

EFFECT OF TEST ITEM ARRANGEMENT ON PERFORMANCE IN MATHEMATICS AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN OBIO/AKPOR LOCAL GOVERNMENT AREA OF RIVERS STATE NIGERIA.

Dr. Opara Ijeoma Margaret, Uwah Idongesit Victor

Department of Educational Psychology, Guidance and Counselling, University of Port Harcourt, Rivers State. Nigeria.

ABSTRACT: *The study investigated the effect of test item arrangement on performance in Mathematics among Junior Secondary School Students in Obio-Akpor L.G.A of Rivers State. The study adopted the quasi-experimental research design. A sample of one hundred (100) Junior Secondary School Students drawn from the population using the simple random and non-proportionate sampling techniques was used for data collection. The sample included three experimental group labelled 'A-C' and the control group labelled "D" This was selected from a population of 6,777 JS II students from four public schools in the area. A test instrument tagged the "Mathematics Performance Test" which had four types A-D was used. Type A was arranged in ascending order of difficulty. Type B was arranged in descending order of difficulty while type C was arranged based on order of topic presentation in the class. On the other hand, type D was arranged in no particular order. Validity of the instruments was determined using table of specification (TOS) while a general reliability index of 0.96 was determined using Kuder Richardson formular 20 (KR₂₀). Mean, standard deviation as well as t-test analysis were used to compare the mean of each of the group against the control group and test. The findings of the study were that item arrangement based on ascending order of difficulty has a positive and significant effect on students' performance in mathematics at 0.05 alpha level respectively while item arrangement based on descending order has a positive but insignificant effect on student' performance in mathematics. Finally, item arrangement based on no particular order of difficulty has a positive and significant effect on students' performance. It was recommended among others that classroom teachers, test constructors and professional examination bodies should endeavour to arrange items from simple to complex in order to boost students' morale.*

KEYWORDS: Test item arrangement, ascending and descending order of difficulty, order of topic presentation, Academic Performance

INTRODUCTION

Performance in its general sense implies how good or bad an individual does something or how well something works compared to its targeted goal. In the educational system, performance has to do with the degree of effort an individual, students, institutions of learning as well as all other stakeholders in the educational sector put towards achieving the goals of education. Academic performance in particular, relates to the degree of effort students put towards achieving their educational goals. According to Lassiter cited in Obinna (2009), students' academic performance is the outcome of education. It is the extent to which a student has achieved educational goals. From personal observations of the researchers, it is apparent that individual's academic performance is relative to a number of factors which could be the subject

area itself, family background, economic status and many other factors including even biological phenomenon.

Mathematics as a core subject in the curriculum over the years has been a problem for most students (Obinna, 2009). A recent report by the Joint Admission and Matriculation Board (JAMB) states that only 18% of candidates registering for the UTME examinations make a pass mark in mathematics on their first sitting. This remark however is very alarming and calls for rapid attention if Nigeria as a country is to compete with the Western world. Students' academic performance in mathematics as in other subjects may be influenced by a lot of factors which may not allow one to have a judicious knowledge of their real performance. It is also evidenced that students' performance in mathematics can be measured using tests or examinations.

Test as noted by Opara (2014) is an instrument or procedures which is designed to measure the knowledge, intelligence, ability, traits, skills, aptitude, interest, attitude which an individual or thing exhibits. It is a systematic procedure for observing an individual's behaviour as well as describing such behaviour or performance by numerical scale or category. As noted earlier, it is also observed by the researchers that majority of students find it difficult to pass mathematics test effectively. This implies that many students have develop test phobia for the subject and as such attach negative attitude toward the subject which at times are extended toward the teachers handling them. In the words of Hopkins and Antes cited in Orluwene (2012) a test instrument is a procedure that proposes a sequence of task to which students are to respond and the results are used as measures of specified traits. This sequence of task can come in various forms which is referred to as test item arrangement. Test item arrangement involves the various format through which test comes. It has to do with the way the classroom teachers, professional test constructors and examination bodies arrange their test items. As Baxter (1998) noted, test item arrangement plays a vital role in determining the performance of students in examinations. It could be that while some students may find it difficult in guessing answers in multi-choice item for instance, others on the other hand may find it easier while some may totally prefer essay questions. Test item format differs depending on the examiner and the purpose for which the test is conducted. It include multiple-choice, essay type, supply answer type etc. In all these, the various item arrangement formats in which they are presented could as well play a vital role in determining students' responses.

Test item arrangement based on ascending order of difficulty implies arranging test items from simple to complex. Here, students are presented with simple questions first and progressively, less simple (difficult) item are presented. As Tei-Firstman (2008) noted, presenting students with simple question first will help sustain their interest and zeal towards approaching more questions. On the other hand, it could also be that test item arrangement based on descending order of difficulty (i.e arranging test items from complex to simple) may also have impacts on the performance of the students.

Furthermore, students also may seem to remember things based on the order in which they are taught in the class. Hence, it could be that test item arrangement based on order of topic presentation in the class (The way and order in which the topics were introduced to them in the class) may affects their performance. While some psychologists have argued that students remember first things first, others have opined that they remember last things first. This however in the opinion of the researchers may also affect students' performance in mathematics.

Many test experts and classroom teachers in a bid to control for examination malpractices have introduced test items variations in the same test for the individual students. This implies that what student “A” has as number one question is not what student “B” has. This has however created variations in the numbers and in the opinion of the researchers. This item arrangement format could have a serious effect on the performance of students.

Nevertheless, there has been an outcry about students’ poor performance in mathematics which according to Shuabu (1999) could be traced to improper evaluation of students using both valid and reliable instruments arranged in a feasible and realistic manner. This problem however may be due to the limitations if not an oversight of the skills of teachers in constructing a good test instrument.

As Kpolovie (2012) noted not until a test is able to reflect the true attribute, characteristics and abilities of a student, then such a test is invalid. Unfortunately, with all the benefit of testing by revealing students capabilities many students have independently branded themselves as not science oriented and incapable of undertaking mathematical related courses. Some who offer mathematical related courses have failed out of school, some have dropped, some have change their school, some have constantly change their mathematics teachers, some have lost confidence in themselves of being capable of solving any mathematics problem. Nevertheless, it has been evidenced that despite the effort of teachers, parents, guidance counsellors as well as government in improving students’ performance in mathematics through extra moral classes, the reality of the situation is that students generally do not perform well in mathematics as evidenced in both internal and external examinations. Obviously, most students’ performance in various mathematical related areas has now called for serious concern. One of the Millennium Development Goals is to achieve basic education. Nigeria also has a goal of meeting up the educational system compared to that of Canada and the United Kingdom. It also aims at improving science and technology to compete at international level. Amidst all these fantastic dreams, the truth remains that Nigeria as a whole cannot and will not talk of competing internationally if performance in Mathematical related courses and mathematics itself are not improved. In the area of science and technology, one cannot talk about an improvement if students’ performance in mathematics is not improved. Particularly, there is a concern in the performance of students in school certificate examinations, which to a great extent determine selection and placement of students into various field and courses in tertiary institutions. With these poor performances, one can out rightly sense the danger in the admission process. Many students who would probably perform better in their aspired courses have been dropped due to their poor performance. Recently, it was stated by the director of the Nigerian Universities Commission (NUC) that due to the cancellation of the Post – UTME by the Federal Government, Universities should consider students’ performance in O’ Level result at first sitting. This implies that only students who pass their mathematics and other related subjects in first sitting have a better chance of being admitted. This however has left one to lament on the fate of students who by error of omission or commission could not make it in their first sitting. Such problem however is a looming danger which inadequate performance in mathematics holds for both the individual students and the entire educational system. In the light of the above the problem is, “can test item arrangement in mathematics affects students’ performance in secondary schools in Obio-Akpor Local Government Area? In line with the study problem, the study aims at determining the effect of test item arrangement on performance in mathematics among junior secondary school students in Obio-Akpor Local Government Area of Rivers State.

The following research questions were formulated to guide the researchers in the course of the study;

- (1) What effect does test item arrangement based on ascending order of difficulty have on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A?
- (2) What effect does test item arrangement based on descending order of difficulty have on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A?
- (3) What effect does test item arrangement based on order of topic presentation has on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A of Rivers State?

The following null hypotheses tested at 0.05 alpha level were also postulated to guide the study.

- (1) Test item arrangement based on ascending order of difficulty has no significant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A of Rivers State.
- (2) Test item arrangement based on descending order of difficulty has no significant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A of Rivers State.
- (3) Test item arrangement based on order of topic presentation: has no significant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A of Rivers State.

METHOD

The study adopted the quasi-experimental research design. A sample of one hundred (100) junior secondary school students (JSSII) was drawn from the population of six thousand, seven hundred and seventy seven (6,777) from five upper UBE schools using simple random and non-proportionate sampling techniques. The Mathematic Performance Test (MPT) was used as instrument for data collection. This is a test instrument which has four types (Type A-D). Type A of MPT contains 40 items arranged in ascending order of difficulty, Type B equally contained 40 items arranged in descending order of difficulty. Type C was arranged in order of topic presentation while type D was arranged in no particular order. Content validity of the instrument (MPT) was determined using table of specification (TOS). Equally the reliability of the instrument was determined using Kuder Richardson formular 20(KR₂₀). The reliability coefficient obtained was 0.96. The four types of instrument were administered on separate basis to four different groups of students from four schools. Type A was administered to 25 students in the first school likewise Type B and C. Type D was administered to the control group. In other words, the test instrument was administered to three experimental groups and one control group through the help of a research assistant and the classroom teachers. Mean and standard deviation were used to answer the research questions while the t-test was used to test their corresponding null hypotheses.

RESULT

Research Question One: What effect does test item arrangement based on ascending order of difficulty has on performance in mathematics among junior secondary school students in Obio-Akpor?

Hypothesis One: Test item arrangement based on ascending order of difficulty has no significant effect on performance in mathematics among junior secondary school students in Obio-Akpor.

In order to answer the research question, mean statistics was used while t-test of independent mean was used to test the hypothesis at 0.05 alpha level.

Table 1: Mean, standard deviation and t-test analysis of the effect of item arrangement based on ascending order of difficulty on students' performance in Mathematics.

Groups	N	\bar{X}	S.D	d.f	t-cal	t-crit	Sig.	Alpha	Result
Ascending order	25	28.72	4.67						Significant (Reject Ho)
Control group	25	20.76	8.02	48	4.290	1.96	0.000	0.05	

The analysis above as shown in table 1 reveals mean and standard deviation for the experimental group (ascending order) to be 28.72 and 4.67 respectively. The control group had a mean of 20.76 and a standard deviation of 8.01 respectively. From their performance through the mean scores, it is evidenced that those in the experimental group score higher compared to those in the control group. This implies that arranging test items based on ascending order of difficulty has a positive effect on students' performance in mathematics.

Subjecting the data further to t-test analysis, a t-calculated value of 4.290 was obtained at a sig-value of 0.000. Hence, since the sig- value ($p = 0.000 < 0.05$) is less than chosen alpha level of 0.05 and the t-cal 4.290 greater than the t-crit of 1.96 at 48 degrees of freedom, the null hypothesis was rejected meaning that test item arrangement based on ascending order of difficulty has a significant effect on performance in mathematics among junior secondary school students in Obio-Akpor Local Government Area of Rivers State.

Research Question Two: What effect does test item arrangement based on descending order of difficulty has on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A?

Hypothesis Two: Test item arrangement based on descending order of difficulty has no significant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A?

In order to answer the research question, mean statistics was used while t-test of independent mean was used to test the hypothesis at 0.05 alpha level.

Table 2: Mean, standard deviation and t-test analysis of the effect of item arrangement based on descending order of difficulty on students' performance in Mathematics.

Groups	N	\bar{X}	S.D	d.f	t-cal	t-crit	Sig.	Alpha	Result
Descending order	25	21.48	6.66						Insignificant (Accept Ho)
Control group	25	20.76	8.017	48	0.345	1.96	0.731	0.05	

Table 2 reveals that mean and standard deviation for the experimental group (i.e descending order group) is 21.48 and 6.66 respectively. That of the control group remains 20.76 and 8.017 respectively. From their mean performance, it is evidenced that test item arrangement in descending order of difficulty equally has a positive effect on students' performance in mathematics compared to the control group. Furthermore, subjecting the data to t-test analysis reveals a t-calculated value of 0.345 and a sig-value of 0.731. Hence, since the sig-value ($p > 0.731 > 0.05$) is greater than the chosen alpha level and t-cal 0.731 less than the t-crit of 1.96 at 48 degrees of freedom, the null hypothesis accepted meaning that test item arrangement based on descending order of difficulty has an insignificant effect on performance in mathematics among junior secondary school students in Obio-Akpor Local Government Area of Rivers State.

Research Question Three: What effect does test item arrangement based on order of topic Presentation has on Performance in Mathematics among Junior Secondary School Students in Obio-Akpor L.G.A?

Hypothesis three: Test item arrangement based on order of topic presentation has no significant effect on performance in mathematics among Junior Secondary School Students in Obio-Akpor L.G.A.

In order to answer the research question, mean statistics was used while t-test of independent mean was used to test the hypothesis at 0.05 alpha level.

Table 3: Mean, standard deviation and t-test analysis of effect of item arrangement based on order of topic presentation on students' performance in mathematics.

Groups	N	\bar{X}	S.D	d.f	t-cal	t-crit	Sig.	Alpha	Result
Order of topic presentation	25	26.60	5.723						Significant (Reject Ho)
Control group	25	20.76	8.017	48	4.964	1.96	0.005	0.05	

The analysis as shows in table 3 reveals mean and standard deviation for the experimental group (order of topic presentation) as 26.60 and 5.72 respectively. The mean and standard deviation of the control group remains 20.76 and 8.017 respectively. It is also observed through their mean score performance that item arrangement based on order of topic presentation in class has a positive effect on performance in mathematics among junior secondary school

students. The t-test analysis also reveals t-calculated value of 4.964 and a sig-value of 0.005. Hence, since sig-value ($p = 0.005 < 0.05$) is less than 0.05 chosen alpha and t-cal of 4.964 greater than of t-crit of 1.96, the null hypothesis was rejected and the alternate accepted meaning that test item arrangement based on order of topic presentation has a significant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A of Rivers State.

DISCUSSION

The findings with respect to research question one reveals that test item arrangement based on ascending order of difficulty has a significant positive effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A. The result means that students who are presented with easier task first are always happy and derive zeal and eagerness to do more or perform better. It also implies that students will always perform better academically especially in mathematics if they are presented with task from simple to complex. This result is very much expected because when students are presented with less taskful work, they tend to attempt more even when such task get more difficult. Just like the popular television programme “who want to be a millionaire”, participants are always presented with easy questions first and through observations, they normally get it right and tend to go for higher options even when the presenter often presents them with an option of walking away. The result of this finding however is in line with that reported by Ollemu and Etsey (2008) who noted that students perform significantly better as shown by their mean score when questions are arranged from easy – to- hard format. Similarly, the findings of Barbara, Ansorge, Parker and Lowry (2005), Nwana (2007) and Layer (2007) reported that test item arrangement based on simple to-complex aids students understanding and consequential better performance than when they are presented on random basis. Tei-Firstman, (2011) also submitted that ascending order of difficulty aids students’ performance. The secondary report as cited in Tei-Firstman (2011) reported that test item arrangement based on ascending order of difficulty has no significant effect on students’ performance. The difference in the two findings may be as a result of ethnic differences.

Research finding two reveals that test item arrangement based on descending order of difficulty has a positive but insignificant effect on performance in mathematics among junior secondary school students in Obio-Akpor L.G.A. The results of this study means that students who are presented with test or examination items from complex-to-simple will perform positively but such performance will not be obvious. It also means that it is only on rare instances that such item arrangement format can yield visible positive result on students’ performance. The result also indicates that the positive performance recorded is insignificant. This means that majority of students failed because of the arrangement of the test or examination items from hard to simple ones. It likely arises because students do not like tedious task. This, of course coincides with the psychological theory of job performance which notes that humans naturally do not like taskful jobs and they will do everything possible in order to avoid such except in inevitable circumstances like test or examination situations like this.

The findings of this study however is expected and at the same time very surprising to the researchers. It is expected in the sense that the result has shown that students’ positive performance based on this pattern of item arrangement is insignificant. This means that there

is no way students can perform better in mathematics if items are arranged from complex to simple. On the other hand, the result of the study is surprising because students in this group still manage to outperform those in the control group. The present findings correspond with that reported by Tei-Firstman (2011). She noted that test item arrangement based on descending order of difficulty has an insignificant effect on students' academic performance. On the contrary, the study contradict that earlier reported by Bodas and Ollendick (2005) who argued that test item arrangement of any format does not have any effect on students' performance in mathematics. The differences in the results may be due to sample size or location.

Research finding three reveals that test item arrangement based on order of topic presentation has a positive as well as a significant effect on students' performance. This result means that students tend to perform better when they are exposed to test items in order in which they were presented in the class. As educationists and test experts argue, this may be due to the fact that while some students remember or recall things earlier presented to them, some might tend to recall the later ones. This also means that anytime students are required to give an account to previous acquired knowledge they tend to perform better when such requirements are in order through which they acquire such knowledge. They tend to perform better when such requirements are in order through which they acquire such knowledge. The result of this findings may also arise because at the beginning of an academic school term or semester, students may have been more alert and taking details of every instruction with enthusiasm either at the beginning of the semester, or term or at the beginning of the day. The present study however is in line with a study carried out by Babara, Anson, Parker and Lowry (2005) who reported that students who were presented with test items systematically in line with their curriculum tend to perform better than those whose test arrangement were randomized.

RECOMMENDATIONS

Based on the findings, the researchers recommend that;

- (1) Classroom teachers, test constructors and other stakeholders involved in test construction should ensure that test items are arranged from simple to complex in order to give students the motivation to perform.
- (2) Though complex to simple format of test item arrangement is found to have a positive effect, such effect being insignificant implies that test constructors should avoid this format at every point in time.
- (3) Teachers as well as professional educational bodies should always follow the order of topic in the curriculum in setting test or examination questions. They should also use the same approach in introducing it to the students during classroom instructions.

CONCLUSION

Based on the study, it is evidenced that test item arrangement in its general sense, has an effect on students' performance in mathematics. Specifically test item arrangement based on ascending order of difficulty (i.e from simple to complex) as well as order in which they were

presented in the classroom have more positive and significant effects on students' performance in mathematics and such pattern should be encouraged among classroom teachers, evaluators as well as professional examination bodies.

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