



Test-Taking Strategies As Predictors Of Students' Mathematics Achievement In Rivers State

Igwe, Benjamin Nwaudo & Orluwene, Goodness Wobihiele

**Department of Educational Psychology, Guidance and Counselling
Faculty of Education, University of Port Harcourt
Rivers State, Nigeria**

ABSTRACT

This work investigated test-taking strategies as predictors of students' Mathematics achievement in secondary schools in Rivers State. The correlational research design was used with a sample of 800 students drawn from the population of 35,201 Junior Secondary School three (JSS 3) students in Rivers State public schools. Multiple-choice questions on Mathematics of 2017 Rivers State Basic Certificate Examination were adapted and used to determine students Mathematics achievement. Test-Taking Strategies Scale (TSS) was adapted and used for students' test-taking strategies. The reliability coefficient of the TSS subscales determined using test-retest method were: Cognitive (0.852), Meta-cognitive (0.822), Social (0.651), Time management (0.887), Item Analysis (0.881), and Distracter Selection (0.889). Data collected were analyzed using multiple regression, t-test and analysis of variance (ANOVA) associated with multiple regression. Results of the study tested at 0.05 level of significance showed: test-taking strategies jointly do have a significant prediction on students' academic achievements in Mathematics. It was therefore recommended that students should adopt test-taking strategies jointly and educators should teach students test-taking strategies.

Keywords: Test-taking strategies, mathematics achievement, Time Management, Meta-Cognitive skills

INTRODUCTION

All educational institutions are established with the primary goal of holistic development of learners in the three domains namely the cognitive, psychomotor and affective. This educational goal is further subdivided into specific measurable objectives for easy achievement and assessment. All human and material resources are geared towards the achievement of these objectives. When learners have acquired a particular relatively permanent change in behaviour with respect to instructional content, it is assumed that learning has taken place. Hence that particular objective has been achieved.

Mathematics is one of the core subjects offered at all levels of education. At the kindergarten stage, it comes up as numerical skills. At the primary and the secondary levels, it is offered as General Mathematics. While at the (senior) secondary level, it is taken as Further or Additional Mathematics. At these stages, Mathematics is compulsory for all students irrespective of their chosen area of specialization, either arts, social sciences or sciences. At higher institutions of learning, the subject is no longer mandatory depending on the student's course of study. However, it is one of the requirements for admission into higher institutions. In higher institutions, Mathematics is taken in several forms such as Geometry, Statistics, Mechanics, Algebra, Calculus, etc.

The discourse herein underpins the importance of Mathematics as a subject that cuts across all human endeavours. Arasian (2003) viewed academic achievement as an expression of a student's achievement from school-based instructions. Generally, academic achievement refers to the expression of knowledge acquired by a learner in the course of education. These definitions imply that academic achievement is the measured aspect of students' levels of mastery of instructions. Students' academic achievements are measured with various types of tests suitable for the purpose for which the test scores are used.

The determination of the extent to which learners have comprehended what has been taught, in Mathematics and any other subject, is ascertained through testing. The ability of the teacher to

determine these behavioural changes in students, using testing to some extent may be dependent on the teacher's testing skills and likely upon the student test-taking strategies.

Test-taking strategy is defined by Dodeen (2015) as a mental capacity to deal with any testing situation inappropriate attitude and to know what to do during the test. Dodeen gave examples of such strategies as; time management, investigating questions before responding, starting with easy questions, checking and reviewing answers, taking note of keywords and concepts in questions, ruling out wrong options. Test-taking strategies are the necessary prerequisite for any test taker. Nitko (2004) stated that to adequately prepare students for testing, schools should in addition to impacting the subject matter to the students also teach students the general test-taking strategies, such as paying attention to oral and written direction, writing responses or making answers neatly, using assessment time wisely to complete all the required task. Test-taking strategies can, therefore, be defined as the manner and approach of students to responding to a test which does not have a direct link to the subject matter.

Students' test-taking strategies is likely a factor that can affect students' academic performance especially in quantitative subjects like mathematics. The importance of students' appropriate test-taking strategy is obvious as it reduces anxiety during examinations and results in improved scores in examinations (Dodeen, Abdelfattah & Alshumrani, 2014). Affirmed by Dodeen (2015,2) while citing Sweetnam, stated that acquisition of test-taking strategies or skills will positively affect students' testing competency and hence their academic performance. Studies indicate that those students with test-taking strategies knowledge: (i) have improved studies towards test (ii) have lower levels of test anxiety (iii) achieve better in academic-related tasks. Even students who are familiar with the subject may do poorly in test because of the lack of test-taking skills (Sweetnam 2003). Hayasi (2008) reported that proficiency is a key factor in the use of selected test-wiseness strategies. Furthermore, their result showed that gender did not significantly influence the selection of test-wiseness strategies.

Slim, Must and Taht (2013) carried out a study on how test-taking effort can predict the performance of students in low-stakes tests. They found that students performance in low-stakes tests was dependent on test-taking effort characteristics such as the number of items, the test-taker attempts to solve and the meantime that is devoted to solving an item. In 2014, Dodeem, et al conducted a study on the association that test-taking skills had with motivation to learn mathematics, mathematics anxiety, attitudes towards mathematics and attitudes towards tests. They found that test-taking skills positively relate with students' test-taking skills and their motivation to learn mathematics, attitudes towards mathematics and attitudes towards tests, on the other hand, that a significant negative relationship existed between test-taking skills and mathematics anxiety.

A critical examination on the reviewed studies shows that they were all conducted in foreign societies that is not Nigeria let only Rivers State. Meanwhile, in Rivers State, Nigeria the researchers' experiences and observations suggest that most students exhibit to a reasonable extent phobia and negative attitude towards learning mathematics. This is evident on their high failure rates, low-grade performance, low rate of attendance to mathematics classes, non-commitment to both class and homework related to mathematics etc.

In all, mathematics is viewed as a monster subject by most students. This may suggest that many of the students are not well equipped with the requisite strategies for taking tests in the process of writing mathematics tests. This is because many of them complain that "no matter how they read and prepare for mathematics test they still fail in the long run". It is stated that success in examinations does not depend only on the knowledge of contents or subject matters but also on the acquisition of some non-cognitive skills such as test-taking skills and emotional intelligence (Eklof, 2010). Test-taking skills are the skills that are not related to the subject matter but to the attitude and approach of taking a test. Hence it can help to reduce nervousness and fear thereby creating an enabling situation for the students to write the examination or test calmly, which lead to improved performance. (Dodeen, 2015).

To this end, even if all the factors affecting the students' success in the examinations are positive, it is still essential to have a special preparation in the methods of responding to examination questions and to use appropriate strategies during the examination to be successful. Bond and Herman in Bicak (2013) asserted that ability, success, and GPA are factors overlapped due to individual test-taking

strategies. Therefore; the main focus needs to be on test-taking strategy rather than the testing experience to increase examination performance. Bicak further commented that Sternberg pointed out the meta-cognitive aspects of test-taking experience which include selection strategy, timing, difficulty prediction, and tracking. These strategies are considered to be important test-taking skills. The affective characteristics of students are regarded to be constituents of students meta-cognitive attributes, which shows that some of the students are more confident on test-taking than others regardless of test difficulty or test format (Krebs & Roebers, 2010). The above discussion suggests that the academic performance of a student in Mathematics could be dependent also on the student's test-taking strategies and not only on learning.

In essence, owing to the fact that students may still fail their tests or score very low despite their high level of subject matter acquisition, and the importance of mathematics to education and life after education, there is, therefore, an urgent need to carry out a study such as the present one.

Significance of the Study

Hopefully, it is believed that findings from this study will help to promote achievement in mathematics and other related subjects such as Physics, Chemistry, Accounting, Economics and so on. This also suggests that through the findings from the study, our economy that is technological-driven will be improved upon. This is because the findings from the study shall help to solve some of the problems of poor achievement in mathematics that are linked to poor test-taking strategies. Building upon this, students with poor test-taking strategies shall be helped and achievement shall improve.

The study will also be beneficial to teachers, for they will be better equipped with appropriate test-taking techniques and then teach alongside with the techniques. The study will help institutions of higher learning because the subsequent improvement in students Mathematics achievement in the Senior School Certificates Examination (SSCE) and in the Post-Unified Tertiary Matriculation Examination (PUTME) will enhance admission and placement in the universities and other institutions of higher learning.

Aim and objectives of the Study

The aim of the study is to investigate the predictive powers of test-taking strategies on students' academic achievement in Mathematics. In specific terms, the study intends to: achieve the following objectives,

1. Determine the joint predictive power of test-taking strategies (cognitive, meta-cognitive, social, time management, item analysis and distracter selection) on students' academic achievement in Mathematics.
2. Determine the relative contribution of test-taking strategies (Cognitive, Meta-cognitive, Social, Time management, Item analysis and Distracter selection) on students' academic achievement in Mathematics.

Research Questions

The following research questions were answered to obtain the results of the study.

1. What is the joint predictive power of test-taking strategies (cognitive, meta-cognitive, social, time management, item analysis and distracter selection) on students' academic achievement in Mathematics?
2. What is the relative contribution of each of the test-taking strategies (cognitive, meta-cognitive, social time management, item analysis and distracter selection) on the prediction of Mathematics achievement?

Hypotheses

The following null hypotheses were tested at 0.05 levels to obtain the results of the study on:

1. Test-taking strategies (cognitive, meta-cognitive, social, time management, item analysis and distracter selection) jointly do not significantly predict students' academic achievement in Mathematics.
2. Test-taking strategies (cognitive, meta-cognitive social, time management, item analysis and distracter selection) do not independently contribute significantly in the prediction of mathematics achievement.

METHOD

The design used for the study is the correlational research design. The study adopted this design because the researchers collected sets of data from students’ test-taking strategies (predictor variables) and academic achievements in Mathematics (criterion variable) and then established the predictive ability of the former on the later.

A sample of 800 Junior Secondary School three (J.SS 3) students drawn using a multi-stage approach of sampling was used as the sample for the study. At the first stage, disproportionate stratified random sampling techniques based on senatorial zone was employed. This gave a total of three senatorial zones (strata) and two local government areas each were selected using simple random sampling by balloting. At the second stage, disproportionate stratified random sampling was also employed to select only two schools from each Local Government Area chosen, which gave a total of 12 Junior Secondary Schools used for the study. Then at the third stage, 848 students were drawn from the 12 schools chosen using proportionate stratified random sampling. Although after administrating the 848 copies of the instruments due to omission, and double ticking of the responses 48 copies (5.70%) of the instruments were invalidated while 800 (94.30%) of the instruments were used for the study.

Two instruments were used to collect data for the study. The first instrument used for the study is the Basic Education Certificate Examination (also referred to as Junior Secondary Certificate Examination –JSCE), multiple choice questions in Mathematics for 2016/2017 session. This instrument was used because it suitably applies to the population under investigation.

The second instrument used is Test-taking Strategies Scale (TSS), made up of 34 items used for assessing students’ test-taking skill. It is an instrument which measures the following test-taking strategies: cognitive (CO), meta-cognitive (MC), social (SO), time management (TM), Item Analysis (IA) and Distracter Selection (DS). The abbreviation is written against each item to indicate what the statement seeks to measure. Furthermore, the two instruments were all adapted and were further validated in terms of clarity and suitability by experts in Measurement and Evaluation in the Department of Educational Psychology, Guidance and Counselling, University of Port Harcourt.

For their reliability, the first instrument is the Junior Secondary Certificate Examination (JSCE) Mathematics multiple choice questions for 2016/2017 session. This instrument was designed by subject specialists as well as experts in Measurement and Evaluation using the appropriate syllabus for each subject. This instrument has been used over the years for certification, employment admission and placement. It is therefore considered reliable for this investigation. The test-retest method was used to establish the reliability of the TSS. Forty respondents different from those used for the actual investigation was used. The instrument was administered twice giving an interval of three weeks. The two sets of scores obtained from the repeated measures were correlated using Pearson Product Moment statistics (r). The sub-scales had the following coefficients Cognitive(0.852); Meta-cognitive (0.822); Social (0.651); Time management (0.887); Item Analysis (0.881); Distracter Selection (0.889).

To collect data, the two instruments were administered to each of the respondents at their schools. This was done by the researchers with the help of an assistant at each chosen school. The data collected were analyzed using multiple regression analyses, beta values, t-test and analysis of variance (ANOVA) associated with multiple regression. The results of the null hypotheses were tested at 0.05 level of significance.

Research Question 1: What is the joint predictive power of test-taking strategies (cognitive, meta-cognitive, social, time management, item analysis and distracter selection) on academic achievement in Mathematics?

Students’ scores in Test-taking strategies scale used as the independent variable while students scores in mathematics achievement test were used as a dependent variable. After the analysis, the result obtained is presented in Tables 1.

Table 1: Regression Analysis on joint Test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection) and Academic Achievement in Mathematics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.232 ^a	.054	.047	15.10838

a. Predictors: (Constant), DS, S, C, TM, A, MC

In Table 1, the correlation between the joint Test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection) and students' Mathematics achievement has a coefficient of 0.232, a weak positive relationship between these two variables. The adjusted coefficient of determination gotten for predicting students' Mathematics achievement on joint Test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection) is 0.047, implying that 4.7% changes in the students' Mathematics achievement is accounted for by changes in their joint Test-taking strategies.

Hypothesis 1: Joint Test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection) do not significantly predict students' academic achievement in mathematics.

Table 2: Summary of ANOVA on the prediction of mathematics achievement using test-taking strategies

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	10321.669	6	1720.278	7.536	.000 ^b
	Residual	181012.651	793	228.263		
	Total	191334.320	799			

Table 2 reveals an F-value of 7.536 was obtained at degree of freedom of 6 and 793 at 0.001 level of significance ($p = 0.001 < 0.05$). Thus, joint test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection), significantly predict students' academic achievement in Mathematics.

Research question 2: What is the relative contribution of each of the test-taking strategies (cognitive, meta-cognitive, social time management, item analysis and distracter selection) on the prediction of Mathematics achievement?

Hypothesis 2: Test-taking strategies (cognitive, meta-cognitive social, time management, item analysis and distracter selection) do not independently contribute significantly in the prediction of mathematics achievement.

The joint influence of Test-taking strategies (cognitive, meta-cognitive, social, item analysis and distracter selection) prediction is significant on academic achievement in mathematics. It is, therefore, necessary for one to determine the relative contribution of each Test-taking strategy on mathematics achievement. This was done using Beta and t-value associated with multiple regressions. The results obtained are depicted in table 3.

Table 3: Relative Contribution of Test-taking strategies on Mathematics Achievement model

	Unstandardized Coefficients		Standardized Coefficients		t	P-value.
	B	Std. Error	Beta			
(Constant)	21.669		4.387		4.940	.000
C	-.368		.119	-.118	-3.091	.002
MC	.280		.118	.093	2.377	.018
S	.085		.123	.024	.692	.489
TM	.469		.169	.102	2.779	.006
IA	.447		.129	.133	3.466	.001
DS	.094		.126	.028	.743	.457

From Table 3, the beta value in relation to the relative contribution each of the test-taking strategies have on mathematics achievement shows thus-item analysis test-taking strategy contributes highest (0.133), followed by cognitive test-taking strategy (-0.118), time management (0.102), meta-cognitive test-taking (0.093), distracter selection test-taking strategy (0.028), then social test-taking strategy (0.024). However, among all, the cognitive test-taking strategy made a negative contribution to students' mathematics achievements. It is also found that all the strategies except social test-taking strategy made a significant impact on the prediction of mathematics achievement independency. From the Unstandardized coefficients, associated with multiple regression as shown in Table 3, the model

for the prediction of students' mathematics achievements on their test-taking strategies can, therefore, be presented thus:

$$Y^1 = 21.669 - 0.368X_1 + 0.280X_2 + 0.085X_3 + 0.469 X_4 + 0.447X_5 + 0.094X_6$$

Where:

- Y^1 = the predicted score on mathematics achievement and
- X_1 = the students' score on cognitive test-taking strategy.
- X_2 = the students' score on meta-cognitive test-taking strategy.
- X_3 = the students' score on social test-taking strategy.
- X_4 = the students' score on time management test-taking strategy.
- X_5 = the students' score on item analysis test-taking strategy.

Discussion of Results

One of the findings of the study is that students' test-taking strategies jointly predict students' mathematics achievement significantly. This result is expected and not surprising for a student who has good time management, able to analyze items in a test, appropriately select the distracters will definitely obtain high scores in his/her tests.

This finding of the present study is in agreement with that of Sweetnam (2003) who researched the relationship between teaching Test-taking strategies and improving Test scores. In his study, students were advised to use the Test-taking strategies (item analysis, time management, distracter selection, cognitive, meta-cognitive all inclusive) taught them in every test given in school. The result of this study, showed a significant improvement in students' scores when measured at the end of the year. Again this finding of the present study is also in consonance with the findings of Bicak (2013) who found a significant relationship between the application of test-taking strategies and improvement in students' scores.

Secondly, it was found that item analysis test-taking strategy made a higher contribution to the students' mathematics achievement. This is followed by the cognitive test-taking strategy, time management, meta-cognitive, distracter selection and social test-taking strategies. This suggests that the ability of students to analysis items, in the test, will give the student insight on how to respond accurately to such item thereby increasing the score in the overall test. Furthermore, when students are well equipped on the non-cognitive approach to writing a test in conjunction with the students' level of subject matter knowledge, it will go a long way to promote their overall score in a given test. Notwithstanding students' acquisition of the meta-cognitive test-taking strategies will calm their affection and mood while writing the test. Based on all these, the researchers expected this finding. However, this finding did not support that Sweetnan (2000) who found that test-taking strategies improve academic achievement. The two findings differ on the basis of the relative impact of the specific test-taking strategy.

Finally, it also found that among all, test-taking strategies only the cognitive test-taking strategies made a negative impact on students' mathematics achievement significantly. This implies that as the students' level in the acquisition of cognitive test-taking strategy increases, their achievement in mathematics decreases. This is surprising because the researchers felt that since mathematics. Achievement is embedded in the cognitive domain of educational objective; cognitive test-taking strategy would have contributed greatly and positively. This finding suggests that cognitive test-taking strategy may contribute little or nothing to mathematics. However, this finding did not support that of Silm et al (2013). They found that test-taking effort and the speed influence achievement in academics.

CONCLUSIONS

From the results obtained from the analysis of the students' responses on the test-taking strategies scale and the Mathematics multiple choice questions, the following conclusions were drawn:

Only a small aspect of the changes in the academic achievement of students in Mathematics is accounted for by changes in their various test-taking strategies. A greater part of the changes in the student academic achievement in Mathematics is due to other variables than these ones considered in this investigation. Despite all these, the test-taking strategies significantly predict students Mathematics achievement.

The following variables relatively and significantly predict academic achievement in Mathematics-Cognitive test-taking strategy, Meta-cognitive test-taking strategy, Time management strategy and Item analysis test-taking strategy. Social test-taking strategy and the Distracter selection strategy are the only variables that could not be used to predict academic achievement.

RECOMMENDATIONS

With regards to the findings from the study the researchers recommended the following:

- 1) Students' would not only prepare for examination on the basis of the content or subject matter knowledge but should also consider equipping themselves with proper and adequate test-taking strategies.
- 2) Teachers and concerns should encourage the students to adopt the proper test-taking strategies, which include the cognitive meta-cognitive, time management and distracter selection strategies jointly.

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