Effects of Testwiseness Training in Mathematics on Adolescent Secondary School Students' Test Anxiety in Ondo State, Nigeria

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Abstract
This study investigated the effects of testwiseness training in Mathematics on adolescent secondary school students' test anxiety The research study adopted for the study was an experimental research that involved pre-test, posttest and control groups design. One hundred and twenty (120) adolescent senior secondary school class three students of Ondo State public secondary schools selected through stratified random sampling technique formed the sample. These participants were randomly assigned to experimental and control groups. Experimental group was made to undergo the testwise training package in Mathematics (TTPM), which lasted for six weeks, while 'placebo' was used on the control group. Two instruments were used to collect data. They are Adolescent Students' Test Anxiety Scale (ASTAS) and Adolescent Students' Testwiseness Scale in Mathematics (ASTSM). Three research questions were raised translated into two hypotheses The data collected were analyzed using simple mean, standard deviation and t-test statistics, The findings showed that: (i) There is no significant difference in the test anxiety levels of the participants before exposure to treatments; (ii) testwiseness training in Mathematics had positive impact on the adolescent secondary school students' test anxiety levels. Adolescent students without testwiseness training in Mathematics are more test anxious than the adolescent students with testwiseness training in mathematics. It is therefore recommended that testwiseness training in Mathematics should be inculcated into the curriculum of both secondary schools and teacher training colleges. Teachers are also encouraged to add testwiseness instruction to their regular Mathematics classes so that their students may become testwise in a testing situation
Keywords: Testwiseness training, Mathematics, Test Anxiety, Adolescent students

1.0 Introduction

It is the wish and aspirations of most parents in Nigeria that their children should attain high academic performance and receive university education. For a student to be admitted into Nigerian universities, he/she must have scaled through all the hurdles of primary and secondary school education. At each stage of education levels, students must participate and pass series of tests. Test is believed to be one of the psychological instruments used to quantify a specific behaviour or measure students' level of attainment. Dodeen (2009) sees test as the most common evaluating method in most of the educational systems and academic institutions worldwide. Tests can be used in education arena for placement, certification, admission, detection of specific behaviour, selection and decision making (Pour-Mohammadi & Jafre, 2011). Tests, in this country, are taken as high stakes (that is tests with very important consequences for students). In view of the importance accorded to tests, therefore, to the future prospects of students, concerted effort should be made by the teachers for students to do well in their tests. To achieve this, therefore, test-related factors that can improve students' performance needed to be studied. The most important tests related factors that have significant impact on students' academic performance according to Hembleton, Swaminathan & Rogers as cited in Dodeen (2009) include test-anxiety, test-taking skills, tendency to guess, attitude towards test and cheating. As observed in the related literature, the most important factors are test-anxiety, examination malpractice and testwiseness. The three factors are interrelated and affect students' academic performance. Therefore, what is test-anxiety?

Test anxiety according to Olatoye (2007) is an experience which expresses itself in candidates' mind and behaviour in form of fear of failure, negative self-evaluation in relation to ones previously established standard, self blame for perceived shortcomings, social evaluation in relation to ones estimate of how others are doing, and negative prediction of what will be the outcome of a test. Test anxiety has been identified as the major factor militating against students' ability to recall organized materials, ability to comprehend simple sentences or questions and instructions during examinations; this is as a result of heightened psychological and physiological states of the mind and body system prior to or during the examination period..

The International Group for the Psychology of Mathematics Education (IGPMF) as cited in Segun-Martins (2010) reported in her 31st Annual Conference held at Cyprus University in Rome in 1999 that a quarter of students population had poor results in all cadre of education in Arithmetic and Statistics all over the world as

a result of bizarre behaviour called test anxiety. High and low test anxiety is bad, but, moderate level of anxiety can afford individuals to respond rapidly and efficiently. Test anxiety makes it hard for students to concentrate on tests and perform adequately. Findings from numerous studies have shown that test anxiety has negative correlation with academic performance (Chapell et al., 2005; Cassady & Johnson, 2002; and Jing, 2007). But, Adelola & Bolarinwa, 2011; Tom-Jenovc & Nikcevic-Mikovic, 2005; Ndirangu, Muola, Kithuka & Nassiuma (2009) reported low positive correlation between test anxiety and academic performance.

Testwiseness on the other hand is being defined by Ebel & Frisbie (1991) as that quality possessed by a testee's at a particular period, which enable him/her to do well in a test, irrespective of if he/she knows much about the test or not. Students who are test-wise according to Alonge (2004) know how to manipulate their time, speed, manner of answering questions in the test and they have developed their writing skills for the essay questions. They also understand instructions quickly and as a result of this, they usually score high marks in examinations. It can be inferred from these definitions that test-wiseness is the skill that the testees possess, which is different from skills that the test is intended to measure. Since test-wiseness is independent of testee's knowledge of subject matter, it can be regarded as one of the factors that contribute error variance to observed scores. It therefore implies that unless all students are testwise, differences in test scores caused by levels of test-wiseness may affect test reliability. The need to make students test-wise by teaching them test-taking skills in the classroom has been stressed (Mustapha, 2001; Ugodulunwa & Ugwuanyi, 2003). This is necessary because students' lack of test-taking skills may contribute to poor performance. It may also make students' scores to fall short of his true scores, which will constitute a threat to validity of the test. Mustapha (2001) was of the opinion that test-taking skills should be taught to all students at all levels of education in Nigeria. He further stressed that such training should focus on all components of test-wiseness such as how to prepare for a test, how to respond to different types of test items, how to avoid errors during tests, how to use idiosyncrasies built into a test by the teacher, how to use time effectively, how to eliminate incorrect alternatives, and how to avoid examination malpractice, who to use similar alternatives, stem cue, guessing strategy, content information, consistency in grammar, response set and abstract foils

1.1 Statement of the Problem

Past studies have shown that test anxiety has negative correlation with students' academic performance, but testwiseness has positive correlation with academic performance. It seems sufficient efforts have not been directed to explore test-wiseness as one of the factors responsible for test anxiety in this country. In view of the importance accorded Mathematics as the queen of science subjects and as a compulsory subject for entrance into tertiary institutions in Nigeria, it has aggravated the anxiety level of students during examination which have resulted into a "Mathematics Anxiety". Since high mathematics anxiety often leads to poor academic performance, it is the belief of these researchers that if classroom teachers could identify students' level of test-wiseness in mathematics and provide adequate training for them during mathematics instructions, high test anxiety being experienced due to lack of skills in test-wiseness could be eliminated. Research is still missing in the area of the application of test-taking skills in addition to testwiseness training in mathematics in dealing with students' test anxiety. . In furtherance of this, therefore, this study sought to examine the effects of testwiseness training on adolescents students text anxiety in secondary school Mathematics.

Based on the purpose of this study, only one general question and two research questions translated into hypotheses for verification were raised.

1.2 General Question

1. What is the anxiety level of adolescent secondary school mathematics students with or without testwiseness training?

1.3 Research Questions

1. Will there be any difference in the anxiety level of the students in the experimental and control groups before exposure to treatment of testwiseness package?
2. Will there be any difference in the anxiety level of students with or without testwiseness training in Mathematics?

1.4 Research Hypotheses

1. There is no significant difference in the anxiety levels of students before exposure to the treatment package of testwiseness training in Mathematics
2. There is no significant difference in the anxiety levels of students with or without testwiseness training in Mathematics

2.0 Methodology

The research study adopted for this study was an experimental research that involved pre-test, post-test and control group design. The participants in this study were randomly assigned into two groups. The first group which is experimental group was given training on test-taking strategies. The second group which is the control group was exposed to the normal conventional talk and chalk method as a placebo treatment

The population for the study consisted of all the adolescents senior secondary school class III students in two public secondary schools in Ondo State. Two schools which were selected from two randomly selected senatorial districts of Ondo State out of the existing three senatorial districts are mixed schools and are grade A schools. The sampled, one hundred and twenty (120) students which were selected by stratified random sampling technique from the two grade A schools consisted sixty (60) students from each of the schools. Subjects in one school were assigned to the experimental group, while those in second school were assigned to the control group. Each group was an intact group and were geographically separated from the other.

2.1 Research Instruments

To collect data for this study, two instruments were used. They are:
    i.   Adolescent Students' Testwiseness Scale in Mathematics (ASTSM)
    ii.   Adolescent Students' Test Anxiety Scale (ASTAS)

The Adolescent Students' Test Anxiety Scale (ASTAS) consists of 16-item of four point likert form of scale constructed by the researchers and used to assess the test anxiety of the adolescents students. ASTAS was designed based on research and theory in the field. The initial draft of 40-items for the scale was based on the four components of test anxiety as identified by Joiner et al (1999) and Stober (2004). All the four dimensions satisfied the factorial validity test (done through the use of exploratory factor Analysis), since all of them had an item loading that ranged between 0.27 and 0.72. The reliability analysis was done through the use of 'corrected item-to-total correlation' and 'Cronbach's alpha coefficient if item deleted. A total of 24 items were dropped from the scale because of negative or very low corrected item-total correlation, low item loadings, low Cronbach's alpha coefficient if item deleted. The internal consistency analysis showed a Cronbach's alpha of 0.83 for the entire scale, whereas, reliability analysis of the four sub-scales ranged between 0.65 and 0.93.

2.2 Validation of ASTAS

To further ascertained the validity of the scale, concurrent validity measure was carried out on the scale. The test Anxiety Inventory for Children and Adolescents (TAICA) developed by Lowe & Lee (2004) was administered concurrently with ASTAS on twenty (20) sampled students that were not part of this study. Using Pearson Product Moment Correlation for data analysis, a correlation coefficient of 0.87 was obtained for the entire scale. Correlation coefficients of 0.79, 0.81, 0.80 and 0.85 was obtained for the four sub-components of ASTAS. For the reliability of the ASTAS, this scale was also administered on twenty (20) sampled students that were not part of this study on two occasions at an interval of two weeks. Using Pearson Product Moment Correlation for data analysis, a correlation coefficient of 0.83 was obtained for the entire scale, while coefficients that ranged between 0.82 and 0.91 were obtained for the four sub-scales.

The Adolescent Students' Testwiseness Scale in Mathematics (ASTSM) is a 15-item four point form of likert questionnaire in testwiseness skills in mathematics. This scale was developed and validated by the researchers after through search of literature in the field. Using Principal Component Analysis (PCA) with an orthogonal varimax rotation, eight interpretable dimensions of testwiseness accounted for 62.4% of the total variance in the total factor solution were identified. The important factors identified, in order of importance, were effective use of time, appropriate response techniques, avoidance of error, avoidance of malpractice, management of difficult questions, preparations before tests, usage of teachers' idiosyncrasies, and management of anxiety. The index of internal consistency obtained was 0.82. To ascertain the validity of this scale, it was correlated with testwiseness questionnaire for students developed by Ugudulunwa & Dadughun (2005). A correlation coefficient of 0.77 was obtained. For the consistency of the scale, the test-retest reliability coefficients ranged between 0.72 and 0.83 was also showed.

2.3 Procedure

Adolescent Students' testwiseness scale in mathematics and Adolescent Students' test anxiety scale were administered in the first week before the commencement of a training package on a total of 250 subjects randomly selected from two public secondary schools in Ondo state, Nigeria, to identify students with high test anxiety and non-testwise in Mathematics. Since ASTAS is 16-item four point likert format and ASTSM, a 15-item four point likert format, maximum mark obtainable in ASTAS is 64 and minimum mark obtainable is 16. In the same vein, maximum mark obtainable in ASTSM is 60, while the minimum mark obtainable is 15. Students that scored 32 and above in ASTAS (high test anxiety students) and below 30 in ASTSM (Non-testwise students in mathematics) were extracted. One hundred and sixty (160) students (76 students from school A and

84 students from school B) met the two conditions. On the basis of this, one hundred and twenty (120) students (30 male and 30 female from school A and 30 male and 30 female from school B) were assigned into experimental and control groups each (Experimental group = 60; 30 males, 30 females; Control group = 60: 30 male, 30 female). The experimental group was exposed to testwiseness training package in mathematics (TTPM). The experimental treatment lasted for eight weeks. The 'placebo' package was used on the control group, lasting the duration of eight weeks. At the eighth week, both the experimental and control groups were exposed to Adolescent Students' Test Anxiety Scale (ASTAS).

3.0 Results

General Question

What is the anxiety level of the adolescent secondary school mathematics students with or without testwiseness training?

Descriptive Analysis

In proffering solution to the problem of this study, data collected on students identified to have possessed test anxiety from the ASTAS on the basis of gender of the experimental and control groups were subjected to descriptive analysis using simple mean The result is shown in table 1.

From table 1, the mean anxiety of the experimental group before testwiseness training is 41.5, while that of control group is 42.4. The mean difference between the two groups is 0.9. The mean anxiety of experimental group after the training package is 35.6 but that of the control group is 43.9. The mean difference between the two groups after treatment is 8.3 which appears wide but cannot be acclaimed significant since it is not statistically tested. It could be inferred from this descriptive analysis that testwiseness training package in mathematics could possibly brought about appreciable reduction in the anxiety level of adolescent students of Ondo State, Nigeria.

Hypothesis One: There is no significant difference in the anxiety levels of adolescent secondary school students before exposure to the treatment package of testwiseness training in Mathematics.

In testing this hypothesis, data collected on both experimental and control groups before exposure to treatment package were analyzed using mean, standard deviation and t-test. The result is as shown in table 2

Results from table 2 showed that the value of t calculated is 0.95 while the value of t-table is 1.960. Since the value of t-calculated is lesser than the value of t-table, the hypothesis early stated that there is no significant difference in the anxiety levels of adolescent students before exposure to testwiseness training in mathematics is not rejected. It showed clearly that there is no significant difference in the anxiety levels of experimental and control groups before exposure to testwiseness training in mathematics. This adduces to the homogeneousness of the two groups under study.

Hypothesis Two: There is no significant difference in the anxiety levels of adolescent students with or without testwiseness training in Mathematics.

In testing this hypothesis, data collected on both experimental and control groups after exposure to treatment package were analyzed using mean, standard deviation and t-test. The result is as shown table 3

Results from table 3 showed that the value of t calculated is 2.95 while the value of t-table is 1.960. Since the value of t-calculated is greater than the value of t table, the hypothesis early stated that there is no significant difference in the anxiety levels of students with or without testwiseness training in mathematics is therefore rejected at 0.05 level of significance. It showed clearly that there is a significant difference in the anxiety levels of adolescent secondary school students with testwiseness training and those without formal testwiseness training in mathematics. Students with formal testwiseness training in mathematics were less anxious with a mean of 35.6 than students without a formal testwiseness training in mathematics with a mean of 43.9.

4.0 Discussion

Findings from hypothesis one showed that there is no significant difference in the anxiety levels of adolescent secondary school students before exposure to testwiseness training in Mathematics. This testifies to the fact that the two groups used for this study were homogenous in nature, despite subjects were selected from two different schools. This affirmed the claim of Methia (2004) that test anxiety is a serious problem among a high proportion of children and adolescents attending elementary and secondary schools.

Findings from hypothesis two coupled with results of the general research question as shown in table 1 showed clearly that testwiseness training in Mathematics significantly influence the anxiety levels of adolescent students, as adolescent students without testwiseness training were more anxious than the adolescent students with testwiseness training in mathematics. This finding supports the early findings of Pearl, Dennis, & Mel (1988) which reported that children with testwiseness training generally had higher reading scores, greater internality and less test-irrelevant thinking. Students are not been distracted by test-irrelevant thinking, for instance, consequences of failure in the mathematics examination. The amount of test-irrelevant thinking was

drastically reduced in the experimental condition hence the mean anxiety level was lower in experimental group than the control group at the post-test session. This finding is also in line with the finding of Phakiti, (2003), Scharnagl, (2004) and Chiu (2011) which reported that teaching test-taking strategy can reduce test anxiety among students. This could also be attributed to the effect of testwiseness training programme employed for the studies. By implication, student test performance level could be improved better if high test anxiety level could be effectively managed to a minimal low level.

5.0 Conclusion and Recommendations

Overall, it became clearer that testwiseness training in Mathematics had positive impact on the adolescent secondary school students' test anxiety levels. Exposing students to test taking strategies in Mathematics and their applicability could make them test sophisticated. This could further enhance their problem solving capabilities which could eventually reduce their anxiety levels while taking mathematics tests. It is therefore recommended that testwiseness training in Mathematics should be introduced into the curriculum of both secondary schools and teacher training colleges in Nigeria. Teachers should also incorporate testwiseness instructions to their regular mathematics classes to further improve test taking skills of their students

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List of Tables

Table 1: Mean scores of test-anxiety level of adolescent mathematics students with or without testwiseness training before and after treatment

PRE-TEST			POST-TEST		
Gender	Experimental Mean	Control Mean	Gender	Experimental Mean	Control Mean
Male	41.3	41.7	Male	32.4	42.1
Female	41.6	43.2	Female	38.8	45.7
Total	41.5	42.4	Total	35.6	43.9

Table 2: Difference in the anxiety levels of adolescent students before exposure to testwiseness training package in mathematics

Variables	N	Mean	SD	df	t_{cal}	t_{tab}
Experimental	60	41.5	4.7	118	0.95	1.960
Control	60	42.4	5.6			

$P<0.05$

Table 3 Difference in the anxiety levels of experimental and control groups after exposure to testwiseness training package in mathematics

Variables	N	Mean	SD	df	t_{cal}	t_{tab}
Experimental	60	35.6	8.1	118	2.95	1.960
Control	60	43.9	7.6			

$P<0.05$