

**SENIOR SCHOOL STUDENTS' PREFERENCE OF TEST FORMAT AND
THEIR ACADEMIC PERFORMANCE IN MATHEMATICS**

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Abstract

The poor performance of students in mathematics at both internal and external examinations have been traced to a host of factors which are related to teachers, parents and students. But does the format in which these examinations are prepared contributes to the students' poor performance? Then, it is imperative to examine students' preferred test format and their academic performance in mathematics. The objectives of this study are to determine students preferred test format; the likely reasons for their choice of test format; influence of gender and subject combination on their choice of test format; and compare their academic performance in mathematics based on test format preference. Three hundred (300) senior school students were randomly sampled to participate in this study. The instruments for data collection were researchers' designed questionnaire and a performance test. The instruments were validated and reliability indices of 0.87 and 0.76 were obtained using test-retest method. Frequency, simple percentage, chi-square and t-test were used for analyzing and testing the hypotheses. The result of the study indicated that senior school students prefer multiple choice tests for mathematics examination; the reason for their preference was largely based on their belief that multiple choice tests are easy to pass; there is significant difference in the choice of test format based on gender and subject combination; and there is no significant difference in the performance of students based on their test format preference. The study recommends among others that teachers should use suitable test format for assessing the students. Also, since the competence in mathematics can be demonstrated through conceptual and procedural knowledge, mathematics teachers should continuously assess students so that they can demonstrate in-depth knowledge of problem solving rather than just selecting from alternatives.

Keywords: Test format, multiple choice, essay, assessment

Introduction

Evaluation is a crucial phase in the learning cycle because it reflects the degree to which the objectives of curricula and other programs are achieved (Udoh, 2016). According to Abimbola (2009), teaching-learning process involves three phases namely; planning phase, implementation phase and the evaluation phase. He stated further that evaluation phase is the most important phase because at this phase, instructor makes judgement of the teaching and learning exercise. Therefore, the teaching-learning process is not complete until students are assessed. Students' knowledge and skills are evaluated through test (examination). A standard examination assesses both students' knowledge and their ability to transfer acquired knowledge to solve problems (Pronto, 2012).

Testing is the process of measuring learners' knowledge to determine what they know or have learned. According to Abiri (2015), test is defined as a task, treatment or situation which intend to obtain the behaviour of persons in order to ascertain specific abilities or attributes of those persons. Azwar (2005) defined a test as a systematic procedure for observing a person's behaviour and describing it with the aid of a numerical scale or category system. In an educational setting, a test instrument proffer a sequence of task to which students are to respond and the results are used as measures for specified traits. This means a test is an instrument of evaluation which shows how successful teaching and learning is. However, assessment which can either be a process or product, subsumes testing.

Test is one of the powerful tools of measuring students' abilities as well as enhance their attitudes towards learning. Brown (2004) stated that a test often measures a person's skill, ability, knowledge, or performance in a given domain. Furthermore, according to Thawabieh (2016), the four main methodological challenges of testing in schools are what to test i.e. content to be assessed; how to test i.e., format of items or questions; conditions to implement the test i.e., when to test - formative or summative, time allocation e.t.c; and judging and interpreting the outcomes of the test. This article however focuses on students' preference for testing mathematical competence. In addition to the mentioned factors, many studies indicated that students' attitudes and perceptions toward the different test format should be taken into account while examining them. (Oosterhof, 2001;Tozoglu, Gurses & Dogar 2004). Depending on the previous factors and the experience of the teacher, his skills, and his believes, the teacher selects appropriate test to be used.

Items differ in their degree of the freedom given to the students to express themselves on the skills and knowledge they acquired (Allam, 2008). Test format must be suitable to the learning outcomes, students' age, and appropriate to the assessment objectives. So test constructors must choose the best test format to assess students' performance (Allam, 2008; Alzude & Alaan, 2005). Phipps and Brackbill (2009) indicated that assessment items should correspond with the content and learning objectives of the lesson.

There are two major test formats that are commonly used in testing secondary school students in Nigeria: multiple choice and essay format (Oosterhof, 2001; Tozoglu, Gurses & Dogar, 2004). Multiple choice consists of the problems and set of alternative response options (Abiri, 2015). The options are between four and five, although four options are the most common. It should be noted that the more the number of options in a multiple choice question, the less the influence of mere guessing. From the set of alternative options, only one of the options is correct while the others are distracters. These distracters sound like possible answer so that only those who know what is being asked would be able to pick out the correct option (Abiri, 2015). Multiple choice items have both its strengths and weaknesses. Part of the strengths is its characteristics of objectivity and high reliability (Chan & Kennedy, 2002). The answers to multiple choice questions are easy to correct, especially for a large group of students (Kuechler &

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Simkin, 2004; Bible, Simkin & Kuechler, 2008). The test writer can measure variety of skills and learning outcomes, they are scored easily, rapidly, accurately and objectively by teachers, the use of scoring machines or computers, and ease of administration. An additional advantage is the possibility to cover almost the complete content of a course, because more questions can be asked (Chan & Kennedy, 2002; Kuechler & Simkin, 2004; Bible, Simkin & Kuechler 2008). Although they may have items which have the following shortcomings: high guessing ratio, easy to cheat, and it needs professional test writer, especially writing effective alternatives. However, tests may also award partial credit for unanswered questions or penalize students for incorrect answers, to discourage guessing.

In contrast, essay tests allow students to communicate their ideas freely by writing. It has no restriction to list of choices and students can express themselves in their own language (Tozoglu, 2004). On the other hand, it is difficult to cover the objectives of the course through this format of testing, the scoring process could be subjective and difficult, it is not easy to computerize such format of examination especially in terms of the scoring process and in addition there is a bluffing problem (Nassar, Qaraeen & Abu Naba'h, 2011). Essay questions are wonderful way to test higher-level learning, but they require careful construction to maximize their assessment effectiveness (Champlin, 2006). While essay questions can assess all the cognitive domains, most educators suggest that due to the time required to answer them, essay questions should not be used if the same material can be assessed through a multiple-choice item.

Furthermore, in relation to assessment in mathematics, Rittle-Johnson (2012) affirmed that the ultimate reason for assessing mathematical competence is to inform teachers of students' conceptual understanding so as to guide future teaching and learning. Mathematics competence can be demonstrated by both conceptual and procedural knowledge. Rather than assessing the curriculum goals only, competence in mathematical knowledge reflects critical thinking, mathematical workings, content knowledge and skills and effective communication of mathematical ideas and findings. Mathematical concepts and symbols are used in expressing the physical laws of nature (Tsue & Anyor, 2006). Again, mathematical concepts and procedures provide scientists with insight about natural phenomenon. Since mathematics normally deals with calculations and relations, questions in mathematics testing often comes in form of problem solving, proofing, which sometime require special formulae to be able to solve. Therefore, for this study, only multiple choice and essay test format are considered since these two are the most widely used and most suitable for the nature of senior secondary school mathematics.

The importance of mathematical knowledge to individual and national development cannot be overemphasised. Despite the importance, Nigeria students' performance in mathematics has not been satisfactory. This claim has been supported by several researchers and the chief Examiner's report. The poor performance of students at both internal and external examinations in mathematics have been traced to a host of factors. Some of these factors are teacher, parent and student related factors (Huitt, 2007;

Ajayi, 2006). Adesoji and Olatunbosun, (2008) in their study also established that school environment and teacher-related factors contributed to the students' poor performance. Aside from the aforementioned factors, does the format in which these examinations are presented to the students influence their performance? Then, it is necessary to investigate the test format that is preferred by students and its possible relationship with their performance.

Students' preference regarding the different formats of test can be considered very essential factor in terms of getting valid and reliable evaluation (Oosterhof, 2001). Students vary in terms of their test preferences in various examination since every individual has their own choices which may differ from one another in line with the theory of individual differences. In this sense, preference is a choice of one thing over the other. Gijbels, Dochy and Van-der (2008) defined assessment preference as imagined choice between alternatives in assessment and the possibility of the ranking these alternatives. The valid evaluation of students' achievement which reflects the outcomes of teaching and learning processes cannot be achieved without taking into account students' needs, students' perspectives, and their attitudes toward the different methods of evaluation (Nassar, 2004). Method of evaluation, in this regards means different formats of test since the primary objective of any test given to students is to assess the students' performance which will serve as a feed back to the teacher on the effectiveness of learning so that the judgement would be placed on their performance. Moreover, students' perceptions toward the different types of evaluation should be taken into account (Oosterhof, 2001; Tozoglu, Gurses & Dogar, 2004).

Essay and multiple-choice test exams are the most popular item formats used in educational testing for secondary school level testing (Oosterhof, 2001; Tozoglu, Gurses & Dogar, 2004). Each of which required from the examinee to have some specific skills in order to get high scores (Nassar, 2006). Some students might be able to perform well in one than the other. Hence, students' preference of format of test could differ according to their expectations about their performance on that examination. Although students sometimes report that multiple-choice exams are easier than essay exams, they in some situations could consider multiple-choice format more difficult than essay format (Holtzman, 2008).

Several studies have been carried out on students' test format preference, some of the studies carried out investigated only students' test format preference, while others investigated why students prefer one test format to the other and their attitude? Nassar, Qaraeen, and Abu Naba'h (2011) did study on students' test type preference of essay and multiple-choice examinations. This study was carried out by involving samples from Jordanian secondary school students. They found out that students preferred multiple-choice exam to essay exam. Also, in their study, Tozoglu, Gurses, and Dogar (2004), examines students' perceptions toward essay versus multiple-choice exams. Overall student rating data revealed that students showed significantly more favourable attitudes toward multiple choice test format compared to essay formats in terms of the most critical

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dimensions assessed: difficulty, complexity, clarity, interest, trickiness, fairness, value, success expectancy, degree of anxiety evoked, and feeling at ease.

Furthermore, in a study of Agbuya (2017), students' preferences arranged from most preferred to least preferred are multiple choice, binary choice (true or false), short answer, matching type, enumeration, essay, definition, performance or practical, oral, and problem solving. Their study revealed that students' most preferred test format was multiple choice. Nasser (2005) also reported that students preferred multiple choice to essay. Although, the learning domain of each of these studies differs and it is possible that the students' preferred test format in one subject may differ in another subject since nature and contents of individual subject also differ. Moreover, students' performance based on their test preference, subject combination and gender were not investigated. Therefore, the main purpose of this study was to determine students' preference of test format and their academic performance in mathematics. Specifically, the study investigated:

1. Students' preference of test format for mathematics examinations
2. The likely reasons for students' choice of test format
3. The difference in students' choice of test format based on their subject combination
4. The difference in students' choice of test format based on their gender
5. The difference between students' academic performance in mathematics based on students test format preference.

Method

This study adopts descriptive research design of survey type. The population for this study consists of all senior secondary school students in Ilorin. The sample for this study consisted of 105 senior school II and 195 senior school III students, making a total of 300 students. Also, 103 of the respondents are male while females are 197. Based on subject combination, 157 of the respondents are in science class, 73 in art class, and 70 are in commercial class. The samples were randomly drawn from six selected schools in Ilorin. Only SS II and III classes were chosen because students in the two classes are expected to have had experience on solving quadratic equation which the researchers' use as a basis to judge their performance in mathematics. The sampling technique for this research was a random sampling.

Two instruments were used for this research, they are: (1) researcher's developed questionnaire on students test format preference and (2) performance test having ten multiple choice and 4 essay questions. Students' score on each of the test format was recorded separately. The questionnaire was grouped into sections namely: Sections A, B, and C. Section A elicited information on respondents' bio-data, Section B contained information on test format preference, while C elicited information on the reasons for their choice of test format. To ascertain the face and content validity of these instruments, the researchers gave a copy of the instruments (the questionnaire & performance test) to two education professors and two senior school mathematics teachers. Their suggestions were incorporated into the instrument.

To ascertain the reliability of the instruments, the researchers adopted a test re-test method, where the instruments were administered to twenty (20) respondents from non-participating school within an interval of two weeks. The result of the first administration was correlated with the result of the second administration using Pearson product moment correlation statistical analysis. Reliability coefficients of 0.87 and 0.76 were obtained at 0.05 level of significance. This indicates that both the questionnaire and performance test are reliable.

After the consent of the students were sought, the researchers collected the data by firstly administering the questionnaire to the students. Each of the item of the paper-based questionnaire was explained to the students and they are requested to ask questions when necessary. All these are done in the presence of their mathematics teachers. After they have completed filling the questionnaire, the performance test was given to them to complete in 30minutes. The information provided by the student were treated with utmost confidentiality and for research purposes alone.

The quadratic equation test was scored and the data emanating from this study were collated, coded and subjected to appropriate statistical analysis. The data was analysed using Statistical Package for Social Science (SPSS) version 25. Students' demographic and test format preference information were analysed using descriptive statistics of frequency counts and percentage, students test preference based on gender and subject combination were analysed using chi-square. Students' academic performance was tested using *t*-test statistic.

Results

Research question 1: What test format do secondary school students prefer?

Table 1: Frequency and Percentage distribution of students' test format preference.

Test format	Frequency	Percentage (%)
Essay	101	33.7
Multiple choice	199	66.3
Total	300	100

Table 1 shows that out of 300 respondents involved in this study, only 101 representing 33.7% prefer essay format while 199 representing 66.3% of the students prefer their mathematics examinations to be in multiple choice format. This implies that more students prefer to be assessed by multiple choice questions than essay questioning format.

Research question 2: what are the likely reasons for the choice of the test format?

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Table 2: Students' reasons for preferring essay question format for mathematics examinations.

Supplied responses	Frequency	Percentage (%)
It helps me to express myself.	43	42.5
More time is given to solve essay question.	25	24.8
The solution steps earn me more mark even if the answer is wrong	33	32.7
Total	101	100

Responses for this research question were collected in an open response format. Students' similar responses were grouped and coded. The frequencies of the likely reasons for the choice of test format were shown in Table 2. Out of 101 students who preferred essay question format, 43 preferred essay question format for mathematics examination because it allows them to express themselves while 33 claimed the solution steps of solving mathematics allow them to earn more mark even if the final answer is not correct. The last 25 students preferred essay question format because of the lengthy time allocation.

Table 3: Students' reasons for preferring multiple choice format for mathematics examination.

Supplied responses	Frequency	Percentage (%)
It is easy to pass	161	80.9%
It can be completed within short time	10	5%
It allows guessing and I don't read too much to pass	28	14.1%
Total	199	100

Against the reasons for essay question format, Table 4 shows the frequency of likely reasons stated by students for their preference of multiple-choice format. As shown in Table 3, 80.9% of the students preferred multiple choice because they claim that it is easy to pass. While 14.1% prefer multiple choice question format due to its guessing nature, only 5% prefer it because of the short time given to complete such questions.

Hypothesis 1: - There is no significant difference in the students' choice of test format based on their subject combination.

Table 4: Chi-Square tests of significance difference in the students' choice of test format based on their subject combination.

Subject combination	Test format			df	Chi-square value	p-value (2-sided)
	Essay	Multiple-choice	Total			
Science	57	100	157	2	9.99	0.007
Art	14	59	73			
Commercial	30	40	70			
Total	101	199	300			

$P(0.007) < 0.05$

From Table 4, out of 300 respondents who participated in the study, 157 are science students, 73 are art students and 70 are commercial students. Table 4 also shows that 57 of the science students, 14 of the art students and 30 of the commercial students preferred essay question format while 100 of the science students, 59 of the art students and 40 of the commercial students preferred multiple choice questions for mathematics examinations. Although, the percentages of students' preferences for essay and multiple-choice test format differs, but generally, more students irrespective of their subject combination prefers to be assessed by multiple choice questions than essay format of questioning.

Table 4 also shows the chi-square value of 9.999 with a calculated significance value of 0.007 which is less than 0.05 alpha value of significance, that is $p(0.007) < 0.05$, therefore the stated hypothesis that there is no significant difference in the choice of test format by students based on their subject combination is thereby rejected. Hence, there is significant difference in the students' choice of test format based on subject combination.

Hypothesis 2: - There is no significant difference in the students' choice of test format based on their gender.

Table 5: Chi-Square test of significance difference in the students' choice of test format based on gender.

Subject combination	Test format			Df	Chi-square value	p-value (2-sided)
	Essay	Multiple-choice	Total			
Male	51	52	103	1	17.64	0.00
Female	50	147	197			
Total	101	199	300			

$p(0.00) < 0.05$

In Table 5, out of 300 respondents who participated in the study, 34.3% are males, and 65.7% are females. In relation to test question format, 51 out of 103 of the males and 50

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out of 197 of the females preferred essay questions format. Also, 52 male students and 147 female students preferred multiple choice. From the results, the number of male students who prefer essay question format and multiple-choice format are relatively equal. However, more females prefer the multiple-choice format than the essay format for mathematics examinations. Hence, there is difference in students test format based on gender. The findings from the analysis in the Table 5 indicated calculated chi-square value of 17.640 and the p -value of 0.00 with the degree of freedom of 1 at 0.05 alpha level of significance. Since p (0.00) < 0.05 level of significance, the null hypothesis stated above is thereby rejected. This implies that the difference in the students' choice of test format based on their gender is significant.

Hypothesis 3: - There is no significant difference in the students' performance based on their test format preference.

Table 6: Paired sample t -test analysis of students' performance in mathematics based on their test format preference.

Group	N	Mean	SD	Df	t -value	p -value
Essay	101	62.88	5.18	288	17.34	0.24
Multiple choice	199	68.20	6.44			

The result from Table 6 shows that the mean score of students based on their test format preference. Students who prefer multiple choice have a mean score of 68.20 while those who preferred essay type questions have 62.88. This means students who prefer multiple choice performed higher than those whose preference is essay format. Also, there is no significant difference in the performance of students based on their choice of test format, $t_{(288)} = 17.34$, $p > 0.05$, since the p -value is greater than the level of significance, 0.05, the hypothesis which states that there is no significant difference in the academic performance of students based on their choice of test format is not rejected. Therefore, there seems to be no significant difference in the academic performance of students in mathematics based on their preferred test format.

Summary of Findings

The following are summary of the findings

1. Out of 300 students who participated in this study, 66.3% preferred multiple choice while 33.7% preferred essay.
2. More secondary school students (80.9%) prefer multiple choice because they believe that it is easy to pass while some students prefer essay test because it allows self-expression.

3. There is a significant difference in the choice of test format by the students based on their combination i.e., more art students prefer multiple choice while more commercial students prefer essay test.
4. There is a significant difference in the choice of test format based on their subject gender i.e., more females than male prefer multiple choice questions.
5. There is no significant difference in the performance of students based on their test format preference.

Discussion of findings

This study investigated secondary school students' preference of test format in mathematics. The result of the finding showed that more students prefer multiple choice over essay test format. Their choice of multiple choice was largely based on the believe that multiple choice tests are easy to pass. This implies that students do not want to be involved in intense reading and studying before they pass. The result is in line with Agbuya (2017) who found out that their students reported more positive attitudes towards multiple choice. It was also reported that student preferred multiple choice tests because this test format seemed easier to take, and may produce higher scores (Nassar, Qaraeen, & Abu Naba'h, 2005; Tozoglu, Tozoglu, Gurses, & Dogar, 2004).

Furthermore, there is significant difference in the students' choice of test format based on subject combination and gender. For students' gender, there is equitable preference for multiple choice and essay format among male students. But in the contrary, more female students prefers multiple choice than essay test format for mathematics examination. Hence, there is significant difference in the preference of test format by male and female students. The implies that, female students are not likely to be involved in the demonstration of rigorous mathematical knowledge and may quit learning mathematics when they are allowed to do so – at higher studies. This result is contrary to the finding of Nassar, Qaraeen and Abu Naba'ah (2011) who reported no influence of gender on Jordanian secondary school student choice of test format. In relation to subject combination, more than half of science, art and commercial students prefer multiple choice to essay test format, the differences in their preferences are still significant.

Lastly, there was no significant difference in students' academic performance based on their test format preference. This result is in line with the findings of Gijbels, Dochy and Van-der (2008) who reported that no significant difference was found between students' perceptions of assessment and their assessment score. But the finding is in contrary with that of Thawabieh (2017) who found a relationship between students' performance and their preferred test format. The results of his study showed that students' performance was not affected by test format. It implies that both test format can assess students' mathematical knowledge and students preferring a test format does not necessarily mean that they are not good at the other.

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Conclusion

This study provides empirical evidence of students' preferred test format. From this study, students most preferred test format in mathematics is multiple choice because it is easy to pass, allows guessing and less time allocation for the administration. Students' gender and subject combination influence their test format preference. Also, students' performance is not influenced by their choice of test format. Rather than using quadratic equation as the content scope to justify students' performance in mathematics, further studies could assess students' mathematical knowledge from varying content.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Mathematics teachers should use test format that is suitable for achieving learning outcomes to assess the students.
2. More female students should be encouraged to participate in rigorous mathematical task so that they will be willing to demonstrate their problem-solving skills.
3. Since the competence in mathematics can be demonstrated by conceptual and procedural knowledge, mathematics teachers should continuously assess students so that they can gain in-depth knowledge of problem solving rather than just selecting from alternatives
4. In order to make multiple choice test rigorous, students should be asked to provide reasons for their choice of answers, this will reduce its feature of guessing.

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