

Difficulty Levels of Topics in the New Senior Secondary School Mathematics Curriculum as Perceived by Mathematics Teachers of Federal Unity Schools in Nigeria

Azuka, Benard Festus.; Jekayinfa, Olatoji; Durojaiye, David; Okwuoza, Sylvester Orobosa.
National Mathematical Centre, Abuja, Nigeria
*E-mail of corresponding author: benardazuka@yahoo.com

Abstract

In line with Federal Government of Nigeria's directives, the curriculum for Senior Secondary Schools has been reviewed for use in Nigerian schools. Some new topics have been added to the Senior Secondary School Mathematics Curriculum. It is a well known fact that teachers form the hub of the teaching and learning processes in schools. Therefore, this study was carried out to determine the difficulty levels of topics in the new Mathematics Curriculum as perceived by Federal Unity Schools Mathematics teachers. Researcher's designed questionnaire was administered to 58 mathematics teachers from 18 Federal Unity Schools from the six geo-political zones of Nigeria. Percentage count, t-test and ANOVA were used to analyze the data. Findings of the study revealed that most existing topics in the previous mathematics curriculum were perceived less difficult while some were perceived averagely difficult. However, all the newly added topics were perceived very difficult to the teachers. Gender, academic qualifications, professional qualifications and years of experience were of no influence on teachers' perceptions in the study. It was therefore recommended that provisions should be made for teachers to be trained and re-trained in workshops and seminars especially on the new topics. Relevant books, teaching modules and teaching guides detailed in the topics should also be made readily available to schools.

Keywords: Difficulty levels of Mathematics topics, New mathematics curriculum in Nigeria, Mathematics Teachers of Federal Unity Schools

1. Introduction

Curriculum is a vital component of any educational environment. It is central to education at all levels in the world. As education is central to the society, so is curriculum which is the heart and life-wire of education (Alade, 2005). There are as many definitions of curriculum as there are authors and scholars on the subject. Alade defines curriculum as a programme of education prepared for definite group of learners within a time frame in order to achieve the intended behavioral outcomes. Curriculum provides a medium through which educational institutions seek to translate the societal values into concrete reality. It is through curriculum that our schools and institutions achieve what is considered to be desirable learning outcomes by the Society. In his description of curriculum, Ajibola (2008) sees it as the engine which propels the education to achieve for both the individual and the society what they hold as prize. Oriafio cited in Alade (2011) also defines curriculum as an educational programme of learning experiences offered to the learner under the guidance of a school for the purpose of effecting change in the behavior of the learner.

The term curriculum therefore can be said to be the total environment in which education takes place. Thus, it embraces the child, the teacher, the subject, the content, the methodology of teaching and evaluating as well as the physical and psychological environment of teaching and learning experiences outside the classroom which were formally regarded as extra-curricular activities according to Onyike, and Bilesanmi-Awoderu, as cited in Alade (2011). Also, curriculum can be seen as the reconstruction of knowledge and experience, systematically developed with the guidance of the school or relevant agencies which will enable the learner to have better mastery of learning experiences for the learners and the society's well-being.

Mathematics has been with man since the creation of the world. The nature and method of study change from time to time. As the society changes, so also mathematics changes since its study and use at any point in time is geared towards serving the need of the society. The study of mathematics has passed through so many changes of development from the pre-colonial time to the present day. Historically, mathematics is believed to have evolved and developed out of the need for man to meet up with certain expectations of life. In the primitive age, the need for man to count his cattle, farm produce, children etc was crudely done, which evolved the use of mathematical knowledge (Kurumeh, 2006).

Curriculum like a pendulum changes according to the social, economic and technological changes in the host society and the surrounding societies. Nigeria has witnessed so many changes in curriculum during the era before the coming of the missionaries, the period of colonial rule, post independence era and in the last two decades. Some of the reasons why curriculum changes include:

- a) To make it relevant to the needs and culture of the society;
- b) To keep abreast with the current technological trends;
- c) To address the current socio-economic states of the nation
- d) To make up for the failure of the old curriculum to achieve the objectives expected by the society;
- e) To keep up with some international standards of the study of the subject

Generally in designing or changing any curriculum, three basic features are to be considered: They are the society, the learner and the subject matter (Badmus, 2002). It is incumbent on the curriculum planners to analyze the implications of changes in the society when deciding upon the new programme of study for the school. Some of the things in the society to be considered include employment pattern since schools are to provide basic skills, and the requirements arising from the development of new behavior in health, welfare and political activities. Case in point is the inclusion of ICT, HIV/AIDS education and quantitative reasoning in the Basic Education Curriculum for mathematics in 2006 (FME, 2007).

The characteristics of the learner and how he learns should be part of what needs to be put into consideration by the curriculum planners. Just as in the case of the society, the employment and educational need of the learners are to be considered in curriculum planning. This is because the purpose of education itself is to make life easier and make the learner fit into the society he finds himself. For the subject matter, the specialized fields of knowledge, the nature and the philosophy should be considered. The subject matter is in constant change just as the society (Azuka, 2009). In this regard, the curriculum to be devised has to consider some new things or findings, topics structure etc that is relevant to living in the contemporary setting.

The Nigerian Educational Research and Development Council (NERDC) has the mandate to develop curriculum for use at all levels of educational system in Nigeria. In line with Government reform in education, NERDC was directed in 2005 by the National Council on Education (NCE) to review and re-align the existing Senior Secondary School Curricula to meet the target of the reform in the context of National Economic Empowerment and Development Strategies (NEEDS) and the Millennium Development Goal (Egwu, 2007). Also, Obioma (2007) summarized the MDGs and NEEDS targets as value orientation, poverty eradication, job creation, wealth generation and using education to empower the people, hence the need to review the existing secondary school curriculum. It is against this backdrop that the secondary school mathematics curriculum has some topics added to the existing ones. The new mathematics curriculum added some introductory topics in matrices, modular arithmetic, simple calculus (differentiation and integration), simple co-ordinate geometry, logical reasoning and financial mathematics like annuity and amortization.

The teacher factor is very prominent in determining the quality and the output of any educational system. Hence teachers are regarded as the “hub” around which every other factor affecting the quality of education revolves. In other words irrespective of the quality and quantity of buildings, curriculum, books and other infrastructures are provided in any educational system, in the final analyses the success and performance of the educational system will depend on the teacher. In particular, the knowledge of the curriculum by the teachers is very important as no educational system can rise above the level of the teachers. In the mathematics class a teacher cannot effectively teach students what he does not know.

The pertinent question is how prepared are the teachers to effectively teach these topics at the secondary school level? Thus, the main purpose of this study is to examine the difficulty level of the new topics in new mathematics curriculum among Federal unity schools’ mathematics teachers in Nigeria. The study also determines the possible influence of teachers’ academic qualification, professional qualifications, years of teaching experience and gender on the difficulty levels of the topics.

2. Research Questions

The study proffered answers to the following research questions:

- What are the topics in the new mathematics curriculum that are perceived difficult by the mathematics teachers of Federal Unity Schools?
- Is there any significant difference in the difficulty levels of the topics between male and female teachers?
- Is there any significant difference in the difficulty levels of the topics among first degree, masters’ degree and PhD holders?
- Is there any significant difference in the difficulty levels of the topics among teachers with different years of experience?
- Is there any significant difference in the difficulty levels of the topics between professional and non-professional teachers?

3. Hypotheses

Four hypotheses were formulated in the study as follows:

- There is no significant difference in difficulty levels of the topics between male and female teachers;
- There is no significant difference in the difficulty levels of the topics among first degree, masters, degree and PHD holders;
- There is no significant difference in the difficulty levels of the topics among teachers with different years of experience;
- There is no significant difference in the difficulty levels the topics between professional and non-professional teachers

4. Methodology

This study is a descriptive of the survey type. This method is appropriate for the study because a descriptive research type reports things the way they are. The population consisted of all the Federal Unity Secondary School Mathematics teachers in Nigeria. However, purposive sampling was used to sample 58 mathematics teachers from 18 Federal Unity Schools from the six Geo-political zones of Nigeria. From each Geo-political zone, 3 Federal Unity Colleges were sampled and from each school, at least 3 Mathematics teachers formed the subjects for the study. These were teachers, who attended the capacity building workshops organized by the Federal Ministry of Education at the National Mathematical Centre in May, 2013. The 58 teachers were comprised of 26 male and 32 female Mathematics teachers.

The instrument for the study is a Researcher designed questionnaire titled 'Difficulty levels of the new topics in the new Senior Secondary School Mathematics Curriculum as perceived by Federal Unity Schools Mathematics Teachers'. The questionnaire was validated by experts in mathematics education to ensure its content validity. There are two parts of the questionnaire. Part one of the questionnaires was concerned with teachers' Bio-data namely sex, academic qualifications, professional qualifications and teachers' years of teaching experience. Part two of the questionnaire contained the topics in the new mathematics curriculum to determine teachers' difficulty levels in each of the topic from their responses. The instrument was of a 4 point likert scale with 'very easy, easy, difficult and very difficult'. A total of 22 topics were put in the questionnaire for the teachers to determine their levels of difficulties. The selected topics covered all the aspects of the new curriculum. To analyze the data, the researcher used percentage count, t-test and ANOVA.

5. Results

Research Question 1: What are the topics in the new Mathematics Curriculum that are perceived difficult by the Mathematics teachers of Federal Unity Schools?

Table 1- Percentage Difficulty level Table

TOPICS	Very easy & Easy	Percentage (%)	Difficult & Very Difficult	Percentage (%)
Logarithms & Applications	51	87.93	7	12.07
Matrices	43	74.14	15	25.07
Number Bases	55	94.83	3	5.17
Modular Arithmetic	23	39.66	35	60.34
Variation	50	86.21	8	13.79
Surds	50	86.21	8	13.79
Plane & Circle Geometry	32	55.17	26	44.83
Quadratic equations & Applications	47	81.03	11	18.97
Areas and Volumes of shapes/solids	44	75.86	14	24.14
Trig Ratios of Angles between 0° and 360°	47	81.03	11	18.97
Sine and Cosine Graphs	29	50.00	29	50.00
Bearing	22	37.93	36	62.09
Coordinate Geometry	18	31.03	40	68.97
Differentiations & Applications	13	22.41	45	77.59
Integration & Application	11	18.97	47	81.03
Probability	43	74.14	15	25.86
Measures of Central tendency & Dispersion for grouped & ungrouped data	46	79.31	12	20.69
Inequalities & Applications	47	81.03	11	18.97
Arithmetic & Geometric Progressions	47	81.03	11	18.97
Logical Reasoning	21	36.21	37	63.79
Geometrical Constructions	23	39.66	35	60.34
Financial Mathematics	15	25.86	43	74.14

Table 1 above shows the percentage difficulty levels of topics in the new Mathematics Curriculum as perceived by teachers. The percentage difficulty levels are divided into groups. Topics with less than 50 percent are seen to be easy while those with 50-59 percent are seen to be fairly difficult and those with 60 percent and above are seen to be very difficult. The easy topics include Logarithms and Applications, Number bases, Variation, Surds, Quadratic equations and Applications, Areas and Volumes of shapes and solids, Trigonometric ratio of angles, Probability, Measures of tendency and dispersion, Inequalities and Applications, Arithmetic and Geometric progression. The only topic perceived to be fairly difficult is Sine and Cosine graphs. However, topics perceived as very difficult are logical reasoning, Geometric Construction, Financial Mathematics, Integration and Applications, Differentiation and Applications, Coordinate Geometry, Bearing and Modular Arithmetic. Hypothesis 1: There is no significant difference in the difficulty levels of the topics between male and female Mathematics teachers.

Table 2: T-Test analysis of responses of male and female Mathematics teachers

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SCORES	Equal variances assumed	.002	.964	.136	56	.892	.41106	3.01825	-5.63522	6.45733

From table 2 above, the Sig (2-tailed) value is 0.892 which is greater than 0.05. This means that there is no significant difference in the difficulty levels of topics in the new mathematics curriculum between male and female teachers. Therefore, we accept hypothesis 1.

Hypothesis 2: There is no significant difference in difficulty levels of the topics among the first degree, masters' degree and Ph.D holders.

Table 3: ANOVA of response of Mathematics teachers in terms of different academic qualifications.

ANOVA

Score					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	256.666	2	128.333	.999	.375
Within Groups	7063.765	55	128.432		
Total	7320.431	57			

From table 3 above, Sig. value is 0.375 which is greater than 0.05. This means that there is no significant difference in difficulty levels of the topics among teachers with different academic qualifications. We therefore accept hypothesis 2.

Hypothesis 3: There is no significant difference in the difficulty levels of the topics among Mathematics teachers of different years of experience.

Table 4: ANOVA of Responses of Mathematics teachers in terms of years of experience

ANOVA

SCORES					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	163.220	3	54.407	.410	.746
Within Groups	7157.211	54	132.541		
Total	7320.431	57			

From table 4 above, the Sig value is .746 which is greater than 0.05. Therefore, there is no significant difference in difficulty levels of the topics among teachers in terms of their years of experience. Thus, we accept hypothesis 3

Hypothesis 4: There is no significant difference in difficulty levels of topics in the new Mathematics curriculum between professional and non-professional teachers.

Table 5: T -Test analysis of Responses of professional and non-professional Mathematics teachers

Independent Samples Test

	Levene's Test for Equality of Variances	t-test for Equality of Means								
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
SCORES	Equal variances assumed	.903	.346	-1.31586	56	.194	-6.93208	5.26809	-17.48532	3.62117
	Equal variances not assumed			-1.59885	5.285	.168	-6.93208	4.33566	-17.89904	4.03489

Table 5 above, Sig (2-tailed) value is 0.194 which is greater than 0.05. Therefore, there is no significant difference in difficulty levels of topics between professional and non-professional teachers. Hence, we accept Hypothesis 4.

6. Discussions of Findings

Research question 1 is to find the difficulty levels of teachers in the topics of the new Mathematics Curriculum. It was however found that the difficulty levels in some topics were low. The topics are logarithms and its applications, Matrices, Number bases, Variation, Surds, Quadratic equations and its applications, Areas and volumes of shapes and solids, Trigonometric ratio of angles, Probability, Measures of central tendency and

dispersion, Inequalities and its applications, Arithmetic and Geometric progression.. All these topics are in the former Mathematics curriculum. The only topic perceived slightly difficult is Sine and Cosine graphs. However, teachers perceived Logical reasoning, Geometric construction, Financial Mathematics, Integration and applications, Differentiation and applications, coordinate Geometry, Bearing and Modular arithmetic as very difficult. All these topics apart from Bearing are new in the Mathematics Curriculum. This is a major challenge as all the newly added topics are perceived difficult by teachers and this is likely to have a negative implication on the learning of students in these topics, and ultimately a derogatory impact on the overall performance of students in the subject.

Also, the study showed that there is no significant difference in the difficulty levels of the topics in the new Mathematics Curriculum between male and female teachers, professional and non-professional teachers, and among teachers with low, average and high years of experience, and also among teachers who are First degree, Masters' degree and Ph.D holders. This means that gender, academic qualifications, professional qualifications and years of teaching experience do not affect the perception of teachers about the difficulty levels of the Mathematics topics.

7. Conclusion

As a result of the findings of this study, the following conclusions were reached:

- Most topics in the previous mathematics curriculum are perceived less difficult.
- Only few topics in the previous mathematics curriculum are perceived averagely difficult by teachers and these include Probability, Areas and Volumes of Shapes, Matrices, plane and Circle Geometry, and Sine and Cosine Graphs.
- All the newly added topics in the new Mathematics Curriculum are perceived difficult. They are Financial Mathematics, Logical reasoning, Integration and Application, Differentiations and Application, Coordinate Geometry and Modular Arithmetic.
- Gender, academic qualifications, professional qualifications and years of teaching experience are not factors of influence on the difficulty levels of the topics as perceived by the Mathematics teachers.

8. Recommendations

Based on these findings, the following recommendations are made:

- More books especially those containing the new topics should be made available to the teachers to keep them abreast with the topics;
- Workshops and seminars should be organized for the training and re-training of teachers on the new curriculum topics;
- More teachers should be employed to complement the existing ones in the teaching of Mathematics so that the burden of the newly added topics will not be too much;
- Teaching modules/guides should be provided to the teachers on the new topics in the curriculum;
- More time gap should be given to schools before the new topics are fully incorporated into the school curriculum. This is to allow the teachers to be well prepared for the task.

Many curriculum innovations in Mathematics have failed in the past due to some problems. These problems include planning, lack of enough preparation of the teachers, content, pedagogy and assessment. This new curriculum should not be allowed to suffer the same fate of curriculum failure. All stakeholders in the educational system should rise to the task. The beginning of the solution is the identification of difficult topics in the curriculum and ensuring that teachers are prepared to handle the topics well in the school system. This is imperative as no educational system can rise above the level of its teachers.

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