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Contents

Effect of Testwiseness Training on Objective Test Performance In Mathematics among Secondary School Students in Ekiti State

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Abstract

This study examined the effect of testwiseness training on objective test performance in mathematics among secondary school student in Ekiti State. The study employed a pre-test, post-test, control group quasi-experimental design with a 2x2x2 factorial matrix. A stratified random sampling was used to select 188 participants from four Senior Secondary Schools (two private schools and two public schools) in one local government areas in Ekiti state. The participants were randomly assigned to treatment and control groups. The treatment group was exposed to seven weeks training in testwiseness skills while participants in control group were not given treatment. Four hypotheses were tested at the 0.05 level of significance. Data were analyzed using Analysis of Covariance (ANCOVA). The results revealed that there was significant main effect of treatment on Mathematics achievement test scores of participants. There were no significant main effects of gender and school type on Mathematics achievement test scores of participants. There was also no significant interaction effect of treatment, gender and school type on Mathematics achievement test scores of participants. The study points to the need for Mathematics teachers to integrate Testwiseness training into the teaching of Mathematics.

Keywords: Testwiseness, Objective test, Mathematics

Introduction

Mathematics as a subject, affects all aspects of human life at different degrees (Maliki, Ngban & Ibu, 2009). The social, economic, political, geographical, scientific and technological aspect of man is centered on numbers. One subject that cut across all the sciences is mathematics. Today, mathematical methods pervade literally every field of human endeavour and play a fundamental role in economic development of a country. The importance of mathematics does not only lie in its contributions to scientific and technological development but also in its utility in day-to-day interactions at the market places, transportations, business of all sorts by both literate and illiterate members of the society.

The poor performance observed in mathematics has been a matter of serious concern to all well meaning educators (Maliki, Ngbani & Ibu, 2009). With the trend of poor performance in mathematics, educators have relied on many source of information and focused on various factors that might affect student's mathematical achievements. Some of these factors include: student's own background, peer influence, environmental and parental involvement (Young, Reynolds & Welberg, 1996). Researchers have also observed that student's performance over the years in Mathematics varies from "sex to sex" and "school to school" (Grogger & Eide, 1995; Weinberger, 1999, 2001; Kolawole, 2005).

Academic achievement is a concern that is common to parents, employment agencies, school owners or proprietors, teachers as well as the students themselves. This perhaps due to the use to which the outcome of such achievement measures is generalized, especially in this days where test are use to determine students performance. But the need for regular and systematic tests in all subjects throughout the school year tends to warrant the more popular use of objective test than essays test in all school system. Objective test has been one of the measures used by examination bodies (e.g. JAMB, WAEC, NECO) in writing questions. It is now widely used by teachers in promotion examination and they have also been popularized by examination

bodies such as Joint Admission Matriculation Board (JAMB), West African Senior School Council Examination (WASSCE), National Examination Council (NECO), General Certificate Examination (GCE) etc. These bodies often use objective test for entrance examination into higher institution to sample domain of knowledge covered and for certification purposes (Alonge, 2004)

Some of the advantages of objectives test includes ease, rapidity and objectivity of scoring wide content coverage, prevention of bluffing and hence reduction of chance error in total score. objectivity i.e. in the test, attention is concentrated on the content or matter of questions and answer or response and that factors such as their teacher's opinion, individual decision and mental state of the teacher don't interfere; reliability i.e. those people that marks the paper has no variation on it or any influence works; validity i.e. the tests measure only those predetermine ability(quality) for which these are constructed; comprehensiveness i.e. it covers all domain of the syllabus, hence student have to study all the chapters; discrimination(the major quality of objective test is its ability of discrimination) i.e. by it, talented and mentally retarded can be easily identified and special provision can be made for their education; practicability; easy scoring; real test of knowledge; economy of time (Ebel, 1981; Yogesh, 2007).

However, performance in objective test items can also be influence by guessing, response changing, response sets, cheating and testwiseness among others. These and several other factors that put limitation of varying magnitude on the usefulness of objective test as a means of measuring education achievement (Madaus 1998). Testing is an indispensable element of our daily activities. Whether we realize it or not we are involved in hypothesis testing about every cognitive and affective effort we make. The motive behind testing is to make decision about a course of action, depending upon the significance to be attached to them. Students are always tested every time in the classroom settings by their teachers in order to evaluate how well they have mastered what they were taught. It may come in form of a class exercise, continuous assessment or examination.

Testwiseness is the ability to use special strategies to select the correct response in multiple choice tests, without necessarily knowing the content or skill that is being measured. Specifically, multiple–choice tests are more susceptible to testwiseness cues, so it was expected that there will be a strong relationship between test–taking skills and multiple-choice test performance than with constructed response test performance (Edwards, 2003). Oakland & Weilert (1972) defined testwiseness as the ability to manifest test-taking skills, which utilize the characteristics and formats of the test and or test taking situation to receive a score commensurate with the ability being measured. Learning test-taking strategies actually improves the validity of a test by making scores reflect more accurately what students know (Scruggs & Mastropieri, 1992). A test-wise student will answer a question incorrectly only if he or she does not know the content, not because the test format is confusing or intimidating.

Murayama, (2003) found that test-wise individuals are aware that they may not only select the option most likely to be correct, they may also discard items unlikely to be correct, by using elimination strategies. Based on test taker prior or partial knowledge, test taker can eliminate responses known not to be correct. Afolabi and Eso-Olawale (1999) also found that there was a significant difference in the posttest scores of participant in the experimental and control groups. The result confirmed the effectiveness of testwiseness training programme. However no significant difference was observed in the testwiseness of male and female participants in the study. The finding further revealed that there was no significant difference in the testwiseness among high, moderate and low levels of academic ability. The researchers concluded that students of all ability groups and sexes are likely to equally benefit from training in testwiseness skills.

Purpose of the study

The present study sought to investigate the effect of testwiseness training on objective test performance in Mathematics among Secondary School Students. The moderating influence of gender and school type on Mathematics Achievement Test was also part of the investigation.

Statement of Hypothesis

The following null hypotheses were tested at the 0.05 level of significance:

1. There is no significant main effect of treatment on Mathematics achievement test scores of participants.
2. There is no significant main effect of gender on Mathematics Achievement Test scores of participants.
3. There is no significant main effect of school type on Mathematics Achievement Test scores of participants.
4. There is no significant interaction effect of treatment, gender and school type on Mathematical Achievement Test scores of participants.

Research design

A 2 x 2 x 2 pre-test, post-test, control group experimental-quasi design was adopted for the study. The design as the potential for controlling all threats to validity, so that the cause and effect relationship may be established (Bandele, 2004; Cook & Campbell, 1979; Ogunsanwo, 2003).

Sampling Procedure

A multi-stage sampling procedure was adopted to select one local government area out of the sixteen local governments in Ekiti State used for the study. This was done by using random sampling ballot procedure. A simple random sampling technique was employed to select two private and public schools each from the LGA selected. A simple random sampling was also used to select 188 participants 101 males and 87 females from the schools selected out of those who met the inclusion criteria.

This technique was adopted because of the heterogeneous nature of the participants, making sure that students from different (private/public) schools were effectively and properly represented. This, to a degree, introduced a measure of control in the study and ensured balancing case (Best & Kahn, 1989 cited in Yinyinola, 2008). A randomization technique was adopted to group the participants into treatment and control group. Randomization is one of the chief tenets

of inferential statistics and it is a crucial way of neutralizing the possible effects of extraneous variables, greatly increasing the chance that the sample will represent the entire population and minimizing bias (Kirk, 2005; Isaac & Micheal, 1982).

Instrumentation

The instrument used for this study was Mathematics Achievement Test (MAT) and a treatment package adapted from Millman et al (1965).

Mathematics Achievement Test (MAT)

This test was made up of 100 multiple-choice items with five options A-E based on the syllabus for Senior Secondary School (SSS) 2 classes which aim at making decision including selection, classification, and evaluation of treatment procedure. The test items were constructed by the researchers with the assistance of an expert in the field. All the test items were then submitted to some other experts in the field of Mathematics for validation. After some revisions were made, the experts independently and unanimously recommended the use of the test. To establish the highest degree of reliability, the test was pre-tested on a small sample of (n = 50) randomly selected Senior Secondary School (SSS) 2 students. The internal consistency reliability coefficient (Cronbach's alpha) for the subscale reported was .79. The test-retest reliability measure of the test with interval of three weeks was .81.

Procedure for treatment

This study was carried out covering the period of seven sessions for seven weeks among the participants who willingly showed interest in participating in the training programme. Each session covered 60 minutes. Each of the session apart for the first and the last was subdivided into four parts: Review, Opening, discussion and Closing. The first six minutes was used for reviewing the last session's work and discussing any question that had arisen. This was subsequently followed up by the researchers sharing the aims of that session with the participants and then introduced the new topic through vocal teaching and expression. At the end of the session, both the experimental and

control groups were subjected to post test using the same scale to assert results derive from the treatment. Treatment started after a week, after the pre-treatment session.

Treatment Sessions

Experimental Group-Testwiseness training

The seven sessions covered the following:

Session one: General orientation and Pre-Test Measure
Session two: Discussion
Session three: Guessing and Deductive Strategy
Session four: Intent consideration and cue strategy
Session five: Techniques of taking tests
Session six: Repetition of previous sessions (i.e. sessions two to six)
Session seven: Post-test Measure

The control Group

The control group was the participants screened and selected for the training programme but who as a result of balloting, fell into control group to which no training was given. This group of participant was engaged in just two sessions apart from the period of screening. The first session was strictly used for the administration of the pretest measures. Thereafter, the participants were engaged in a group discussion on the subject "Problem of examination malpractices" which lasted for forty minutes, the purpose of which is to compensate them for their participation.

Data analysis

The experimental and control groups formed the units observation. The analyses centered on the group mean scores of the participant's performance in Mathematics achievement test. The experimental and the control groups were compared on the dependent variables respectively. The data generated for this study was subjected to Analysis of covariance (ANCOVA) with the pretest scores as covariate to test for the main effect.

Results

Table 1: Summary of Analysis of Covariance (ANCOVA) showing the direction of the significant interaction effects of treatment, gender and school type on Mathematics Achievement Test of experimental and control group.

*** ANALYSIS OF COVARIANCE *

POSTTEST Posttest(Maths)
by TRTGRP Treatment Groups
GENDER
SCHTYPE School Type
with PRETEST Pretest (Maths)
HIERARCHICAL sums of squares
Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	P
Covariates	10156.098	1	10156.098	246.934	.000
PRETEST	10156.098	1	10156.098	246.934	.000
Main Effects	4304.599	3	1434.866	34.887	.000
TRTGRP	4109.663	1	4109.663	99.603	.000
GENDER	143.607	1	143.607	1.069	.063
SCHTYPE	51.329	1	51.329	0.111	.265
2-Way Interactions	37.966	3	12.655	.308	.820
TRTGRP x GENDER	27.092	1	27.092	.659	.418
TRTGRP x SCHTYPE	2.555	1	2.555	.062	.803
GENDER x SCHTYPE	8.513	1	8.513	.207	.650
3-Way Interactions	38.206	1	38.206	.929	.336
TRTGRP x GENDER x SCHTYPE	38.206	1	38.206	.929	.336
Explained	14536.870	8	1817.109	44.181	.000
Residual	7362.040	179	41.129		
Total	21898.910	187	117.106		

*Significant at P <.05

The result presented in table 1 above shows that there was significant main effect of treatment on Mathematics achievement test scores of the participants ($F_{(1,179)}$ =99.60< 0.05). The result shows that

the null hypothesis is significant. It was therefore concluded that there was significant main effect on the Mathematics Achievement Test of the participants. To further provide information on the Mathematics achievement test, the Multiple Classification Analysis (MCA) was computed and the result is shown in Table 2 below.

Table 2: Summary of Multiple Classification Analysis (MCA) showing the direction of the significant interaction effects of treatment, gender and school type on Mathematics Achievement Test of experimental and control group.

Grand Mean: 53.29

MULTIPLE CLASSIFICATION ANALYSIS

Grand Mean = 53.29

Variable + Category	N	Unadjusted Dev'n	Eta	Adjusted for Independents + Covariates Dev'n	Beta
TRTGRP					
1 Experimental	94	6.46		4.94	
2 Control	94	-6.46		-4.94	
				.60	.46
GENDER					
1 male	101	1.17		.83	
2 female	87	-1.36		-.97	
				.12	.08
SCHTYPE					
1 Private	94	1.84		.54	
2 Public	94	-1.84		-.54	
				.17	.05
Multiple R Squared					.660
Multiple R					.813

Table 2 shows that the participants exposed to treatm obtained the highest adjusted post test mean scores(x) of 58.23 whi the participants in control group has the lowest adjusted mean scor (x) of 48.35. These values were obtained by adding the respective adjusted deviations with the grand mean. The table indicated that treatment accounted for as much as 66% ($MR^2 = 0.66$) of the variance of the participant MAT scores, while the remaining 34% are due to other unexpected sampling errors. The table also shows that male

participants obtained the highest adjusted post test mean scores ($\bar{x}$= 54.12) while female participants has the lowest adjusted mean score ($\bar{x}$= 52.32). The MCA also shows that participants from private school obtained the highest adjusted post test score mean ($\bar{x}$=53.83) while the participants from public school has the lowest adjusted mean score ($\bar{x}$= 52.75). There was no significant main effect of the school type on Mathematics achievement test scores of participants ($F_{(1,179)}$ = .111 > 0.05). The result shows that the null hypothesis is not significant. It was therefore concluded that there was no significant main effect of the school type on Mathematics achievement test scores of participants.

Table 1 also revealed that there was no significant interaction effect of treatment, gender and school type on Mathematics achievement scores of participants ($F_{(1,179)}$ = .929 > 0.05). The result the null hypothesis is not significant. It was therefore concluded that there was no significant interaction effect of treatment, gender and school type on Mathematics achievement test scores of participants. The result also shows that there was significant main effect of gender on Mathematics achievement test scores of participants ($F_{(1,179)}$ = 1.06 < 0.05). The result shows that the null hypothesis is significant. It was therefore concluded that there was significant main effect of gender on Mathematics achievement score of participants.

Discussion

The result of the findings revealed that there was significant main effect of treatment on the Mathematics achievement test scores of participants. This finding agrees with the findings of Scruggs and Mastropieri (2007); Gallagher (1992); Mohamed, Gregory and Austin (2006); Seaton (1992); Yinyinola (2008); Aburime (2009); Vattanapath and Jaiprayoon (1999); Yien (2001); Amer (1993); McCraty, Tomasino, Atkinson, Aasen and Thurik (2000) who found that testwiseness skills training was effective in enhancing academic performance of participants in all their study.

The fact that the participants in the experimental group showed a greater improvement in their post test scores on Mathematics than control group proved that the training programme was effective and

that the utilization of the treatment gained by the participants contributed to their improved scores. While the observed low scores of control group participants' might be as a result of their non exposure to training programme. One way of explaining this is that it might be possible that while the experimental group was actively participating in the training programme, the control group participants were busy with things that cannot improve their Mathematics performance. Another possible explanation for this above findings is that obviously, the participants that were exposed to test taking skills using testwiseness training package will do better having acquire the basic skills they were hitherto deficient of, unlike the control group which never have such exposure. The findings tend to confirm that students with test taking skills performed more than those who had the same ability but lack test taking skills

There was also significant main effect of gender on Mathematics achievement scores of participants. The findings is consistent with previous works of Bassey, Joshua and Asim (2008); Hedges and Nowell (1995); Randhawa (1994); Campbell and Beaudry (1998); Engelhard (1990); Ogunsanwo (2003); Adetunde, Asare and Oladejo (2006) who found significant difference in the academic achievement of male and female participants in their various studies. The possible explanation for this may be due to several studies have documented that females have lower level of self-efficacy in some courses compared to male (e.g. DeBacker & Nelson, 2000; Miller, Greene, Montalvo, Ravindran & Nichols, 1996; Pintrich, 1991).

There was no significant difference in the Mathematics Achievement Test scores of participants from private and public schools. The finding corroborate with the study by Center on Education Policy (CEP) 2007 that private school students and public school students perform equally on achievement tests in mathematics, reading, science, and history. This implies that school type did not have significant difference on mathematics achievement test scores of experimental and control group. The possible explanation for the result may not be unconnrcted with the fact that most of the secondary schools are ill-equipped in terms of instructional materials, school buildings especially public schools which are not properly planned,

sited, constructed, equipped and maintained. Many schools do not have enough chairs and desks. In some cases, many students had to sit on the floor to receive lectures and write examinations.

The interactions effect of treatment, gender and school type respectively did not produce any significant effect on Mathematics achievement test scores of participants. This implies that one cannot associate participants' performance in the treatment condition with their gender and school type with regards to all measures. This non significant effect further suggests that the observed differences in group mean scores were small for gender and school type. This could be as a result of sampling error or due to chance. This also implies that irrespective of the gender and school type, participants' in the experimental group performed better than their control group counterpart.

Implications of the Study

This study had several implications, which includes the fact that the current study has proved that testwiseness skills training was effective in enhancing better performance in Mathematics achievement test among secondary school students.

Moreover, it is worth mentioning that testwiseness skills can be enhanced. That is, students who are not testwise, if they are taught, can understand these testwiseness skills based on the skill in them since it can lead to the enhancement of their test scores.

Also, that both male and female students can benefit from testwiseness training skill so that it will improve their test taking skills, develop positive attitude towards testing, avoid making unnecessary errors, be time conscious, reduce acquired test anxiety and therefore possess enhanced academic performance.

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