

RESTRUCTURED MATHEMATICS QUESTIONS AND ACADEMIC ACHIEVEMENT OF STUDENTS IN SENIOR SCHOOL MATHEMATICS

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Abstract

This study investigated, using survey research design, the effect of question restructuring on academic achievement of 6,580 senior school three (SS3) students in mathematics vis-à-vis their academic achievement when assessed with question from textbook in use or past question paper. One null hypothesis was formulated to guide the study. A validated and reliable-tested instrument, Mathematics Re-assessment Test (MRT), was administered on the respondents. The result of the analysis showed that the Mean Academic Achievement Score(MAAS) of the students assessed using question from textbook in use/past question papers was higher than their MAAS after being assessed with restructured question. Also, the Z-test analysis showed significant difference between the MAAS of students assessed with question from textbook in use/past question papers and their MAAS as assessed with restructured question. It was, therefore, recommended that teachers should be trained on question restructuring in addition to using questions from textbook in use/ past question papers in assessing students in order to make them understand and apply what is learnt to real-life situation, the essence of School Based Assessment (SBA).

Mathematics is regarded as the general science of which Arithmetic, Geometry, Algebra, Trigonometry, etc are branches (Graham, 1975). Sowunmi (1986) opined that Mathematics is a symbolic logic of possible relations and concerned with hypothetical truth. Dogo (1996), stated that Mathematics is a prime instrument for understanding and exploring scientific, economic and social world. Igbojinwaekwu (2004) asserted that Mathematics is a truthful way of finding solutions to problems.

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Grundy and Rollet (1961) in Igbojinwaekwu (2004) concluded that Mathematics is the “bread and butter” of science and science related courses/subjects. Supporting Grundy and Rollet (1961), Ukeje (1997) stated that Mathematics is the precursor and the queen of science and technology and an indispensable single element in modern societal development. Also supporting, Abiodun (1997) asserted that Mathematics is the gate and key to science. According to Tranter and Lambe (1980), hardly is there any scientific theory that cannot be expressed mathematically. Therefore, Okeke and Okeke (2011) stated that for scientific thoughts and ideas to be devoid of ambiguities, they must be expressed in Mathematics Language.

Rogers (1986), explained that mathematics has become the central intellectual discipline of the technological society and that as the society develops, so will its quantitative aspects assume greater influence and dominance over its qualitative features. Supporting Rogers (1986), Chinweoke (2011), stated that the importance of Mathematics to scientific and technological development of a nation cannot be overlooked. According to Ukeje (1997), without Mathematics, there is no science, without science there is no modern technology and without modern technology there is no society. Osafehinti (1990) and Aminu (1995) in their separate studies opined that mathematical concepts and symbols are used in expressing the physical laws of nature. Tsue and Anyor (2006), supporting Osafehinti and Aninu, stated that mathematical concepts and methods, therefore provide scientists with insight into and about natural phenomena.

Eguavon (2006) described Mathematics as the pivot of all civilization and technological development. In line with Eguavon’s assertion, Osafehinti (1990) and Aninu (1995) came to a conclusion that any society which aspires to be scientifically and technologically developed must have an adequate level of Mathematics education, since Mathematics has ingredients for the effective articulation of the abstract elements of science that give impetus to the development of technology. Also supporting, Imoko and Angwagah (2006), opined that Mathematics is a key factor in the development of any nation. Odo (1999), agreed that Mathematics is a model for thinking, developing scientific structure, drawing positive conclusion, as well as, for solving problems. Maduabum and Odili (2006), acknowledged that Mathematics as science, the science of quantity and space, occupies a key position in Nigeria’s Educational System reflecting accurately the vital role the subject plays in the contemporary society. They concluded that for a nation, such as ours, aspiring for scientific and technological take-off, the need to pay due attention to our students’ academic performance in Mathematics and how it relates to their abilities to face societal challenges cannot be over emphasized. Supporting Maduabum and Odili (2006), Carl (1996) in Igbojinwaekwu (2010), reported that social changes are strongly tied to the nature of science and Mathematics, and that technological breakthrough rested on proper understanding of the nature of science and Mathematics.

According to Obanya (1980, 1985), Imoko and Angwagah (2006), Igbojinwaekwu (2010) and Gbodi and Laleye (2006), many teachers in schools use only the techniques they know, even if such techniques are not relevant to the concept under discussion. In support, Akuezuilo and Chinweoke (2009), Offiah and Akusoba (2009), Anyamene and Anyachebelu (2009), Okigbo and Akusoba (2009), Esomonu (2009), Kpangban and Onwuegbu (1992), Obanya (1980, 1985), Okeke (1986) and Okoye (1998), reported that the inability of students to perform satisfactorily in Senior School Mathematics is due to teachers non utilization of appropriate teaching techniques/strategies/methods.

Evaluation is usually Defined as educational measurement, followed by the passing of value judgment on data obtained (Ndu, 1999). Over the last twenty years or more, many seminars/ workshops have been sponsored, particularly, by the Federal Government, to disseminate information about and cause teachers to adopt modern practices in evaluation (Dogo, 1996). In every Faculty of Education or College of Education in Nigeria, there is a course on Measurement and Evaluation. Yet, research findings have repeatedly shown that teachers' structured examination questions in Secondary School Science and Mathematics demand mainly recall of information at the knowledge level of Bloom's taxonomy of educational objectives (Ndu, 1999). Supporting Ndu, National Teachers' Institute(NTI)(2006) claimed that teachers' structured questions placed emphasis on students to obtain high scores without regard for understanding or ability to apply concepts learnt in solving real-life problems, which the essence of School-Based Assessment(SBA).Also supporting Ndu, Ogidi, Chikwe and Nwachukwu (2011) asserted that teachers' dominant practice is structuring questions that concentrate on assessing the ability of students to reproduce facts or steps in solving problems; very little attention is given to the higher mental tasks, such as thinking and application of skills. The contemporary teachers' belief is that assessment of students, through structured questions, is mainly carried out after teaching has been completed (i.e. assessment is summative). The implications are that teachers do not have sufficient competence in setting test questions; teachers set and mark tests perfunctorily(done as a duty or routine, but without care or interest); 'impossible marking dead line' in all levels of education worsened the situation, because to meet up with the dead line, many teachers donate marks to students.

Igbojinwaekwu (2010) , posited that many teachers lack the skill of restructuring questions. They, therefore, depend solely on questions in the text-books in use and past question papers from examining bodies for assessing students. The problem inherent in this method of assessment is that when the same questions are restructured in such away that they demand the same answers as the original one, students are found not be too comfortable, hence the saying that teachers use simple questions as examples during teaching-learning process, but students often encounter hard questions in external examinations.

Statement of the Problem

Evaluation of students in teaching-learning process is an important activity in the education industry. It involves setting and answering questions by the teachers and the students respectively. It helps the teachers to discover what the students have not learnt, so that he can re-teach; it helps students to learn, because they study hard when examinations are scheduled, achieve along the lines in which they are evaluated e.g. if a teacher sets higher order questions, students learn to think before answering the questions, as well as to give various points of view, unlike when questions demanding recall of facts are set/structured. Evaluation is used to assess the effectiveness of a teaching method or to compare two or more teaching methods. It is the only way to measure achievement. In administration, evaluation is useful in streaming, certification, admission to institutions, career guidance and reporting to parents or employers.

Despite the importance of examination questions in the assessment of students in the school system and the various ways students react to questions in examinations, little or no study has been carried out on effect of question restructuring and academic achievement of students in Senior School Mathematics in Delta North Senatorial District of Delta State, Nigeria. Bridging this gap gave birth to this study. The statement of the problem is, therefore, stated thus: what is the effect of question restructuring on academic achievement of students in the Senior School Mathematics?

Purpose of the Study

Generally, the study probed into the level of preparedness of secondary school students in solving mathematical problem / questions. Specifically, the purpose of this study was to ascertain the academic achievement of students in Mathematics when assessed with questions from the text-book in use or past question papers vis-à-vis their academic achievement when the questions are restructured.

Null Hypothesis

H₀₁: There is no significant difference between Mean Academic Achievement Scores (MAAS) of students exposed to questions from textbook in use or past examination question papers and restructured questions.

Methodology

A survey research design was employed in this study. The population comprised 20, 860 Senior School Three (SS3) students in public secondary schools in Asaba Educational Zone of Delta State who scored 50% and above in Mathematics in the 2011 promotion examination in Senior School Two (SS2). The sample consisted of 6,580 SS3 students selected through a simple random sampling technique.

One valid and reliable instrument constructed by the researchers was used to collect data for the study. This was the Mathematics Re-assessment Test (MRT). The MRT consisted of two Mathematics questions in Geometry (construction). The first

Restructured Mathematics Questions and Academic Achievement of Students in Senior School Mathematics

question was copied from the textbook in use/past question papers; the second question, having the same answer as the first question, was restructured from the first question. The second question demanded critical thinking which is one of the objectives of teaching Senior School Mathematics. Therefore, the students who were able to solve question two correctly were judged to have higher thinking faculties and more prepared to carry out higher mental tasks, such as thinking and application skills. Besides, they can easily pass external examination than those students who could not solve question two correctly. Two Mathematics and two Measurement and Evaluation experts validated the instrument. The reliability of question 2 of the MRT was established through Trial-Testing (T-T) and was found to be 0.93. Thereafter, students' answers in T-T were subjected to Item-Analysis (I-A), which was established as 0.5. Maduabum (2004) posited that achievement test with reliability index of 0.50 and above is reliable. Also, Ndu (1999) asserted that achievement test instrument with I-A index of 0.5 (ie 50% correct and 50% wrong answers from students) is the best. Therefore, MRT was judged to be very reliable.

The Mathematics teachers of students that formed the sample of this study administered the MRT to their students for 40 minutes (20 minutes for each question). The researchers finally collected the MRT from the teachers for analysis of data therein. The Mean Academic Achievement Scores (MAAS) of students in questions 1 and 2 were respectively calculated. The difference between the MAAS of students in questions 1 and 2 was subjected to z-test analysis.

Results

Table 1 shows the z-test analysis of MAAS of students in questions 1 and 2. The table shows significant difference between students MAAS in question 1 and 2 in favour of question 1. This means that H_{01} is rejected; that is contemporary students have low academic achievement in Mathematics when questions are restructured.

Table 1: Summary of Z-Test of Mean Academic Achievement Scores of Students Assessed With Question from Mathematics Text Book in use/Past Question Paper and Restructured Question

Question Source	N	MAAS	SD	Z-cal	Z-crit	Test
From text-book in use/past question papers	6,580	70.7	9.1	7.96*	1.96	2-tailed
Restructured	6,580	60.2	9.3			

* Significant at $p < 0.05$

The data in table 1 indicate that the MAAS of students assessed using from textbook in use/past question papers is higher than the MAAS of the students assessed with restructured questions. Z-test indicated significant MAAS difference in favour of students assessed with questions textbook in use/ past question papers.

Discussion

The results shown in table 1 implied significant difference between the MAAS of students in questions from textbook in use/past question papers and restructured questions in favour of the questions from textbooks or past question papers from West African Examinations Council (WAEC) and National Examinations Council (NECO) of Nigeria in the teaching-learning process.

The continuous use of this strategy, using questions from the textbook in use or WAEC/NECO past question papers is regrettable, because the students are not given the opportunity to develop precision, logic and abstract thinking which are the main objectives of teaching Mathematics in Senior Secondary Schools (WAEC, 2011; Ndu,1999; Ogidi, Chikwe and Nwachukwu,2011). The implication is that when questions from the textbook/past question papers are restructured, students find it difficult to solve them, because they are used to a particular pattern of questions.

The result of this study is worrisome because Rogers (1986), Osafehinti (1990), Aminu (1995), Eguavon (2007), Imoko and Angwagah (2006), Odo (1999) and Maduabum and Odili (2006) had in their various researches linked mathematical knowledge to technological break through and societal advancement / developments.

Supporting the results/findings of this study, Igbojinwaekwu (2011), Ali (1989) and Harbor-Peter (1992) asserted that teachers' incompetence is a contributing factor to students' poor performance in Senior School Certificate Examinations. Also in support of the finding of this study are Akuezuilo and Chinweoke (2009), Okigbo and Akusoba (2009), Esomonu (2009), Kpangban and Onwuegbu (1992), Obanya (1980, 1985). Okeke (1986) and Okoye (1998) who opined that the inability of students to meet up with the main objectives of teaching Mathematics in schools is due to teachers' non utilization of appropriate teaching techniques or strategies. In alignment with the results of this study are the studies of Obanya (1980, 1985), Gbodi and Laleye (2006) and Imoko and Angwagah (2006) and Igbolinwaekwu (2010) which variously agreed that teachers in schools use only the techniques they know, even if such techniques are not relevant to the concept under discussion

Conclusion

This study revealed that students are very much comfortable when they are exposed to solving problems from the Mathematics textbooks in use or from past question papers. It was also shown in this study that students find it very difficult to solve the same questions from either the textbooks in use or past question papers when they are restructured.

Implication

The implication is that teachers using only the past question papers and questions from the textbook in use should be discouraged from doing so, because it does not enhance academic achievement of students and also, does not instill

confidence in students in solving mathematical problems. It is also devoid of instilling in the students the attributes of abstract thinking, logic and application in solving societal problems.

Recommendation

The researchers hereby recommend that the teachers should use both questions in the textbook in use or past question papers and restructured questions as examples during teaching-learning process, so as, to give the students more confident in solving mathematical problems in Senior School Certificate Examination. Also, skills in question restructuring should be included in subject methodology of student teachers in Faculties of Education and colleges of education.

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Restructured Mathematics Questions and Academic Achievement of Students in Senior School Mathematics

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