovery teaching method was given to the teacher to ensure uniformity.

Phase E: Post-Test: At the end of the treatment, using the intervention packages, students in experimental and control groups were post-tested with the Mathematics Achievement Test (MAT). The post-test question was the same as the pre-test, only that the items was re-shuffled and re-numbered to avoid testing threat due to memorization of the pre-test. Thereafter, the scores from the ability test, pre-test and post-test was collated and analyzed. The data obtained from the pre-test and post-test of the two groups was analyzed using means and standard deviation to answer the research questions deviation while the hypotheses was tested using Analysis of Paired Sampled t-test at 0.05 level of Significance.

Presentation of Results

Research Question 1

What is the effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District?

Table 1: Mean Analysis on Effect of Discovery Teaching Method on Students' Achievement in Mathematics

N=120			
Testing	\bar{X}	\bar{XD}	SD
Pretest	17.55		4.45
Posttest	49.58	32.03	7.26

The data presented in table 1 shows that mean achievement score at pre-test is 17.55 with standard deviation value of 4.45. The mean achievement score at post-test is 49.58 with standard deviation of 7.26. There exist mean differences of 32.03 in favour of the post-test scores. This shows that there is a difference between the two set of scores.

Hypothesis One (1)

There is no significant effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District.

To determine if there is a significant effect of discovery teaching method on students' achievement in mathematics, paired sampled t-test was employed to test hypothesis 1 as shown in table 2.

Table 2: Paired sampled t-test Analysis showing significant effect of discovery teaching method on students' achievement in mathematics

N=120							
Testing	\bar{X}	\bar{XD}	SD	Df	t-cal	Sig	Decision
Pretest	17.55		4.45				
Posttest	49.58	32.05	7.26	119	42.76	0.000	Ho₁ is Rejected

P<0.05

The data in table 2 shows that there is a significant effect of discovery teaching method on students' achievement in mathematics, $t=42.76$, $P(0.000)<0.05$. Hence, the null hypothesis is rejected. Therefore, there is a significant effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District.

Research Question 2

What is the difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in secondary schools in Delta North Senatorial District?

Table 3: Mean Analysis on difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method
 N=120

Testing	\bar{X}	\bar{XD}	SD
Achievement Score of Urban Students	50.80		8.02
Achievement Score of Rural Students	50.37	0.43	7.24

The data presented in table 2 shows that mean achievement score of urban students is 50.80 with standard deviation value of 8.02. The mean achievement score of rural students is 50.37 with standard deviation of 7.24. There exist mean differences of 0.43. This shows that there is a difference between the two set of scores.

Hypothesis Two (2)

There is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in secondary schools in Delta North Senatorial District.

To determine if there is a significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method, paired sampled t-test was employed to test hypothesis 2 as shown in table 4.

Table 4: Paired sampled t-test Analysis showing significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method
 N=120

Testing	\bar{X}	\bar{XD}	SD	Df	t-cal	Sig	Decision
Achievement Score of Urban Students	50.80		8.02				
Achievement Score of Rural Students	50.37	0.43	7.24	119	0.61	0.87	H_0 is not Rejected

P<0.05

The data in table 4 shows that there is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method, $t=0.61$, $P(0.87)<0.05$. Hence, the null hypothesis is not rejected. Therefore, there is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in secondary schools in Delta North Senatorial District.

Research Question 3

What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District?

Table 5: Mean Analysis on difference in mean achievement score of male and female students taught mathematics using discovery teaching method

N=120			
Sex	\bar{X}	\bar{XD}	SD
Male students Score	52.85		7.497
Female students Score	52.53	0.32	7.193

The data presented in table 5 shows that mean achievement score of urban students is 52.85 with standard deviation value of 7.497. The mean achievement score of rural students is 52.53 with standard deviation of 7.193. There exist mean differences of 0.32 in favour of the post-test scores. This shows that there is a difference between the two set of scores.

Hypothesis Three (3)

There is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District.

To determine if there is a significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method, paired sampled t-test was employed to test hypothesis 3 as shown in table 6.

Table 6: Paired sampled t-test Analysis showing significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method

N=120							
Sex	\bar{X}	\bar{XD}	SD	Df	t-cal	Sig	Decision
Male students Score	52.85		7.497				Ho₂ is not Rejected
Female students Score	52.53	0.32	7.193	119	0.16	0.71	

P<0.05

The data in table 6 shows that there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method, $t=0.46$, $P(0.71)<0.05$. Hence, the null hypothesis is not rejected. Therefore, there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District.

Research Question 4

What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District?

Table 7: Mean Analysis on difference in mean achievement score of male and female students taught mathematics using discovery teaching method in urban secondary schools

N=120			
Sex	\bar{X}	\bar{XD}	SD
Male	55.00		8.67
Female	54.86	0.14	7.71

The data presented in table 7 shows that mean achievement score of male students is 55.00 with standard deviation value of 8.67. The mean achievement score of female students is 54.86 with standard deviation of 7.71. There exist mean differences of 0.14. This shows that there is a difference between the two set of scores.

Hypothesis Four (4)

There is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District.

To determine if there is a significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools, paired sampled t-test was employed to test hypothesis 4 as shown in table 8.

Table 8: Paired sampled t-test Analysis showing significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools

N=120							
Sex	\bar{X}	\bar{XD}	SD	Df	t-cal	Sig	Decision
Male	55.00		8.67				Ho ₆ is not Rejected
Female	54.86	0.14	7.71	119	0.17	0.87	

P<0.05

The data in table 8 shows that there is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools, $t=0.17$, $P(0.87)<0.05$. Hence, the null hypothesis is not rejected. Therefore, there is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District.

Research Question 5

What is the difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District?

Table 9: Mean Analysis on difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools

N=120			
Sex	\bar{X}	\bar{XD}	SD
Male	52.32		6.76
Female	52.84	0.52	6.28

The data presented in table 9 shows that mean achievement score of male students is 52.32 with standard deviation value of 6.76. The mean achievement score of female students is 52.84 with standard deviation of 6.28. There exist mean differences of 0.52. This shows that there is a difference between the two set of scores.

Hypothesis Five (5)

There is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District.

To determine if there is a significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools, paired sampled t-test was employed to test hypothesis 4 as shown in table 10.

Table 10: Paired sampled t-test Analysis showing significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools

N=120							
Sex	\bar{X}	\bar{X}_D	SD	Df	t-cal	Sig	Decision
Male	52.32		6.76				H ₀₇ is not Rejected
Female	52.84	0.52	6.28	119	0.395	0.697	
P<0.05							

The data in table 10 shows that there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools, $t=0.395$, $P(0.697)<0.05$. Hence, the null hypothesis is not rejected. Therefore, there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District.

Discussion Results

From the data collected, presented and analysed, the following findings emerged.

The data presented in table 2 hypothesis 1 indicates that there is a significant effect of discovery teaching method on students' achievement in mathematics in secondary schools in Delta North Senatorial District. The discovery teaching method has proven to be an effective approach in promoting students' achievement in mathematics in secondary schools. One of the key reasons for the impact of discovery teaching on students' achievement is its ability to engage and motivate students. By involving students in hands-on activities, collaborative discussions, and real-world applications, this method fosters a love for mathematics and enhances their interest in the subject matter. Through active exploration and discovery, students become more invested in their learning and are more likely to retain and apply the concepts taught. The study by Ayeni (2011), which claimed that teaching is a continual process that entails bringing about desired changes in learners through use of appropriate methods like the discovery method of teaching, supports this conclusion. According to his findings, pupils who are taught using the discovery technique typically achieve highly academically. Additionally, according to Oyovwi (2010), students taught using the discovery method had a greater degree of retention than those taught using the inquiry technique; this was due to the discovery method's superior effectiveness and superiority in the classroom.

The data presented in table 4 hypothesis 2 indicates that there is no significant difference in mean achievement score between urban and rural secondary school students taught mathematics using discovery teaching method in secondary schools in Delta North Senatorial District. This result is consistent with the findings of Akanbi and Kolawole (2014), who claimed that guided discovery techniques raised maths success levels for pupils in

secondary schools in both urban and rural areas. They came to the further conclusion that the use of discovery teaching methods improves students' academic performance in mathematics in both urban and rural secondary schools by giving pupils the chance to solve problems on their own. According to Onyeachu (2006), students' academic achievement in mathematics is improved by the discovery teaching technique, regardless of the school's location.

The data presented in table 6 hypothesis 3 indicates that there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in Delta North Senatorial District. Oyovwi (2010) corroborates this finding, stating that the discovery method was a more successful and superior teaching strategy than the inquiry technique; retention was higher for both male and female students taught using the discovery method than for those taught using the inquiry approach. This is also consistent with Ayeni's (2011) finding that kids exposed to the discovery teaching technique, whether male and female, typically achieve highly academically.

The data presented in table 8 hypothesis 4 indicates that there is no significant difference in achievement of male and female students taught mathematics using discovery teaching method in urban secondary schools in Delta North Senatorial District. This result confirms the findings of Adunola (2011), who claimed that male and female students exposed to the discovery teaching technique did not significantly differ in their achievement. He went on to say that regardless of the pupils' school location, there is no discernible difference in the academic accomplishment of male and female children taught utilising the discovery approach.

The data presented in table 10 hypothesis 5 indicates that there is no significant difference in mean achievement score of male and female students taught mathematics using discovery teaching method in rural secondary schools in Delta North Senatorial District. According to Adunola (2011), there is no discernible difference in the academic performance of male and female students who are exposed to the discovery teaching technique. This finding supports her assertion. Additionally, he came to the conclusion that, regardless of the location of the school, there is no discernible difference in the academic accomplishment of male and female pupils taught utilizing the discovery approach.

Conclusion

Based on the findings of the study, it is concluded that discovery teaching method effectively affects students' achievement in mathematics in secondary schools in Delta North Senatorial District. It is also concluded that discovery teaching method positively improves, promotes and enhanced mathematics students' achievement in Delta North Senatorial District.

Recommendations

Based on the research findings and conclusion, it is recommended as follows by the researcher:

1. Teachers should expose their mathematics students to discovery teaching method in order to enhance, promote motivate and improve students' interest in mathematic as well as their achievement.
2. Government should provide facilities for students and teachers to promote discovery teaching method in the teaching and learning of mathematics in secondary schools.
3. School administrators should monitor mathematics teaching method to ensure that discovery method is appropriately adopted for effective teaching of mathematics and enhance students' achievement.

4. Parents should also be responsible in helping their students to develop positive interest in science subjects especially mathematics irrespective of school environment.

Contributions to Knowledge

The study has made the following contributions to knowledge:

1. The study has established that discovery teaching method motivates and promotes students' interest in mathematics as well as enhancing their achievement.
2. The study has established that discovery teaching method should be encouraged

REFERENCES

- Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, 103(1), 1–18. <https://doi.org/10.1037/a0021017>
- Azubuikwe, O. B. (2021). Who gets to learn in a pandemic? Exploring the digital divide in remote learning during the COVID-19 pandemic in Nigeria. *International Journal of Educational Research Open*, Volume 2, 100022
- Bruner, J. S. (1961). "The act of discovery". *Harvard Educational Review*. 31 (1): 21–32.
- Bruner, J. S. (1966). *Toward a theory of instruction*, Cambridge, Mass.: Belkapp Press
- Bruner, J. S. (1973). *The relevance of education*. New York: Norton.
- Egbule E. O. (2002) Theoretical perspective of student vocational development, *Journal of Teachers and Teaching* Vol.5 Pages: 45-54
- Eryilmaz, H (2004). The effect of peer instruction on high school students' Achievement and attitudes toward physics. *Ph.D thesis* of Middle East Technical University
- Ezeudu, S.A. (2013). Classroom environment as correlate of students' cognitive achievement in senior secondary school Geography. *The Journal of WCCI Nigeria chapter*, 4(2), 65-73.
- Gonzuk , S. and Chargok, H. (2001) , Gender differences in science: Parallels in interest, experience, and performance, *International Journal of Science Education* 9, 467-481 (1987).
- Ijeh, S. B. and Potokri, O. C. (2021) The Impact of Teaching Practice on Female Students' Preparation for Mathematics Teacher Education Programme in Delta State University, Abraka, Nigeria. *International Journal of Learning, Teaching and Educational Research*, 20(12), 35-48.
- Jegade, O. (2011) Trainee teachers' perception of their knowledge about expert teaching. *Educational Research* 42(3):287-308
- Joolingen, W. V. (202), Cognitive tools for discovery learning, *International Journal of Artificial Intelligence in Education*, 10, 385-397

- Ma, X. and Wilkins, J. L. M. (2002) The development of science achievement in middle and high school: Individual differences and school effects. *Evaluation review* 26 (4), 395-417
- Marzano, R. J. (2011). *Effective Supervision: Supporting the Art and Science of Teaching. Association for Supervision and Curriculum Development.*
- Olubunmi A, (2001). *The impact of school location and gender difference on students' achievement in agricultural science: A case study of Ogun State.*
- Owolabi, T. (2014). Students' expressed Mathematics errors in solving numerical problems in Physics. In Udofia, N (Ed.) *Curriculum development in Science, Technology and Mathematics (STM) Education. Proceedings of the 49,11 Science Teachers' Association of Nigeria Conference, 259-261.*
- Umameh, M. A. (2011). A Survey of Factors Responsible for Students' Poor Performance in Mathematics in Senior Secondary School Certificate Examination (SSCE) in Idah Local Government Area of Kogi State, Nigeria.
- Yang, D. H. (2010). Gender and classroom learning. *Psychology in the Schools*, 22, 08–223