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Mastery of Secondary School Mathematics Contents by NCE Mathematics Teachers in North Central Nigeria

Agashi P. P.*

Kogi State College of Education Ankpa, Nigeria

Obi C. N.

University of Nigrian Nsukka, Nigeria

Nwokike A. N.

Kogi State College of Education, Ankpa

Abstract: The study investigated the mastery of secondary school mathematics curriculum by NCE mathematics teachers in North Central Nigeria. The study was guided by four research questions and one hypothesis. The instrument used for the study was a test on secondary school mathematics curriculum (TESSMAC). TESSMAC is a 60-item multiple choice objective tests constructed by the researcher in line with the curriculum and guided by the West African Examinations Council (WAEC) and National Examinations Council (NECO) standards. It was face validated by an experienced secondary school mathematics teacher and its content validity was assured using test blueprint covering all the four areas of secondary school mathematics. Its reliability was calculated to be 0.82 using the Po, Pc and K statistics. TESSMAC was administered on a purposive sample of 120 NCE mathematics teachers from 20 randomly sampled secondary schools in Benue and Kogi States in North Central Nigeria. The data collected was analysed using frequency tables, percentages and the z-test. Among other findings, only 25% of the NCE mathematics teachers have mastered the curriculum. Based on these, some recommendations were made among which is that programmed instruction should be introduced in Nigerian schools.

Keywords: Mastery; Secondary school; Mathematics content; NCE teachers; Not Central Nigeria.

1. Introduction

The consistent and persistent poor profile of students result in mathematics in both private and public examinations has become a major source of worry to all stake holders in education. An example of such poor profile is the West African Examinations Council (WAEC) results in mathematics as shown in the table below.

Table-1. performance of students in WAEC Mathematics 2006- 2012

Year	Total	Credit (A1-C6)	%	Pass (D7-E8)	%	Fail (F9)	%
2006	1,149,277	472,582	41.12	357,310	31.09	319,385	27.79
2007	1,249,028	583,920	46.75	333,740	26.72	331,368	26.53
2008	1,268,213	726,398	57.28	302,266	23.83	239,549	18.89
2009	1,373,009	634,382	46.20	344,635	25.10	393,992	28.70
2010	1,306,535	548,065	41.95	363,920	27.85	394,550	30.20
2011	1,508,965	608,866	40.35	474,664	31.46	425,435	28.19
2012	1,658,357	838,879	50.58	478,519	28.86	340,959	20.56

Source: Statistics Office, WAEC, Lagos.

The worry stems from the fact that mathematics is not just an academic discipline; it pervades all endeavours of humanity- science, aviation, engineering, medicine, etc. James (2005) puts it more succinctly when he stated that that not only an academic, a scientist, an engineer but a shop keeper, a grocer, a housewife, a sportsman, an employee needs mathematics and who does not?

Several reasons have been identified as causative factors of the poor behaviour of students towards mathematics such as student-related factors (Nurudeen, 2007), curriculum-related factors (Agashi, 2003), teacher-related factors such as pedagogy and competence (Harbor-Peters, 2001; Ogwel, 2008). Of the various shades of teacher-related factors, competence and mastery of subject content seems to be critical as no one can give what he does not have. In addition, research has shown that lack of mastery of content by the teacher is a major source of aversion in mathematics (Harbor-Peters, 2001). Mastery of content entails attaining a predetermined proficiency level of 70%

and above in a given subject (Anastasi, 1996). There is no gain saying that a teacher who is not a master in his chosen discipline is a liability to education and society. This is even more so for a mathematics teacher because many have fallen by the way side or gone the wrong direction because of their poor status in mathematics.

The Nigerian Certificate in Education (NCE) is the minimum teaching qualification in Nigeria. The NCE is awarded by colleges of education on completion of three-year teacher training programme. Colleges of education provide 3-year post secondary teacher education. Minimum entry qualification into colleges of education is 5 credits in relevant subjects including english and mathematics in WAEC or NECO. Students offer three major courses-education and two subject areas (e.g mathematics/physics) and some courses in general studies. The depth of coverage in the courses is above that at the secondary level and below that at the university level. In many Nigerian secondary schools, NCE teachers are in the majority. The NCE mathematics teachers have therefore studied and passed mathematics at secondary and tertiary level. They are therefore expected to be very competent and proficient in secondary school mathematics. But expectation is different from reality. With the persistent poor outing of secondary school students in mathematics in both internal and external examinations, there is the worry that this may partly not be unconnected to the issue of mastery of the contents of the secondary mathematics curriculum by the teachers who are largely NCE holders. It is this worry that gave impetus to this study.

1.1. Purpose of the Study

The general purpose of the study was to find out the level of mastery of secondary school mathematics curriculum by NCE mathematics teachers in North Central Nigeria. Specifically, the study sought to find out:

1. The proportion of NCE mathematics teachers that have mastered the secondary school mathematics curriculum.
2. The proportion of male and female NCE mathematics teachers that have mastered the curriculum.
3. The mastery status of NCE mathematics teachers in each of the units in the curriculum.
4. The mastery status of male and female NCE mathematics teachers in each of units in the curriculum.

1.2. Research questions

The study is guided by the following research questions:

1. What is the proportion of NCE mathematics teachers that have mastered the secondary school mathematics curriculum?
2. What are the proportions of male and female NCE mathematics teachers that have mastered the curriculum?
3. What are the proportions of NCE mathematics teachers that have mastered each of the units of the curriculum?
4. What are the proportions of male and female NCE mathematics teachers that have mastered each of the units of the curriculum?

2. Hypothesis

The following null hypothesis was formulated to also guide the study at 5% level of significance:

There is no significant difference in the proportions of male and female NCE mathematics teachers that have mastered the secondary school mathematics curriculum.

3. Method

In carrying out the study, the following were considered and addressed: the design of the study, the population and sample, the instrument, validity and liability of the instruments, method of data collection and method of data analysis.

3.1. Design

The study was an ex-post facto design since it investigated an already existing effect (mastery level of NCE mathematics teachers) as a result of their exposure to the secondary school mathematics curriculum (the independent variable which was not manipulated) (Nworgu, 1991).

3.2. Population and Sample

The population of the study comprised all the NCE mathematics teachers in Benue and Kogi States in North Central Nigeria during the 2013/2014 session. From each of the states, 10 secondary schools were randomly selected using systematic sampling technique and all the mathematics teachers in the 20 schools, totaling 120 (39 female and 81 male) were used as the purposive sample for the study since it was possible for the researchers to reach all of them.

3.3. Instrument

The instrument used for the study was Test on Secondary School Mathematics Curriculum (TESSMAC) constructed by the researchers based on the content of the curriculum and guided by past questions in Senior School Certificate Examinations (SSCE) by WAEC and NECO. TESSMAC was a 60-item criterion referenced 5-option

multiple objective test which was subjected to face validation by an experienced teacher in a secondary school. The content validity was ascertained through table of specification comprising all the units of the secondary school mathematics curriculum—Number and Numeration, Algebra, Geometry and Trigonometry and Statistics and Probability. From the table of specification, 20 items were drawn from Geometry and Trigonometry, 15 each from Number and Numeration and Algebra and 10 from Statistics and Probability. Using the P_o , P_c and K statistics for criterion referenced test, the test retest stability measure was found to be 0.82. TESSMAC was administered on the 120 NCE mathematics teachers from the sampled schools on the same day with the help of research assistants. The test lasted 2.5 hours which was certified by the validator. Each item carried a score of 1 mark giving a total of 60 marks. The scores were converted to percentage. Also the scores for each of the units were converted to percentage. A subject with a score of at least 70% was adjudged a master, otherwise, he/she is adjudged a non- master of the curriculum (Anastasi, 1996).

4. Analysis

Frequency tables and percentages were used to answer the research questions while the z-test for proportions was used to test the hypothesis.

5. Results

The results of the analysis are presented in the order of the research questions and hypothesis in the tables shown below.

Research question 1: What is the proportion of NCE mathematics teachers that have mastered the secondary school mathematics curriculum?

Table-1. Proportion of NCE mathematics teachers that have mastered the curriculum

Total number teachers	Number of masters	Number of non-masters
120	30 (25%)	90 (75%)

Table 1 show that out of 120NCE mathematics teachers, only 25% of them are masters of secondary school mathematics curriculum.

Research question 2: what are the proportions of male and female NCE mathematics teachers that have mastered the curriculum?

Table-2. Proportions of male and female masters of the curriculum

Sex	Total number	Masters	Non-masters
Male	81	21 (26%)	60 (74%)
Female	39	9 (23%)	30 (77%)

Table.2- shows that about the same proportion of male and female NCE mathematics teachers have mastered the curriculum.

Research question 3: What are the proportions of NCE mathematics teachers that have mastered each unit of the secondary school mathematics curriculum?

Table-3. Proportions of masters in each of the units of the curriculum

Units	Masters	Non-masters
Number and Numeration	21 (17.5%)	99 (82.5%)
Algebra	26 (24%)	94 (76%)
Geometry and Trigonometry	13 (11%)	107 (89%)
Statistics and Probability	55 (45.8%)	65 (54.2%)

Table 3- indicates that NCE mathematics teachers representing 45.8% of the total number are masters in statistics and probability and those only 13 representing 11% are masters in geometry and trigonometry.

Research question 4: What are the proportions of male and female masters of the curriculum?

Table-4. Proportions of male and female masters in each of the units of the curriculum

Units	Male masters	Female masters	Total
Number and numeration	21 (100%)	0 (0%)	21
Algebra	26 (100%)	0 (0%)	26
Geometry and trigonometry	9 (69%)	4 (31%)	13
Statistics and probability	35 (63.6%)	20 (36.4%)	55

Table 4 indicates that none of the female teachers is a master in number and numeration and algebra while only 4 females representing 31% are masters in geometry.

Hypothesis: There is no significant difference in the proportions of male and female NCE mathematics teachers that have mastered the curriculum

Table-5. Z-test of proportions of male and female masters of the curriculum

Sex	Number of masters	proportion	Z-cal	Z-crit	Remark
Male	n=21	0.26	0.33	11.96	NS
Female	n=9	0.23			

NS=Not significant

Table 5 shows that the calculated Z of 0.33 is less than the critical Z of 1.96. We therefore accept the null hypothesis that there is no significant difference in the proportions of male and female NCE mathematics teachers that have mastered the mathematics curriculum.

6. Discussion of Results

The result in table 1 presents a curious picture of the status of NCE mathematics teachers in the mastery of the content of secondary school mathematics curriculum. The summary is that NCE mathematics teachers are not in full grasp of the content of the secondary school mathematics curriculum. Since no one can give what one does not have, there may be doubt that with this type of situation, teaching and learning of mathematics suffers a great deal and may be partly responsible for the poor outing of students in both internal and external and private and public examinations. This finding supports Harbor-Peters (2001) and Ogwel (2008) who reported that competence of mathematics teachers was a major factor in the problems associated with teaching and learning mathematics.

The result in table 2 indicates that there is no gender disparity with respect to the non-mastery of the curriculum. Put in another way, the mastery of the content of secondary school mathematics curriculum has nothing to do with gender. This is confirmed by the result in table 5. This finding has added to the growing pool of controversy over gender superiority in achievement in mathematics.

Table 3 presents the statistics of the mastery status of the mathematics teachers with respect to units of the curriculum. Without exception, majority of the mathematics teachers were found to be deficient all the units of secondary school mathematics. In particular, the teachers' highest deficiency is in geometry. Surprisingly, number and numeration, which is the first point of call in the study of mathematics, ranked second from below after geometry in the mastery of the units. If a teacher of mathematics is not a master in this preliminary unit of mathematics, one wonders what happens to the rest.

Table 4 x-rays the mastery status of male and female NCE mathematics teachers in the various units of the content of the curriculum. The female NCE mathematics teachers are weakest in number and numeration and algebra and strongest in statistics. Equally the males are strongest in statistics. Both males and female NCE mathematics teachers are almost at the level in geometry and trigonometry. The weakness or strength as reported

here is in terms of the proportions of teachers that mastered the units.

6.1. Implications of the Findings

The major finding of the study that majority of NCE mathematics teachers are not masters of the content of the secondary school mathematics curriculum has some implications: It is either that these teachers did not properly learn or were not properly taught the content when they were in secondary school or it is a case of hard content as reported by Agashi (2003) or that there is the need to reinforce some of the secondary school contents in the NCE mathematics curriculum.

Suggestions For Further Studies

In view of the findings and implication of this studies the following suggestions for further studies are advanced:

1. Simillar studies in other geopolitical regions of Nigeria should be carried out with a view to establishing some comparability and or generalizaibility
2. Educational researchers should embark on a study on the teachers perception of the contents of the secondary school mathematics curriculum with a view to determining the hard contents to enable appropriate review measure by the relevant authorities
3. Similar study involving universities graduate mathematics teachers should be embarked upon with a vieow to establishing some comparatibility with their NCE conterpers.

7. Conclusion

The study has exposed a major ill with respect to the mastery of the content of secondary school mathematics curriculum by NCE mathematics teachers. That majority of these teachers are ill-equipped in terms of competence goes a long way to shed light on the persistent poor achievement profile of students in mathematics. No education system can rise above the quality of the teachers. It is hoped that with these findings and the recommendations below, appropriate steps will be taken by the relevant stake holders in education in Nigeria.

8. Recommendations

Based on the findings and implications of the study, the following recommendations are made:

1. Mastery learning technique should be introduced in Nigerian teacher production institutions. Education planners may think that the technique cannot be accommodated in our type of school system but the

benefits derivable from it are worth overhauling the system in order to accommodate it. Once this is done, the issue of competence and mastery of contents by teachers will be assured.

2. There is the need for curriculum review based on empiricism aimed at shedding off some of the hard contents of the curriculum. Research (Agashi, 2003) has shown that the geometric contents of secondary school mathematics in Nigeria are above the mental levels of the students. There may therefore be no doubt that hard content is a contributory factor to lack of mastery. The hard content can be made part of the NCE curriculum in the first and second year of the programme.
3. Closely related to the second recommendation above is the issue of reinforcing some of the secondary school mathematics contents at the NCE level since reinforcement and repetition, according to the English philosopher, Lord Marcus, has the capability to impact a deeper idea in the memory of man.

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