Test-Taking Strategies and Secondary School Students Academic Performance in Chemistry in Ekiti State, Nigeria

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Abstract: *The study investigated test-taking strategies used before and during test and the academic performance of Secondary School Students in Chemistry tests and also the relationship between test-taking strategies before test and students' academic performance in Chemistry. Descriptive survey design was adopted. The population of the study consisted of all Senior Secondary Chemistry students with the sample size of 288 SSIII Chemistry students which were selected from 18 public schools in six Local Government Areas using multistage sampling procedure. The research instruments used are Test-taking Strategies Questionnaire (TSQ) and Chemistry Achievements Test (CAT) in which validity was ascertained by Experts in Science Education and reliability of the instruments TSQ and CAT were determined through Cronbach Alpha and Split half with the co-efficients of 0.74 and 0.85 respectively. The data was analyzed using descriptive statistics and inferential statistics of Pearson Correlation and multiple regression analysis at 0.05 level of significance was used to test hypothesis. Results showed that there was significant relationship between test-taking strategies and academic performance in Chemistry and also mnemonics is the highest used component of strategies before test. It can be concluded that Testwiseness and Mnemonics has the highest contributions to students' academic performance in Chemistry while permutation was the least contributor to the academic performance of Secondary Schools Students in Chemistry. It is therefore recommended that Testwiseness and Mnemonics should be encouraged among students by teachers while peer tutoring should be discouraged among students by teachers due to its negative relationship on academic performance of Secondary School Chemistry Students in Ekiti State.*

Keywords: *Mnemonics, Testwiseness, Permutation, Peer-tutoring, Skimming of question and Time Management.*

I. Introduction

Chemistry is one of the basic sciences which are essential pre-requisites for technological breakthrough. The need for effective Chemistry education in Nigeria is very crucial and therefore, demands considerable attention. One of the major issues that bother Chemistry students in Nigeria is their academic performance. According to Fehintola (2009), poor academic performance of students in internal and external examination is a reflection of the problems and challenges facing the educational system in Nigeria. Thus, poor academic performance appears bring about sadness and frustration to the individual concerned and to his/her parents as well as other members of the family. This poor performance might hinders the progress of student into fulfilling their dream course.

Chemistry is an integral part of the science curriculum both at the senior secondary school as well as higher institutions. Students' poor performance could be attributed to so many factors among which are teaching strategies, teachers' attitude, lack of instructional materials students laziness but little or no attention has been given to what is happening during the conduct of tests (Ayodele, 2017). Observing students during Chemistry tests shows that some of the students who have adequate knowledge or have prepared well, do not perform well in their Chemistry tests.

Test-taking strategies have both direct and indirect effects on students' performance. According to Dodeen (2009), these strategies can help students increase their scores on tests through the effective use of their time, effort, and test conditions. Indirectly, using test-taking strategies affects other related but important factors such as reducing test anxiety and improving students' attitudes toward tests, but it seems some students are not aware of how to use test-taking strategies and the ones aware are using test-taking strategies inappropriately which leads to poor performance of chemistry students in test.

Considering test-taking strategies (before tests) components such as mnemonics, permutation and peer tutoring have been considered for this study. Mnemonics are techniques for improving memory by the use of elaborative encoding (acronyms), retrieval cues (songs) and imagery (mapping) as a specific tools to encode any given information in a way that allows for efficient storage. Modern memory research by Worthen and Hunt,

(2011) argued that mnemonics are powerful learning tools in certain contexts, such as remembering a list of concrete objects. Despite the fact that mnemonics is a useful strategy that can improve students' performance in chemistry tests, most Chemistry students due to laziness and late preparation seems not to know how to use it to improve their performance in test.

Permutation involves students predicting questions for the next test. Students can only predict likely questions when they study purposively. Most students seems not to know how to set questions (different types) on each chapter/unit during private studying to test their understanding and likewise provide solution for such questions because they do not study for the purpose of understanding. Some students tends to perform poorly in chemistry test because of lack of ability to predict test questions. Such students just read chemistry for reading sake and like novels.

Peer tutoring is a student's partnership method of preparing for a test or examination. It involves a student teaching his peers by linking high achieving students with lower achieving students or those with comparable achievements. The pairing of higher and lower-achieving students is intended so that students gain knowledge from each other through practice and reinforcement. Instead for the student groups to study and learn, they go about gossiping, bragging and some even fight and injure themselves. This eventually affects their performance in chemistry test as this strategy seems not to be used appropriately.

Considering strategies used during test, the following components will be used for the study which are test-wiseness, skimming of test questions and time management. During Chemistry tests, 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. Such students also understand instructions quickly and as a result of this, they usually score high marks in tests while students who are not test-wise will find it difficult to understand instruction which will reduce their speed during test and in turn reduce their score in tests.

Skimming test items is a technique in looking for the easy items in a test in order to attempt the easy items before the difficult ones. This strategy has purpose to get the specific information of the test quickly and attempt the easy ones. According to Brown (2004), skimming is the process of rapid coverage of the test to determine the less difficult items and general idea about the test.

Time management is a skill that every student should not only know, but also apply when writing test. Some students seem to find it difficult managing their time during Chemistry tests because of their lack of experience with test. Time management is critical for students when taking standardized tests. Some Chemistry students may not read through the tests items so as to answer the easiest question first, they tend to answer difficult items thereby wasting time unnecessarily which might reduce their performance in such tests

The academic performance of Secondary Students in Chemistry in Ekiti state has been a challenge to various stakeholders, parents, students' school administrators and government in the state. The average performance of students in Ekiti State at credit level and above in Chemistry from 2009 to 2016 was less than 40%. This failure might be attributed to teachers' method of teaching, non-availability of teaching materials, student factors and parental factors. It is without doubt that some students prepare for Chemistry tests, but the problem is when do Secondary School students start preparation and how do they prepare for Chemistry tests? What test taking strategies do they use and also how well are these strategies used by the Secondary School Students.

So many strategies are being used by the Secondary School students in order to improve their performance in Chemistry, some of which are examination malpractice and cramming. For this study, strategies that will be considered are mnemonics, testwiseness, peer-tutoring, permutation, time-management and skimming of question. It is without doubt that somesecondary School students have been using this strategies but the major problem is do these strategies contribute to the academic performance of Secondary School Student in Chemistry in Ekiti State.

Purpose of the Study
This study examined test-taking strategies and secondary school students' academic performance in Chemistry in Ekiti State. The study specifically:
  i.   examined the relationship between test-taking strategies and students' academic performance in Chemistry;
 ii.   investigated the predictive strength of components of test-taking strategies before test such as using mnemonics, permutation and peer-tutoring on academic performance of students in Chemistry;
iii.   investigated the predictive strength of components of test-taking strategies during test such as test-wiseness, skimming test questions and time management on academic performance of students in Chemistry;

Research Questions
The study sought solution to these research questions:

i. What are the components of test-taking strategies used in Chemistry test by students in secondary school in Ekiti State?
ii. What is the level of academic performance of the students in Chemistry in secondary school in Ekiti State?

Research Hypotheses
The following hypotheses were formulated for the research:
i. There is no significant relationship between test-taking strategies and students' academic performance in Chemistry in Ekiti State secondary schools.
ii. Components of test-taking strategies used before test does not significantly contribute to the academic performance of students in Chemistry.
iii. Components of test-taking strategies used during test does not significantly contribute to the academic performance of students in Chemistry.

Methodology
This research adopted a descriptive research of survey design. This design was chosen because it involved collection of data from a sample of population in the existing situation, in order to measure test-taking strategies of secondary school students and their academic performance in chemistry in Ekiti State. A survey research studies a small sample from a large population from where inferences would be draw about the characteristics of the defined population. Therefore, the survey research provides conceptual and methodological design for investigating the test – taking strategies and academic performance of secondary school students in chemistry.

Population
The population for this study consisted of Senior Secondary Students offering Chemistry in 189 public schools in Ekiti State as at the time of this study. The secondary schools were located in 16 Local Government Areas from the three senatorial districts of Ekiti State, Nigeria, which are Ekiti North, Ekiti Central and Ekiti South senatorial districts.

Sample and Sampling Techniques
The sample for the study consists of 288 Senior Secondary Students III students offering Chemistry drawn from 18 public secondary schools in Ekiti State,Nigeria using multistage sampling procedure. In stage one, two Local Government Areas were randomly selected through balloting method from each of the three senatorial districts in Ekiti State. In stage two, three public secondary schools were selected through stratified random sampling technique from each Local Government Area. In stage three, one intact class of S.S. III Chemistry students were selected from each of the 18 public secondary schools earlier selected.

Research Instruments
Two self constructed instruments tagged Test-taking Strategies Questionnaire (TSQ) and Chemistry Achievement Test (CAT) were used to collect relevant data for the study. Test-taking Strategies Questionnaire (TSQ) consists of two sections namely Section A and B. Section A of the TSQ sought for demographic information about the respondents while Section B consisted of 24 items to elicit information on components of test taking strategies. Using the 5 point Likert type scale - Very Much Like (VM); Much Like (ML); Unlike (UL); Very Much Unlike (VMU); and Not Sure (NS) which were scored 5, 4, 3, 2, and 1 respectively.

The second instrument, Chemistry Achievements Test (CAT) constructed by the researcher to measure the academic performance of Secondary School Students in Chemistry. It contains 50 items from five topics in chemistry according to the scheme of work. The 50 items was administered to a group of 20 Chemistry students outside the selected samples for a tryout testing. Item analyses which are the difficulty power and discriminating power of the items were done in order to determine the bad items. The bad items were determined using the set rules of ranges and were removed. 30 out of the 50 initial items which were considered good after item analysis procedure were selected for CAT.

Validity of the Instruments
The validity of the instruments "Test-taking Strategies Questionnaire" and Chemistry Achievement Test were ascertained by Tests and Measurement Experts including my Supervisor, Chemistry teacher, Lecturer in Science Education and Test blue print. The tests and measurement experts determined the face validity to ensure it covers the strategies before and during Chemistry test and content validity of the Test-taking Strategies Questionnaire to ensure the appropriateness of the instruments in measuring what it is supposed to measure.

The validity of the second instrument, CAT was ascertained using test blue print (table of specification) which was constructed by the researcher. Also, the instrument was given to Lecturer in Science Education and

Chemistry teachers to ascertain its face validity as they gave their opinion and suggest their observation in terms of language, sharing the scheme of work with the researcher in order to construct a valid instrument.

Reliability of the Instruments

The reliability of the TSQ and CAT were estimated using Cronbach Alpha and Split half method respectively. The instruments were administered on 20 respondents outside the sample. The data collected were collated and analyzed using the Cronbach Alpha and Split half. Coefficient of 0.74 and 0.85 were obtained for TSQ and CAT respectively. These values were positive and high enough which shows that the instruments were reliable for the study.

Administration of the Instruments

The researcher visited the sampled schools to administer the research instruments during test period so that the students would be prepared for the Chemistry Achievement Test in each of the selected Local Government Areas with the help of two research assistants. The instruments were administered on Chemistry students and retrieved immediately after the respondents have responded to the instruments. The research assistants were trained so that they can help the respondents have better understanding of the instruments and also for the ease retrieval of the instruments.

Data Analysis

The data collected were analyzed using descriptive and inferential statistics. The research questions were answered using mean and standard deviation. Hypothesis 1 was tested using inferential statistics of Pearson's Product Moment Correlation (PPMC), while hypotheses 2 and 3 were tested using multiple regression analysis. All hypotheses were tested at 0.05 level of significance.

II. Results

Research Question 1: What are the components of test-taking strategies used in Chemistry by students in secondary school in Ekiti State?

Table 1: Components of Test-taking Strategies Mean and Standard Deviation

S/N	Test-taking Strategies	N	Mean	Std. Dev.
1.	Mnemonics	288	13.20	2.10
2.	Permutation	288	11.15	1.32
3.	Peer Tutoring	288	11.32	1.23
4.	Testwiseness	288	13.19	2.09
5.	Skimming Test Questions	288	12.26	1.94
6.	Time Management	288	11.65	1.48

Table 1 shows the components of test-taking strategies used in Chemistry by students in secondary school in Ekiti State. Mnemonics has a mean response of 13.20 while permutation, peer tutoring and testwiseness have a mean response of 11.15, 11.32 and 13.19 respectively. Skimming test questions has a mean response of 12.26 and time management has a mean response of 11.65. Mnemonics and Testwiseness are the most used components because they have the highest mean followed by Skimming Test Questions, Time Management is another strategy commonly used while permutation and peer tutoring have the lowest mean, therefore are the least components used by the students.

Question 2: What is the level of academic performance of the students in Chemistry in secondary school in Ekiti State?

To determine the level of academic performance of the students in Chemistry in secondary school in Ekiti State, the low level of performance was determined by subtracting the standard deviation from the mean score (9.13 – 2.48 =6.65). The moderate level of performance was determined by the mean score (9.13) while the high level of performance was determined by adding the mean score and standard deviation (9.13 + 2.48 = 11.61). Therefore, low level of performance starts from 0.0 to 6.65, the moderate level of performance start from 6.66 to 11.60 and the high level of performance is from 11.61 to 30.00. The level of performance in Chemistry in secondary schools is presented in table 2 and figure ii.

Table 2: Level of students' academic performance in Chemistry

Levels of performance in Chemistry	Frequency	Percentage
Low (0.0 – 6.65)	134	46.53
Moderate (6.66 – 11.60)	98	34.03
High (11.61 – 30.00)	56	19.44
Total	**288**	**100**

The result shows that out of 288 students, 134 students representing 46.53 percent were in low level of academic performance in Chemistry while 98 students representing 34.03 percent were in moderate level of academic performance in Chemistry and 56 students representing 19.44 percent had high level of academic performance in Chemistry. This shows that the level of students' academic performance in Chemistry was low. Figure ii further revealed the level of academic performance in Chemistry.

Testing of Hypotheses
The hypotheses generated in the study were tested using Pearson's Product Moment Correlation, Simple Regression and Multiple Regression Analysis at 0.05 level of significance.
Hypothesis 1: There is no significant relationship between test-taking strategies and students' academic performance in Chemistry in Ekiti State secondary schools.

In testing this hypothesis, data on test-taking strategies were collected from the responses of the respondents to items under Section B of TSQ (item 1 – 24) in the questionnaire. Data on students' academic performance were collected from the Chemistry achievement test (CAT). Both were compared for statistical significance using Pearson Product Moment Correlation at 0.05 level of significance. The result is presented in table 3.

Table 3: Relationship between test-taking strategies and students' academic performance in Chemistry

Variables	N	df	r-cal	r-tab	Remark
Test-taking Strategies	288	286	0.566*	0.195	Significant
Academic Performance	288				

*P<0.05

Table 3 shows r-cal (0.566) is positive and moderate. Table 3 shows r-cal (0.566) is greater than r-table (0.195) at 0.05 level of significance. The null hypothesis is rejected. This implies that there is significant relationship between test-taking strategies and students' academic performance in Chemistry in Ekiti State secondary schools.

Hypothesis 2: Components of test-taking strategies used before test does not significantly contribute to the academic performance of students in Chemistry.

Table 4: Multiple Regression showing contributions of test-taking strategies used before test on Students' Academic Performance in Chemistry

Model	Unstandardized Coefficients		Stand Coefficients	t-cal	R	R²	F-cal
	B	Std. Error	Beta				
(Constant)	-1.524	1.102		-1.383	0.588	0.345	49.954
Mnemonics	.536	.076	.455	7.096			
Permutation	.401	.229	.214	1.749			
Peer Tutoring	-.080	.232	-.040	-.342			

Table 4 indicates that the F-cal value of 49.954 is greater than F-tab value of 2.70 at 0.05 level of significance, the null hypothesis is therefore rejected. Hence, components of test-taking strategies used before test significantly contribute to the academic performance of students in Chemistry. All the sub-variables such as mnemonics, permutation and peer tutoring accountable for 34.5 percent of students' academic performance in Chemistry (R^2= 0.345), while other variable could be accountable for the remaining 65%.

The result shows that Mnemonics having a beta weight of (β = 0.455), Permutation (β = 0.214) and Peer Tutoring (β = -0.040). The table also shows that mnemonics has the highest contribution to students' academic performance in Chemistry followed by permutation while peer tutoring is the least contribution to students' academic performance in Chemistry.
The resulting regression equation is given as:

Y^1 = -1.524 + 0.536X_1 + 0.401X_2 - 0.080X_3

where:
Y=Students' Academic Performance in Chemistry
X_1= Mnemonics
X_2=Permutation
X_3=Peer Tutoring

Hypothesis 3: Components of test-taking strategies used during test do not significantly contribute to the academic performance of students in Chemistry.

Table 5: Multiple Regression showing contribution of test-taking strategies used during test on Students' Academic Performance in Chemistry

Model	Unstandardized Coefficients		Stand Coefficients	t-cal	R	R²	F-cal
	B	Std. Error	Beta				
(Constant)	-1.054	.996		-1.058			
Testwiseness	.541	.086	.458	6.298			
Skimming Test Questions	.061	.091	.048	.665	0.572	0.328	46.124
Time Management	.198	.105	.118	1.878			

Table 5 indicates that the F-cal value of 46.124 is greater than F-tab value of 2.70 at 0.05 level of significance, the null hypothesis was therefore rejected. Hence, components of test-taking strategies used during test significantly contributed to the academic performance of students in Chemistry. All the sub-variables such as test-wiseness, skimming test questions and time management account for 32.8 percent of students' academic performance in Chemistry ($R^2 = 0.328$).

The result shows Testwiseness having a beta weight of ($\beta = 0.458$), Skimming Test Questions ($\beta = 0.048$) and Time Management ($\beta = 0.118$). The table also shows that testwiseness as a sub-variable of components of test-taking strategies used during test has the highest contribution to students' academic performance in Chemistry followed by time management while skimming test questions has the least contribution to students' academic performance in Chemistry.

The resulting regression equation is given as:

$Y = -1.054 + 0.541X_1 + 0.061X_2 + 0.198X_3$

where:

Y = Students' Academic Performance in Chemistry

X_1 = Testwiseness

X_2 = Skimming Test Questions

X_3 = Time Management

III. Discussion

The study indicates that there is significant relationship between test-taking strategies and students' academic performance in Chemistry. This supports the findings of Scruggs and Mastropieri (2009) and Harris (2014) that test-taking strategies helped students familiarize them with the format of the test and reduced test anxiety which improves their academic performance in any given test. This could be as a result of positive relationship that exists between test-taking strategies and students' academic performance which means the better a student becomes at the use of Test-taking strategies, the better the academic performance of such student.

The study shows that of all the components of strategies used before test, mnemonics is the highest used components because it has the highest mean and it also contributed to the academic performance of secondary school Students in Chemistry. This is because mnemonics has a positive relationship with the academic performance of secondary school students in Ekiti State. The more students use mnemonics when studying Chemistry the more it enhances their learning skills which will improve their performance in Chemistry. This supports Iza and Gil (2015) affirmed that mnemonic as memory-enhancing pedagogical methods aimed at improving learning and information recall through the use of imagery, songs and letters.

Peer-tutoring is one of the least used components of strategies before test according to this study. The findings of this study, indicated that peer-tutoring has a negative relationship with academic performance of student in Chemistry this means the more students gather to tutor themselves in Chemistry the less they perform in Chemistry test. This is because whenever students gather to tutor themselves, they gossip, roam the streets, visit their friends, some even fight thereby defeating the purpose of the gathering because peer relationships often have less rigid characteristics than teacher-student interactions in a school setting which makes students abuse the gathering. This is in contrary to Longareth, Godinho, Parr, and Wilson (2009) who claims that peer-tutoring enhances motivation, improved cognition, and social outcomes in learning, increased sense of responsibility for one's own learning and improved meta-cognitive skills.

Permutation is the least strategy used before test according to this study. This means Secondary school student does not permutate questions after studying Chemistry. Secondary school students do not predict questions and answer it before Chemistry tests. Although permutation have positive relationship with the academic performance of student unlike peer-tutoring, only few students knows how to use it to improve their performance in Chemistry test and the more students use permutation when studying, the better their performances in Chemistry tests.

IV. Conclusion

It can be concluded from the findings that mnemonics is the highest used strategies as it has the highest mean score, also Testwiseness has the highest contribution to the academic performance of Secondary School Students in Chemistry, while permutation and peer tutoring is the least strategies used of all the components used in this study.

Furthermore, it can be concluded Peer tutoring contribute negatively to students' academic performance in Chemistry unlike Mnemonics and Permutation.

Recommendations

Based on the findings of this study, the following recommendations were made.
1. Students should be guided by parents or guardian on how to use mnemonics to study.
2. Stakeholders/Parents should teach students how to permutate questions before tests
3. Strategies like peer tutoring should be monitored by teachers so as to enhance maximum performance whenever students gather to study.
4. Students should be trained by the teachers or stakeholders on how to manage their time properly during test.
5. Students should be trained on how to skim test questions before answering so as to answer the ones they know first before answering the ones they do not know.

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