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Effects of Test Taking Strategies on Mathematics Test Anxiety and Performance among Junior Secondary School Students in Bukuru, Nigeria

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Abstract. This study investigated the effects of test taking strategies on junior secondary school student's mathematic test anxiety and performance in Bukuru Nigeria. The study was motivated by the observed problem of high anxiety exhibited by students of mathematics as soon as teachers announce that there will be a test as well as poor performance in mathematics. Researches also show that high anxiety results to poor performance. This was to validate the claim that training and counselling of students on how to be test wise will reduce mathematics test anxiety in students in the junior Secondary School. The study adopted a quasi – experimental design, specifically the non – randomized, pre-test, post-test control group design. The population of the study was 2,812 and the sample consisted of 60 JS one student's in one government secondary school in Bukuru. Two intact classes were used for the experimental and control groups. The experimental group was given training and counseling using test taking strategies while no treatment was given to the control group. Mathematics Test Anxiety Scale (MTAS) and Mathematics Achievement Test were used to collect data. Their reliability coefficients were 0.89 and 0.92 respectively. The techniques employed in answering the research questions and hypotheses were percentages, means, standard deviation and t – test for independent samples. The study revealed that in the experimental group training and counseling on test taking strategies reduced student's anxiety level, and improved their performance. The implication is that teachers and counselors should be trained to also train their students on the use of test-taking strategies to enable students not be anxious before and during tests for a better performance and testing situations in mathematics and other subjects.

Keywords: Test Taking Strategies, Mathematics Test Anxiety and Performance.

1. Introduction

Mathematics provides a framework on how to find solutions to our everyday life. A mathematics concept in everyday activities enhances cognitive, social emotional and physical development for overall growth of an individual. Mathematics skills that students learn while in school will be useful as they gain experience and knowledge over time. A good mathematics education at early stage of a student's life will facilitate problem solving, understanding other aspects of knowledge using the knowledge to reform their lives and promote national development. Mathematics is a powerful tool for global understanding and communication. It helps teachers and parents to predict what courses their students and wards will take to in future.

The knowledge of mathematics enables the world to be interconnected. In view of this, mathematics is made compulsory in primary and secondary schools in Bukuru, Plateau State, Nigeria.

The government of Plateau State has embarked on series of training and workshops to improve the students' performance in both internal and external examinations, there is still persistent poor performance in mathematics. For many students, mathematics is boring, abstract, lacking in creativity, complex and very difficult to understand hence they make statements and expressions like "letter are mine," "I am not for number." However, teaching and learning of mathematics requires counselling and training of the students to bring about the required results in order to achieve the set goal and objectives.

Student's inability for obtain high scores in mathematics examinations affect their academic career progression in mathematics and science-related courses in senior secondary school. If students fail to register science-related courses at tertiary institutions, there resultant effect will be on the growth and development of science, technology and commerce in Bukuru of Plateau State and Nigeria at large.

Factors that lead to student's poor performance have been identified by (Smith 2006, Bai Wang, Pan & Frey, 2009; Okolo 2015) and they showed that high anxious students perform poorly in test. The measurement of mathematic test anxiety is important for understanding the nature of this construct and the degree of its presence in a student for intervention planning and strategies for its reduction. In order for students to perform better in mathematics and have mathematics test anxiety reduced, they should be given training and counseling on test taking skill before during and after tests. Test taking skills enable students perform better in their test and reduce test anxiety (Nourded 2015).
Mathematics test anxiety originates from fear and negative emotional reactions. Anxiety is associated with panic, nervousness, restlessness, helplessness, trembling and confusion that arises in students when mathematics or mathematics test are mentioned. (Okolo, 2015) This could be as a result of students' lack of interest, unpreparedness for tests and past unpleasant experiences related to tests and test results.

The result of high anxiety is it's negative effect on students' performance. Mathematics specifically is a subject that students exhibit high level of anxiety as soon as a test is mentioned. Students can run out of class and start going home if a mathematics test is mentioned. Students with anxiety disorders usually have recurring intrusive thoughts or concerns; they may avoid certain situations out of worry and may also have physical, symptoms such as sweating, trembling, dizziness or a rapid heartbeat. Anxiety involves inner conflict that may appear irrational. Obviously, fear and anxiety are psychological constructs which differ remarkably. Fears are likely to disappear easily but anxiety may persist if the students do not gain insight into the inner danger and develop confidence in their ability to handle it.

Mathematics test anxiety is mostly observed when students do not possess the knowledge of the content they are to be tested in. Moreover, Mathematics as a subject in the foundation of science and technology is necessary for the growth and development of any nation. However, the relevance of mathematics notwithstanding, of there exist a defect in test taking skills of a student this may lead to poor performance in the subject.

Tests are a way of assisting each student appropriate how far he/she is faring in comparison to his/her inclination and potential. It evaluates students' skills and enables them to overcome their nervousness. It also helps in developing one's personality and confidence. Tests have the major role in proving necessary qualities in life such as hard work, patience, creativeness and leadership. It helps to improve the memory power of students. It allows the students to convey their understandings. It not only helps to polish the writing skills, but also helps the students to improve their analytical skills and expand their outlook in the world. Anoka (2016) defined test in counseling as collecting information to analyze and evaluate a client to identify problems, plan for treatment and aid in diagnosing. Assessing a person requires training in areas of psychology, statistics, and the specific test to ensure it is administered, scored and interpreted correctly. On this note, students need counseling and training to effectively undergo testing for a better academic performance. Counselling is seen as the provision of professional assistance and guidance in resolving personal or psycho-social problems. In a similar view, Okolo & Kolawole (2015), Kolawole & Mallum (2018) and Kolawole (2018) opine that counselling is an interaction process, which promotes meaningful understanding of self and environment and result in the establishment and clarification of goals and values for future behavior and to decrease maladjustment behavior, students need training on test taking skills to perform better in a test.

Test-taking skills are skills that allow students to choose questions in a test and answer correctly without high anxiety. Students who are test wise make correct guesses using clues that can be found in a test. Atonge (2010) attest to it that the quality of test taking skills possessed by a testee at a particular time, allows him/her to obtain a higher score in a test.

Takallon, Vahda, Araghi & Tabrizi (2015) carried out their research to investigate if training on test taking strategies could improve performance at the end of the investigation it was observed that those given training on test taking skills performed better than those given placebo treatment. It is vital that the students practice the test taking strategies, until they comprehend the importance of the techniques.

Many researchers focus mainly on the effects of test taking strategies on academic performance. Gobre and Osakuade (2016) attest to it that quality possessed by a testee at a particular time allows him/her to obtain a higher score in a test. This depends on how the student manipulates their time, speed and the ability to use the test taking skills to improve their writing and answering skills. There was no strategy targeted on improving student preparedness on test and reducing test anxiety. There are other strategies and use of formative assessment to reduce anxiety and improve performance by Oduwole (2007), Svihla (2006), Okolo (2015), However, they did not use training on test – taking strategies to investigate mathematics test anxiety reduction and improve mathematics performance.

This study is necessary for the reduction of mathematics test anxiety and also improves student's performance in mathematics. Hence, there is the need to train students on test taking strategies and investigate its effect on mathematics test anxiety and performance of JS one Students in Bukuru, Nigeria. The following broad questions are therefore, formulated for the study: To what extent can the use of training on test taking strategies reduce JS one students' mathematics test anxiety and improve their mathematics performance.

2. Research Questions

The following research questions guided the investigation:

- What are the levels of pre-test and post-test mathematics performance of JS one students in the control group?
- What are the levels of pre-test and post-test mathematics anxiety of students in the control group?
- What are the levels of mathematics, performance of JS one student in the experimental group before and after the treatment?
- What are the levels of mathematics test anxiety of JS one students in the experimental group before and after the treatment?

3. Hypotheses

To facilitate this investigation these hypotheses were formulated and tested at 0.05 level of significance:

- There is no significant difference in the mathematics test anxiety post – test mean score of students in the experimental and control groups.
- There is no significant difference between the post–test mathematics performances mean score of students in the experimental and control groups.

4. Methodology

This study adopted a quasi – experimental design, specifically the non-randomized pretest posttest control group design. The choice of this design is based on the fact that it is an experimental study using intact classes.

4.1 Population and Sample

The population of the study consists of all the public Junior Secondary School Class one (JS1) students in Bukuru, Jos South Local Government Area of Plateau State, Nigeria. The population was 2812 students while the sample for the study was 60 JS one student in Bukuru. Two intact classes were used for the experimental and control groups respectively. The selection of classes assigned to experimental and control group were done by a flip of coin, any of the classes that chose head became the experimental group while those that chose tail became the control group.

4.2 Instruments for Data Collection

The instruments used for data collection were Mathematics Test Anxiety Scale (MTAS) developed by (Okolo, 2019) and Mathematics Achievement Test (MAT) developed by the researchers. The scale anxiety is made up of two parts, A and B. Part A is students personal identification based on the data while part B was made up of 20 items which sought information on mathematics test anxiety levels of students. The Likert scale was used and scored 5, 4, 3, 2, 1, for positively worded items while negatively worded items were scored by reversing the scoring. The main objective of using the anxiety scale was to provide a diagnostic tool for measuring test anxiety in the students and to provide opportunity for the level to be reduced when test anxiety disorder is diagnosed to be high; the items of the scale are concerned with students' feeling towards mathematic tests.

The MAT are two structured alternate forms of 20 items essay test questions. These tests were constructed by the researchers and were used for the pretest and posttest. The MAT covers algebra and geometry from JS One mathematics test book. The table of specification was made to cover topics that

were taught in JS One at the time of the investigation. The table guided the distribution of the topics.

This was followed by subjecting the items to expert security and the items were judged based on content and objectives, representativeness, language use, time given to answer the questions. The face and content validity were established. The appropriateness and comprehensiveness of the items were checked by two experts.
The Kuder – Richardson method for reliability coefficient was used to estimate the internal consistency of all the tests that were used for the study. The reliability result of the MAT is 0.89 which is excellent. The alternative forms of MAT were administered to students that are equivalent to those that were used for the study within two weeks interval and the results were correlated to obtain the correlation coefficient for validation.

4.3 Procedure for Data Collection

Two research assistants were trained by the researchers to assist in administering the instruments and training and counseling students on test taking strategies. A five day training programme was held with the research assistants. The researchers ensured that the training was comparable; applying the same training skills involving counseling and training on test taking strategies.

4.4 Pre-test

The MTAS was administered within 10 minutes followed by the MAT form which lasted for one hour is the pretest. During the period of testing, the researchers and research assistant ensured that the students did not cheat. Those in the experimental and control groups were made to commence the test at the same time. The MTAS and MAT were given to the students to ascertain their prior knowledge before the training was given to the experimental group.

4.5 Treatment

The experimental group was given a six weeks training on test taken strategies as follows:

Week 1: The researchers counseled students on the effect of anxiety on their performance and taught them how to overcome anxiety when preparing for tests. The researchers discussed and introduced training on test taking strategies.
Week 2: Students were trained based on what they need to know as they are preparing for a test.
Week 3: They were trained on how they are to take notes in class and review them through constant practice before a test is announced.
Week 4: They were taught how to be attentive in class to be able to predict the teachers test questions and review them.
Week 5: Tips on how to get ready for the tests using various test taking strategies on types of items were given to the students.
Week 6: Training on general rules before, during and after each test was administered. Discussions and questions were effectively handled.
At the end of the six weeks of counselling and training the post test on MTAS and MAT Form II were administered for ten minutes and one hour respectively. The scripts were collected and scored by the researchers. The results of both the treatment group and control group suggested that the method of data analysis should be the frequency count percentages, means, standard deviation and t-test of independent sample.

5. Results

Efficacy of the use of test taking strategies to reduce JS one student's mathematics test anxiety and improve their performance was investigated. Table 1 show that the performance of the students in mathematics before the experiment was generally poor.

Table 1: Analysis of Pre-test and Post-test Mathematics Performance Level of JS one Students in the Control Group.

MATHEMATICS PERFORMANCE LEVEL								
TEST	**Low (49 & below)**		**Average (50 – 69)**		**High (70 & above)**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Pre-test	28	93	2	7	0	0	30	100
Post test	24	80	6	20	0	0	30	100

This revealed that the performance of students in the control group did not improve significantly even after the experiment due to the fact that the normal class was going on and there was no counseling or training on test taking strategies it showed that 93% of students failed the test and after the investigation, 80% also failed. This group had a normal school teaching and learning which gave rise to poor performance.

Analysis of the results of pre-test and post-test anxiety levels of students within the control group indicates that most of the students' scores fell within the high anxiety levels. Specifically table 2 reveals that 83% of the student in the control group had high anxiety before the experiment and after the experiment 77% of the students in the control had high anxiety.

Table 2: Analysis of Levels of Pre-test and Post-test Mathematics Test Anxiety Levels of Students in the Control Group.

ANXIETY LEVEL								
TEST	**Low (45 & below)**		**Average (46 – 60)**		**High (61 & above)**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Pre-test	0	0	5	17	25	83	30	100
Post test	1	3	6	20	23	77	30	100

This indicated that most of the students' anxiety level was still high after the experiment. This agrees with Okolo (2015), Okolo & Kolawole (2018) that cognitive anxiety is an obstacle to learning, since a high state of anxiety seems to produce preoccupation with potential threats, lack of security; all these seem to constrain effective functioning within the classroom. Lack of knowledge of test taking strategies could contribute to high level of anxiety before and during the test.

Table 3: Analysis of the Pre-test and Post-test Mathematics Performance Levels of JS one Students in the Experimental Group

MATHEMATICS PERFORMANCE LEVEL								
TEST	**Low (49 & below)**		**Average (50 – 69)**		**High (70 & above)**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Pre-test	28	93	2	7	0	0	30	100
Post test	1	3	6	20	23	77	30	100

Table 3 shows that 93% of students in the experimental group obtained a low score of 49% and below on the mathematics pretest while 7% scores from 50% and above. After the training and counseling on test taking strategies, the result of the post-test indicates that students had remarkable improvement 77% of the students scored 70% and above. This is in line with Gbore and Osakuade (2016), the see test wise students as capable of manipulating their time, speed, choice of question and answer for a good performance. All the strategies employed before and during test improved students' performance tremendously. This agrees with the view of Takallon, Valida, Araghio and Tabrizi (2015) that training on test taking strategies improved students' performance on examinations.

Table 4: Analysis of Pre-test and Post-test Mathematics Test Anxiety Levels of Students in the Experimental Group.

TEST ANXIETY LEVEL								
Anxiety Test	**Low (45 & below)**		**Average (46 – 60)**		**High (61 & above)**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Pre-test	1	3	4	14	0	83	30	100
Post test	2	6	24	80	4	14	30	100

The result of the research question shows that before the experiment 83% of the students recorded high anxiety level of 61% and above while 14% obtained moderate level of anxiety. After the experiment, the students who scored high anxiety were reduced to 14% and most of their anxiety was in a moderate level of between 46% - 60% and 80% of the students obtained these scores. This indicates that counselling and training on test taking strategies reduced students' anxiety level. This is in line with the findings of Kalechstein, Hocevar (2007), Nourdad (2015) that the positive effect of test – taking strategies is to reduce students' anxiety and improve test results.

Table 5: Result of T-test Analysis of Post-test Anxiety Score of Students in the Experimental and Control Groups.

Group	**Number**	**Mean**	**SD**	**Df**	**t-cal**	**P-value**
Experimental	30	54.5	7.64	58	-2.204	0.00
Control	30	69.8	10.44			

The t-test analysis present in table 5 shows that there was a statistically significant difference between the mathematics test anxiety scores of the treatment group (M = 54.5, SD = 7.64) and the control group (M = 69.8; SD =

10.44) that were not exposed to treatment as t – value = - 2.204 and p – value is 0.00. This indicates that the null hypothesis is rejected. It implied that counseling with training of students on test taking strategies was more effective on the experimental group than the control group. It shows that the training reduced students' anxiety levels to a moderate level while those in the control group had high anxiety.

Table 6: The Result of T-test Analysis of Mathematics Performance Post-test Mean Score of Students in the Experimental and Control Groups.

Group	Number	Mean	SD	Df	t-cal	P-value
Experimental	30	75.97	12.81	58	9.397	0.00
Control	30	37.36	18.45			

The analysis of t-test for independent samples in table 6 shows that there was a significant difference between the mathematics performance mean scores of those in the experimental group (M = 75.97; SD = 12.81) and those student in the control group (M = 37.36; SD = 18.45); with t – value is 9.397 and p – value = 0.00. It indicates that the training was more effective on the experimental group against those of the control group. This shows that the counseling and training on test taking strategies improved the performance of students within the treatment group while the mathematics performance of those in the control group did not indicates any improvement.

6. Discussion

The findings of the MAT and MTAS revealed that at the beginning of the experiment both the experimental and control group results were equivalent it shows that they took off at the same level. The findings revealed that the mathematics performance of experimental group was low with 93% of the students failing at the pretest and in the control group, 93% scored below 49% which is failure too. Also anxiety level of students in the control group was with 83% obtaining high anxiety score before the experiment and those in the treatment group 83% of the students obtained high anxiety levels too. This is in agreement with Leavilt (2010), Okolo (2015), Okolo and Kolawole, (2018) who stated that cognitive high anxiety is an obstacle to learning since a high state of anxiety can disrupt the cognitive process of students. Findings from research questions three and four shows that the experimental group improved and those of the control group was not remarkable. It also revealed that after training the students on test talking strategies their anxiety level, dropped from high to moderate level. This is in line with the results of hypotheses one and two.

The findings from hypothesis one revealed that there is a significant difference between the mathematics test anxiety scores of the groups. The mean score of students in the treatment group on the mathematics test anxiety posttest was significantly less than that of students in the control group. This agrees with the investigation of Gbore and Osakuade (2016), who attested to it that the acquired test taking strategies possessed by a testee at a particular time allows him or her to obtain a higher score in a test. It shows that the scores of the anxiety influenced the performance of students in mathematics at the post test.

Findings from hypothesis two revealed a significant difference between posttest mathematics performances mean scores of students in the treatment group and control group. Thus indicates that the training on the treatment group improved the mathematics performance of students greatly. It also revealed that the teachers used the training on test talking strategies to reduce student's anxiety and improved their performance. It also prompted students and motivated them to prepare for test regularly and to stop being afraid as soon as a test administration is announced. On the other hand students in the control group obtained high anxiety levels and low performance in mathematics.

This should be adapted for use in our schools because this study demonstrated the efficacy of training of students on test talking strategies. It should be used with good lesson plan and presentation for improved mathematics performance as well as other course of study at all levels.

7. Conclusion

Based on the findings of the study, the training of students on test talking strategies reduced their anxiety level from high to moderate and improved their mathematics performance in Bukuru, Nigeria.

8. Recommendations

Based on the results of this study the researchers therefore recommend this training for all teachers' use in the primary and secondary level. This will improve students test taking strategies as this will aid

brain storming, critical thinking skills, reduce anxiety and improve mathematics performance.

It is recommended that counselors in schools should include this within their counseling classes. There should be more of this training for teachers at all levels.

Government should sponsor such training at state and local government levels for teachers of Mathematics and Counselors.

Parents should learn these strategies and educate their children and wards.

Packages of this type could be used to reduce anxiety and improve performance of students in other subjects

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