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Effectiveness of Frequency of Testing on Students' Study Habits in Mathematics among Senior Secondary Schools in Ogun State, Nigeria

Olaotan Oladele Kuku
Department of Educational Psychology,
School of Education,
Federal College of Education (Technical), Akoka,
Lagos State

Abstract
Mathematics plays a vital role in the scientific and technological advancement of every nation, and Nigeria is no exception. Besides its importance as a school subject, it is associated with more academic and career opportunities. However, students' poor achievement in mathematics may have led to questioning students' study habits. Constant practice and repeated reading is expected to enhance students' understanding and knowledge of mathematics. Thus, this study seeks to examine the effectiveness of frequency of testing on students' study habits in mathematics among secondary schools in Ogun State, Nigeria. The study employed a quasi-experimental pretest-posttest control group design. The population of the study comprised all senior secondary school students in Ogun State, Nigeria. A sample size of 157 students was selected through the multi-stage sampling process. The research instrument titled Study Habits Inventory was used to collect relevant data for the study. Two hypotheses were tested using descriptive statistics and Analysis of Covariance (ANCOVA). The hypotheses were tested at 0.05 level of significance. The study revealed that students tested most frequently developed impactful study habits towards the learning and practices of mathematics. In addition, the study revealed that gender was not a significant factor when trying to improve students' study habits via testing frequency. It was recommended, based on the findings from this study, that frequency of testing of every week should be adopted in the teaching, learning and mastery of mathematics concepts and exercises.

Keywords: Frequency of Testing, Study Habits, Senior Secondary School

Introduction
Aside the applications of mathematics to numerous human professions, it is also helpful in daily life activities. Due to this importance, mathematics is being taught in schools as a subject. However, students' achievement in this subject has remained poor. In the past five years, students' achievement in the Secondary

School Certificate Examination (SSCE) has been below average. The West African Examinations Council's report between 2010 and 2014 presented in Table 1 shows that an average of 41% out of the more than 1.5 million entrants passed mathematics at credit level and above.

Table 1: *Statistics of May/June (Senior Secondary Certificate Examination) Mathematics Performance (Nigeria) From 2010 to 2014*

Year	***Total Entry***	***Total Pass at Credit Level and above***	***Percentage Pass***
2010	1,351,557	534,841	40%
2011	1,540,250	587,630	38%
2012	1,672,224	649,156	39%
2013	1,543,683	889,636	58%
2014	1,692,435	529,427	31%
Average	**1,560,030**	**638,138**	**41%**

Source: West African Examinations Council (2010–2014), Research Division annual reports.

Ayodele and Adebiyi (2013) reported that research on the correlation between study habits and students' academic performance has for long received attention from scholars and educational agencies. Nuthana and Yenagi (2009) have examined the causes of poor academic performance among university undergraduates. Some of the factors identified were intellectual ability, poor study habits, achievement motivation, lack of vocational goals, low self-concept, low socio-economic status of the family, poor family structure and so on. In addition, Fibersima (2001) and Yahaya (2003) identified poor study habits as one of the major causes of poor performance in examinations. Yahaya (2003) noted that examination malpractice which is as old as examination itself and it cuts across geopolitical boundaries could be related to the desire to pass by all means without studying effectively.

Nuthan and Yengi (2009) further narrated that if a child consistently fails or performs poorly in his or her examination, he or she presumably may develop low self-concept and may lack confidence to study or pass. Ghulam (2013) reported that students' performance in schools besides other factors, depends upon study habits and study behaviour of students. The researcher opined that quality of education is reflected through motivation which is a function of study habits and study behaviour of students. The low scores recorded in the examinations may not be a true reflections of the students' abilities. Such low achievements can be linked to a number of factors such as technique of testing/assessment, test anxiety

(resulting in low self-confidence) and poor study habits among others (Kuku, 2016).Besides, Yara (2009) pointed out that poor study habits among other factors could inhibit academic potential of learners. Eweniyi (2002) in a study of the efficacy of moral/religious counselling in checking examination malpractice among secondary school students in Ogun State found that many Nigerian students have defective study habits.

In the study of academic performance of school children in relation to self-handicapping, test anxiety and study habits, Sud and Sujata (2006) reported that male had significant better study habits than girls. However, Ossai (2004) observed that gender has no significant effect of undergraduates' study habits while studying how study habits can be used as a predictor of students' attitude towards examination malpractices.

Adeyemo (2005) described study habits as being beyond reading for pleasure; he perceived it as a planned, deliberate and consistent effort made by students towards the understanding of their academic subjects that help/aid their academic achievement. Ayodele and Adebiyi (2013) perceived the term study habits to be the students' way of study whether systematic, efficient or inefficient. Going by this definition, it literally means that good study habits produce positive academic performance while inefficient study habits lead to academic failure. Study habits are measured directly through reports, examination, assessment and rating. Kuku (2016) defined study habits as a routine of timely and regular study, while Crede and Kuncel (2008) defined study habits as study routines, including frequency of studying sessions, review of material, self-testing, rehearsal of learned material and studying in an environment that is conducive to learning.

Studies have shown the existence of a relationship between study habits and academic achievement of students. Academic achievement, which is the extent to which classroom activities and learning take place, is determined based on assessment. Assessment is any procedure or activity that is designed to collect information about the knowledge, attitude, or skills of the learner or group of learners (Greaney, 2001; Mwebaza, 2010). However, when such an assessment is carried out as an on-going process, it is referred to as Continuous Assessment (CA) (Mwebaza, 2010). Kuku (2016) reported that assessment takes different forms such as formal questions given to students during class (tests), take-home assignments/exercises, projects, practicals and recapitulation exercises.

Tests are used for several purposes in the classroom, some of which are diagnosis of students' learning problems, placement in classroom, promotion to higher classes, and reporting students' progress to parents. When a test is to be used to assess students, it is expected that the students should have been informed. Besides, the students should study before the test day. However, when such tests are frequent, students' habits of studying are expected to be frequent. Thus, it is expected that frequently exposing students to testing would help them develop ideal study habits. Conversely, the frequent administration of tests might negatively affect student's retention and habits of studying mathematics as a result of not having enough time to deepen their knowledge and to understand the relationship among the range of topics covered.

Though the Federal Republic of Nigeria's (2013) National Policy on Education supports the use of continuous assessment during teaching and learning, the rate at which students should be tested in order to inculcate ideal habits of studying mathematics that will lead to satisfactory students' achievement is yet to be determined. Consequently, this study seeks to establish how tests can be efficaciously used to improve study habits and consequently lead to improved achievement in Mathematics.

Statement of the Problem

Students who have irregular study habits might find it difficult to achieve academically, which might also deny students enjoying the benefits that mathematics offers in their personal life. Regular and timely studying of mathematics concepts and exercises is expected to improve students' achievement in the subject. However, tests as a form of assessment can be employed to assist students to develop study habits. Testing frequently can help students not only to study more regularly, but also to imbibe effective study habits which may positively impact achievement in mathematics.

Hypotheses

The following hypotheses guided the study:

1. Study habits will not significantly differ among students exposed to the varying test frequencies.
2. There is no significant difference in the study habits mean scores among students exposed to the varying test frequencies due to gender.

Research Methodology

Design

The research design adopted for this study was quasi-experimental pretest-posttest control group. The quasi-experimental design was used to assess the impact of frequency of test on students' study habits using five experimental groups (four periodic testing groups and one control group).

Population

The population of the study consisted of all Public Senior Secondary School Students in Ogun State.

Sample and Sampling Procedure

The multistage sampling technique was used for this study. At the first stage, the simple random sampling method was used to select one of the four geo-political regions in Ogun State (that is, Remo, Ijebu, Yewa and Egba). Ijebu geo-political region was selected through a lucky dip. Ijebu geo-political region has six Educational Zones. Five Education Zones were selected through simple random sampling.

The next step of sampling was selecting one co-educational public secondary school from each Local Education Zone through simple random sampling. Four of the five schools selected for the study were used as the periodic testing groups while the remaining one was used as the control group. The assignment of the schools into experimental (periodic testing) groups was randomly done.

Besides, students who scored below fifty-five per cent in the SHI were deemed qualified for selection into experimental groups. The participants who qualified for inclusion in the experimental programme were randomly assigned to the experimental groups as shown in Table 2. Figures in Table 2 describe the number of students who participated in the Baseline assessment (Pre-Testing Periods) and those who actually completed the Periodic Testing Conditions in this study. From the Table, a total sample of 250 students was pre-tested on the SHI. A total of 187 students qualified and started the periodic testing conditions.

Table 2: Distribution of Students in the Baseline Assessment and Experimental Groups

SCHOOLS	***Pre-Assessment Participants***				***Experimental Participants***		
(Testing Groups)	***Male***	***Female***	***Total***	***Frequency of Testing***	***Male***	***Female***	***Total***
School A	27	31	58	Weekly Testing	16	17	33
School B	23	26	49	Two Weeks Testing	14	17	31
School C	26	22	48	Three Weeks Testing	16	15	31

School D	22	21	43	Four Weeks Testing	16	16	32
School E	23	29	52	Control (No Test)	14	16	30
Total	***121***	***129***	***250***	***Total***	***76***	***81***	***157***

However, only 157 students completed the periodic testing programme due to experimental mortality. In addition, of the participants who completed the periodic testing conditions (that is, 157 participants), 76 were male while 81 were female. The distribution of the participants across the five selected schools was as shown in Table 2.

Research Instrument

The Study Habits Inventory (SHI) was used to obtain relevant data for this study. The researcher adapted the Study Habits Inventory by Bakare (1977) to find out students' learning habits using five sub-divisions. The sub-divisions are Homework and Assignment, Time Allocation, Reading and Note Taking, Study Period Procedures/Test Preparation and Examinations/Test taking. The instrument has a reliability coefficient of 0.73 while the adapted instrument has a reliability coefficient of 0.75 using the Cronbach Alpha Reliability tool. The researcher obtained a concurrent validity coefficient of 0.76 when validated with the original instrument. The SHI consisted of sections A and B. Section A deals with the personal data of respondents while section B has five parts, which contained thirty seven statements that deal with the main sources of students' study habits problems with a focus on Mathematics. The response to each of the items contained the following options: *Almost Never, Less than Half of the Time, More than Half of the Time* and *Almost Always* which is represented with 1, 2, 3 and 4 respectively. Below are some questions from the items.

1. Do you begin your assignments as soon as the teacher gives them to you?
2. Do you spend more time reading other subjects than Mathematics?
3. Do you find it hard to pick out the important points of a Mathematics assignment?

Administration of Instruments/Data Collection

The administration of the instruments lasted11 weeks. The instruments were administered to the participants in groups by the researcher with the help of the research assistants. The details of the experiment procedure are as follows:

Procedure

The procedure was carried out in three phases.

Phase 1: Pre-Testing Periods: In the first week of resumption for the first term of the 2014/2015 academic session, a baseline assessment (or pre-test) was conducted for all the two hundred and fifty students selected across the five secondary schools. The researcher administered the pre-test using SHI. The students who scored below 55% in the SHI were selected for the study. A total of 185 students qualified and started the experiment.

Phase 2: Testing Periods: This phase lasted for 9 weeks. The five experimental groups were taught by the researcher with the same lesson plans and notes. A mathematics class was scheduled for 40 minutes per period in the mornings before the students' long break for noon or their timetable as 4 times per week in all the experimental groups. Thus, a total of 160 minutes lesson was used for teaching per week. After lessons, the students in the groups were given a 15-item multiple-choice question for 25 minutes based on weekly teaching and learning. The 15-item multiple-choice questions were given at different rates in each of the experimental groups based on the topic(s) taught within the period. The first experimental group (School A) was given the test every week for 25 minutes. The second experimental group (School B) was given the test every 2 weeks for 50 minutes. The third (School C) and fourth (School D) experimental groups were given the test every 3 weeks and 4 weeks for 75 minutes and 100 minutes respectively. The fifth group (School E) was not given any test throughout the 9 weeks of teaching and learning.

Phase 3: Post-Testing Periods. This was the 11th week of the study. In this phase, the treatment was completed and the researcher re-administered SHI to all the participants in both the experimental and control groups in order to gather post-test data.

Method of Data Analysis

Descriptive and inferential statistical tools were used. Mean and Standard Deviation were computed for all the groups where applicable. The Statistical Package for Social Sciences (SPSS) was used for the analysis. All the hypotheses were tested with Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Testing of Hypotheses

Results obtained so far

Hypothesis 1: Study habits will not significantly differ among students exposed to the varying test frequencies.

Table 3: **Descriptive data on pre-test and post-test scores of study habits among students exposed to the experimental conditions.**

SCHOOL CATEGORY	Testing Period	PRE TEST			POST TEST			Mean Difference
		N	MEAN	STD	N	MEAN	STD	
SCHOOL A	One Week Testing	33	79.94	11.43	33	101.76	8.72	21.82
SCHOOL B	Two Weeks Testing	31	79.35	9.55	31	101.16	8.17	22.81
SCHOOL C	Three Weeks Testing	31	79.77	15.44	31	102.65	12.72	22.87
SCHOOL D	Four Weeks Testing	32	78.84	11.04	32	107.47	7.32	28.63
SCHOOL E	Control Group	30	80.93	11.09	30	100.23	8.53	19.3
Grand Total / Average		**157**	**79.77**	**11.71**	**157**	**102.62**	**9.09**	**22.88**

The descriptive data presented in Table 3 indicates that the five experimental groups obtained pre-test mean scores ranging from 79.94 for School A, 79.35 for School B, 79.77 for School C, 78.84 for School D to 80.93 for School E. The table also shows that at post-test, Schools A, B, C, D and E had mean difference of 101.76, 101.16, 102.65, 107.47 and 100.23 respectively. School D (Four Weeks Testing) has the highest mean difference of 28.63 above the average Mean Difference of 22.88. To determine if these differences were statistically significant, the data was subjected to ANCOVA and the results in Table 4 were obtained.

Table 4: **Analysis of Covariance (ANCOVA) on Study Habits among the Experimental Groups**

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2171.99	5	434.40	5.51	*
Intercept	23303.19	1	23303.19	295.55	*
Covariate	1158.97	1	1158.97	14.70	*
Experimental Groups	1113.64	4	278.41	3.53	*
Error	11905.72	151	78.85		
Corrected Total	14077.71	156			

*Significant at 0.05; Fcritical at 0.05 (4, 151) = 2.37

The result in Table 4 reveals that a calculated F-value of 3.53 resulted as the difference in study habits among the varying test frequency groups. Thus, the calculated F-value is statistically significant since it is greater than the critical F-value of 2.37, given 4 and 151 degrees of freedom at 0.05 level of significance. Thus, the null hypothesis was rejected. This implies that study habits significantly differ among students exposed to the varying test frequencies. In order to determine the degree of difference in the experimental conditions in study habits,

LSD's Post Hoc Multiple Comparison was carried out and the outcome is presented in Table 5.

Table 5: **Multiple Comparison of Study Habits among the Experimental Groups**

(I) Experimental Groups	(J) Experimental Groups	Mean Difference (I-J)	Sig.
SCHOOL D	SCHOOL A	5.966*	0.008
	SCHOOL B	6.426*	0.005
	SCHOOL C	5.040*	0.026
	SCHOOL E	7.722*	0.001

*. The mean difference is significant at the 0.05 level.

Table 5 shows that participants in School Dhad significant mean difference when paired with Schools A (Mean Diff. = 5.966, ρ= 0.008), B (Mean Diff. = 6.426, ρ= 0.005), C (Mean Diff. = 5.04, ρ= 0.026) and E (Mean Diff. = 7.722, ρ= 0.001). As a result, it was evident that participants in School D (four weeks testing) spent most time studying when compared with other participants in their respective groups.

Hypothesis 2: There is no significant difference in the study habits mean scores among students exposed to the varying test frequencies due to gender.

Table 6: **Descriptive Data on effect of Gender and Experimental Conditions on Study Habits among participants with reference to Gender**

SCHOOL	GENDER	N	PRE TEST		POST TEST		MEAN
			MEAN	STD	MEAN	STD	DIFFERENCE
SCHOOL A (Weekly Test)	MALE	16	80.50	12.27	101.19	9.22	19.69
	FEMALE	17	79.41	10.93	103.24	8.22	23.82
	TOTAL	**33**	**79.94**	**11.43**	**101.76**	**8.72**	**21.82**
SCHOOL B (Two Weeks Test)	MALE	14	84.07	9.83	104.86	8.47	20.79
	FEMALE	17	75.47	7.55	98.12	6.71	22.65
	TOTAL	**31**	**79.35**	**9.55**	**101.16**	**8.17**	**21.81**
SCHOOL C (Three Weeks Test)	MALE	16	80.38	15.51	104.88	11.74	24.50
	FEMALE	15	79.13	15.88	100.27	13.70	21.13
	TOTAL	**31**	**79.77**	**15.44**	**102.65**	**12.72**	**22.87**
SCHOOL D (Four Weeks Test)	MALE	16	78.56	9.70	107.13	6.56	28.56
	FEMALE	16	79.13	12.55	107.81	8.22	24.69
	TOTAL	**32**	**78.84**	**11.4**	**107.47**	**7.32**	**28.63**
SCHOOL E (Control Group)	MALE	14	79.21	8.95	99.57	9.66	20.36
	FEMALE	16	82.44	12.78	100.81	7.69	18.38
	TOTAL	**30**	**80.93**	**11.09**	**100.23**	**8.53**	**19.30**
Grand Total / Average	**MALE**	**76**	**80.54**	**11.25**	**103.32**	**9.13**	**22.78**
	FEMALE	**81**	**79.12**	**11.94**	**102.05**	**8.91**	**22.93**
	TOTAL	**157**	**79.77**	**11.71**	**102.65**	**9.09**	**22.88**

Evidence from Table 6 shows that the pre-test study habits mean scores for male students were 80.50 for School A, 84.07 for School B, 80.38 for School C, 78.56 for School D while School E scored 79.21. Likewise, the pre-test mean score value of study habits for female students were from 79.41 for School A, 75.47 for School B, 79.13 for School C, 79.13 for School D and 82.44 for School E.

Also, the post-test male participants in Schools A, B, C, D and E had mean scores of 101.19, 104.86, 104.88, 107.13 and 99.57 respectively. Their female counterpart in Schools A, B, C, D and E had mean scores of 103.24, 98.12, 100.27, 107.81 and 100.81 respectively.

The Table further indicates that the male (28.56) and female (24.69) students in School D (with four weeks testing) had the highest study habits mean difference above the average Mean Difference of 22.78 and 22.93 respectively. To determine whether a significant difference existed on study habits due to gender and experimental conditions, analysis of covariance (ANCOVA) statistics was used. The result is presented in Table 7.

***Table 7*: Analysis of Covariance on the effect of Gender and Experimental Conditions on Study Habit.**

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2588.47	10	258.85	3.29	*
Intercept	23269.55	1	23269.55	295.70	*
Covariate	970.48	1	970.48	12.33	*
Experimental Groups	1091.53	4	272.88	3.47	*
Gender	36.27	1	36.27	0.46	ns
Experimental Groups / Gender	385.96	4	96.49	1.23	ns
Error	11489.24	146	78.69		
Corrected Total	14077.71	156			

*Significant at 0.05; ns = Not Significant; Fcritical at 0.05 (4, 146) = 2.37

Evidence from Table 7 shows that a calculated F-value of 1.226was obtained as a result of the interaction effect between the experimental groups and gender. This calculated F-valueis not significant since it is less than the critical F-value of 2.37 given 4 and 146 degree of freedom at 0.05 level of significance. Hence, null hypothesis six was accepted and it implied that there was significant difference in the study habits mean scores among students exposed to the varying test frequencies due to gender.

Discussion of Findings

Hypothesis 1 states that study habits will not significantly differ among students exposed to the varying test frequencies. The findings revealed that there was significant difference in the mean scores on study habits among students exposed to the varying test frequencies. The more the testing frequency, students were more flexible in adjusting to an effective study habits. The students tested more often developed effective study habits than their counterparts tested less often. Besides, students tested less often were observed to spend more time but were less effective in their studies for improved achievement in mathematics. The findings align with the findings of De Paola and Scoppa (2010) who observed that students tested frequently had the probability of passing examinations during their study of frequency of examinations and student achievement in randomized experiment conducted on undergraduate students that enrolled at an Italian university. Sadia (2005) and Abid (2006) noted that effective study habits helps students to achieve satisfactory academic achievement among secondary school students. However, the finding negates the study of Fakeye and Amao (2013) who observed no significant relationship between study habits and students' achievement in Literature-in-English. Also, it negates the work of Zgraggen (2009) that students tested less frequently adjusted to school and their testing method better than the students tested more frequently in mathematics class in Switzerland.

Hypothesis 2 states that there is no significant difference in the study habits mean scores among students exposed to the varying test frequencies due to gender. The result showed that there exists no significant difference in the study habits mean scores among students exposed to the varying test frequencies due to gender. The finding aligns with Ossai (2004) when studying the how study habits of students can be used to predict their attitude towards examination malpractices. The researcher reported that gender has been found not to influence the determinants of undergraduates' study habits. Sud and Sujata's (2006) observation is in contrast with this finding, the researchers noted that boys had significant better study habits than girls. Also, Khurshid, Tanveer and Qasmi (2012) while studying the relationship between study habits and academic achievement among hostel living and day scholars' university students noted that female university students possess more effective study habits and higher academic achievement than male university students.

Conclusion and Recommendations

Frequent Testing yielded significant impact on students' study habits across the experimental groups. School A (weekly test) was most efficient in study habits. The influence of gender was not significant on the students' study habits in the experimental conditions. It was recommended that frequency of testing (particularly at weekly interval) should be adopted by school mathematics teachers in order to assist students effectively manage their workload and imbibe better study habits. In addition, gender should be neglected when frequency of testing is to be used in improving students' study habits in mathematics.

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