

An Investigation of Difficult Topics in the Senior Secondary School Mathematics Curriculum as Perceived by Student Teachers

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Abstract This study investigates difficult topics in the senior secondary school Mathematics curriculum as perceived by student teachers. The study also investigated the influence of teachers teaching experience and gender differences on their perception of Mathematics topics. The participants consisted of 30 male and 30 female students drawn from two tertiary institutions in Lagos state through stratified random sampling procedure. The relevant data were generated using Mathematics Topic Difficulty Assessment Questionnaire (MTDAQ). The instrument has a reliability of 0.87 when tested during the pilot study. Five hypotheses were formulated and tested all at 0.05 level of significance. Results obtained indicated that there exist a significant difference of teachers teaching experience and there were no significant gender differences on their perception of Mathematics topics. Based on the findings of this study, some conclusions were drawn and recommendations were made.

Keywords: *difficult topics, student teachers, gender*

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1. Introduction

Mathematics is a useful tool in the society, more so in the present technology age. No wonder Mathematics is a compulsory subject at primary and secondary school levels, though, not all the student are expected to become Mathematicians, but because of its application in everyday life [13]. For a person to be able to function very well within his immediate environment, the knowledge of rudimentary Mathematics is very necessary. Babalola [4] viewed mathematics as a basic tool in the development of science based knowledge such as technology, industry and even for sound analytical reasoning in daily living in a modern society such as ours.

The purpose of mathematics in our secondary schools curriculum cannot be over-emphasised as there is no single and all-embracing answer to what mathematics is? Mathematics means many and varied things to different people in view of its universality and diversity. It is referred to as the Language of science and technology; Queen of science: Science of counting, number, quantity and space; Study of abstractions and their relationships etc. Hornby [7] defines mathematics as the science of sizes and numbers of which arithmetic, algebra and trigonometry are branches. The encyclopedia of mathematics has it that mathematics is the science of quantitative relations and spatial forms in the real world, being inseparable connected with the needs of technology

and natural sciences. Thus, mathematics is a field of symbolic representation of ideas and relations. It can also be seen as an instrument for effecting a logical examination for the implementation of different ideas [17]. Mathematics is a subject needed at all levels of our educational system, which involves calculations and useful in everyday life. The National Policy on Education states that the broad aims of secondary education are preparation for useful living within the society and for higher education [12]. The general objectives for secondary mathematics education drawn up by the federal ministry of education are as follows to: generate interest in mathematics and provide a solid foundation for everyday living, develop computational skills, develop precise, logical and abstract thinking etc. The Nigerian mathematics curriculum is subject centered as well as student centered. It also emphasizes meeting of learner's development needs and interest. According to Ifejika [9] it is designed to produce sound and effective citizens in Nigeria. There are evidences to show that student cognitive and effective attitude falls below expectation. Concerned stakeholders have been making various efforts to ensure that these problems, which attributed to poor achievements in mathematics as well as poor attitude towards the subject, are identified and tackled effectively. Some of the key issues affecting poor performance can be detected through critical examination of students' selection of question at terminal examinations and their general performance in the question so selected. It has also been observed that students like avoiding questions in

some particular topics during examination. Another observed fact is the recurring pattern of poor performance in such topics. This was because those topics stimulate fear and anxiety on students, they are unpopular topics and require more effort and skills before one can understand and solve them [16]. Few student attempts such questions and they are usually found in part two of theory papers and carry more marks. Due to the fact that either they have not been taught the topics or their teachers have been avoiding them.

This situation calls for a planned approach which should be based on realistic diagnosis of needs, problems and solution processes. Hence, there is the need to identify the difficult topics in the senior secondary mathematics curriculum so as to ensure that corrective measures are taken to facilitate and improve performance.

2. Statement of the Problem

Empirical studies on the perception of difficult topics at the secondary and tertiary level have focus on Biology, Physics and Chemistry [10,14,15]. This present study focuses on student teachers' perception of difficult topics in both junior and senior Secondary School mathematics Curriculum.

Researchers have noted that some topics are not too easy to teach by teachers due to its demanding and abstract nature. These are topics which the students also finds difficult to understand. This topics have the following characteristics: they are hard to understand by most students; they require more effort and skills before one can understand and solve them; they exist in both senior and junior secondary; such topics stimulate fear and anxiety on students; they are unpopular topics; students do not find examination in those topics easy to solve, few students attempt such questions; the few that attempt them usually score low; high achiever in mathematics experience a little difficulty in solving questions on such topics when compared with other topics;

Students are prone to various errors in solving such topics; they consist mostly of abstract topics; they are usually found in part two of the theory paper and carry more marks and are usually responsible for the general poor performance in mathematics and if properly taught students will discover that they are not difficult as they suppose. These difficult topics can be regarded as skipped topics because of the following reasons: some teacher omits teaching the topics deliberately because they

themselves do not understand them; some of those who venture to teach it may leave it in a hurry and teach only the rudiment aspect; they fail to teach students how to solve questions relevant to the topics. Students run away from attempting questions set on such topics especially if given a choice. It is essential that these difficult topics should be identified so that the way of making them easy for students will be evolved. The study thus focuses on investigation of the problems highlighted and how to find appropriate remediations. Hence, the need for the study.

3. Research Hypotheses

The following research hypotheses were tested in this study:

1. There is no significant difference in the difficulty level of mathematics topics in senior secondary Mathematics Curriculum as perceived by student teachers.
2. Student teachers teaching experience does not have significant influence on their level of perception of the difficult topics.
3. There is no significant gender difference in student teachers' perception of difficult topics in Mathematics.
4. The nature of the schools attended by Mathematics student teachers does not have a significant influence on their perceived difficulty levels of the topics.
5. The subject combination of student teachers does not have any significant influence on their perceived difficulty levels of the topics.

4. Research Methodology

The study was a descriptive survey. The population for the study consisted of all student teachers who were pursuing Sandwich Degree Programme in two tertiary institutions. Sixty (60) mathematics students in the 2012 contact session participated in the study. The students in the sample were holders of the National Certificate in Education (NCE) In Mathematics/Chemistry (Mth/Che), Mathematics/Physics (Mth/Phy), Mathematics/Computer (Mth/Comp), Mathematics/Integrated Science (Mth/Int), Mathematics/Economics (Mth/Eco), Mathematics/Geography (Mth/Geo). The Table 1 below shows the sample according to school attended, gender and subject combination of the student teachers.

Table 1. Number of Respondent in the Subject Combinations

| S/N | School Attended | Male | Female | Mth/Geo | Mth /Eco | Mth/Phy | Mth /Chm | Mth/Int | Mth/ Comp |
|-----|-----------------|------|--------|---------|----------|---------|----------|---------|-----------|
| 1 | State COE | 14 | 19 | 2 | 16 | 5 | 6 | 1 | 3 |
| 2 | FCE | 16 | 11 | 1 | 10 | 5 | 5 | 3 | 3 |

5. Instrumentation

The only instrument used to collect data for the study was the Mathematics Topic Difficulty Assessment Questionnaire (MTDAQ). Section A of the questionnaire was on bio-data information such as gender teaching experience, name of the school attended and qualifications. Section B consisted of 13 specific topics in the NECO/WASSCE syllabus covering trigonometry, algebra

and statistics. The MTDAQ has high internal consistency with an alpha of 0.87 and split half reliability of 0.84 when tested during the pilot study. The 30 item questionnaire was a 4 point likert scale and respondents were asked to respond by ticking the appropriate response in order to indicate their preferences.

6. Validation of Instrument

The research instrument was validated by two experienced Mathematics teachers from Federal

Government College, Ijanikin Lagos and experts in Test and Measurement from the Department of Educational Foundations, University of Lagos.

7. Data Analysis

The sixty (60) student teachers completed the questionnaire and the data obtained were subjected to appropriate statistics. The difficulty of a particular topic is determined by the value of mean as follows:-

Mean less than 1.5 ($1.0 < x < 1.5$) ---→ Easy

Mean between 1.5 and 3 ($1.5 < x < 3$) --→ Difficult.

To determine whether gender difference, teaching experience and the school attended influence teachers' perception of difficult topics, the data was subjected to mean, standard deviation, variance and t-test statistics. To determine the influence of teachers' teaching experience on perceived difficulty levels of topics, teachers with less than five years teaching experience were regarded as less experienced (LE) while those with five years and above were classified as highly experienced (HE). Students' T-test statistics was used to determine the influence of gender difference on teaching experience and perception of difficulty levels in Mathematics topics. To determine whether subject combination influence student teachers' perception of Mathematics topics, the data was subjected to Mean and ANOVA statistics. The result is displayed in Table 2 below.

8. Results

Table 2. Mean of Teacher's Perception of Difficulty of Mathematics Topics

| S/N | Mathematics | Mean value |
|-----|--------------------------------------|------------|
| 1 | Trigonometry | 1.57 |
| 2 | Mensuration | 1.60 |
| 3 | Probability | 1.85 |
| 4 | Statistics | 1.75 |
| 5 | Arithmetic and Geometric progression | 1.90 |
| 6 | Longitude and Latitude | 1.82 |
| 7 | Graphs and inequalities graph | 1.46 |
| 8 | Bearing and Distances | 1.57 |
| 9 | Construction | 0.97 |
| 10 | Sets theory | 1.23 |
| 11 | Circle Geometry | 1.41 |
| 12 | Numbers and numerations | 2.15 |
| 13 | Algebraic process | 1.30 |

From the table, number and numerations has the highest mean value of 2.15, followed by arithmetic and geometric progressions of 1.90 and the least mean score was 0.97 (construction). it shows number & numeration at 0.05 level of significant was found to be the most difficult topic, followed by arithmetic & geometric progression, longitude & latitude while construction was seen as the cheapest topic in both junior and senior secondary, followed by sets theory and algebraic theory.

Table 3. t-test to show influence of Teaching Experience on Perception of Mathematics Topics.

| Variable | N | X | S.D | S ² | d.f | t-cal | t-table | P |
|--------------------|----|------|------|----------------|-----|-------|---------|---|
| Highly experienced | 23 | 1.35 | 0.95 | 0.90 | 58 | 2.35 | 1.67 | S |
| Less experienced | 37 | 2.12 | 1.83 | 3.35 | | | | |

Table 4. t-test to show Gender Difference on Perception of Mathematics Topics

| Variable | N | Mean | S.D | S ² | d.f | t-cal | t-table | P |
|----------|----|------|------|----------------|-----|-------|---------|----|
| Male | 30 | 1.62 | 0.98 | 0.16 | 58 | 1.52 | 1.67 | NS |
| Female | 30 | 1.19 | 1.32 | 1.74 | | | | |

Table 5. t-test to Show Perception of Mathematics Teachers that Attended Federal and State Colleges of Education

| Variable | N | Mean | S.D | S ² | d.f | t-cal | t-table | P |
|-----------|----|------|------|----------------|-----|-------|---------|---|
| FCE | 27 | 1.95 | 0.86 | 0.74 | 50 | 1.46 | 1.67 | S |
| STATE COE | 33 | 2.01 | 0.95 | 0.90 | | | | |

Table 6. ANOVA Showing Influence of Subject Combination on Teachers Perception of Mathematics Topics

| Variable | N | Mean | D.F | S.S | M.S | f-cal | f-tab | P |
|----------|----|------|------|-------|------|-------|-------|---|
| Chm/Mth | 11 | 24 | 4.55 | 181.7 | 67.4 | 2.70 | 2.53 | S |
| Mth/Phy | 10 | 23 | | | | | | |
| Comp/Mth | 6 | 21 | | | | | | |
| Mth/Int | 4 | 16 | | | | | | |
| Mth/Geo | 3 | 17 | | | | | | |
| Mth/Eco | 26 | 20 | | | | | | |

Table 6 shows the ANOVA test result carried out to verify the significant difference of subject combination on teachers' perception of mathematics topics.

9. Findings

1. The teachers perceived 8 topics in the senior secondary Mathematics curriculum as difficult topics to teach. These topics are: trigonometry, mensuration, probability, statistics, arithmetic & geometric progression, longitude & latitude, bearing & distances and numbers & numerations. These are topics that have mean value of 1.50 & above.
2. The teachers' teaching experience has significant influence on their perception of the difficulty levels of the Mathematics topics
3. Gender does not significantly influence the perception of student teachers on the difficulty levels of the Mathematics topics.
4. The type of school attended by student teachers does not significantly influence their perception on the difficulty levels of the mathematics topics.
5. Student Teachers' subject combination significantly affects the perception of difficulty levels of the Mathematics topics.

10. Discussion of the Findings

The outcome of this study revealed that Mathematics student teachers perceived about half of the senior secondary Mathematics topics as difficult to teach (Table 2). Perhaps the low performance of Mathematics students at the WASSCE cannot be surprising since teachers can only teach what they know. Table 3 shows the influence between teachers' teaching experiences on perception of difficult topics in senior secondary Mathematics curriculum. The t- calculated (2.35) obtained is higher than t-critical (1.67) at 0.05 level of significance. It implied then that, the teaching experience of the teachers

influenced their perception of mathematics topics. These findings are in line with an adage that says "experience is the best teacher".

Table 4 shows that there is no significant gender difference in student teachers perception of Mathematics topics. The t-calculated (1.52) is lower than the t-critical (1.671) at 0.05 level of significance. The findings of this study are in line with those of Adedayo [1] and Adeleke [2] who found that gender difference of the teachers does not influence their perceptions of difficult levels of topics in Mathematics. Table 5 shows the perception of teachers that attended Federal and State Owned Colleges of Education on Mathematics topics. The t-calculated (1.46) is lower than t-critical (1.67) at 0.05 level of significance. The study showed that the type of school attended by student teachers (State COE or FCE) had no influence on their perception of Mathematics topics. Table 6 shows the influence of subject combinations on perception of Mathematics topics. The F-calculated (2.70) is greater than F-critical (2.53) at 0.05 level of significance. The study showed that student teachers' subject combinations influence their level of perception of Mathematics topics. The findings on mathematics topics mostly disliked by the majority also corroborate the WAEC chief examiner's [20] reports. The report showed that majority of the candidates avoided questions on geometry, bearing, and trigonometry, longitude and latitude since they are imaginary lines that are not vestry. Students' dislike could be as a result of the abstract nature of topics. For instance many students might find it difficult to understand the concept feasible in the real sense. Also, to effectively learn some of this disliked topic effectively, students need to possess mathematical tools which many students do not have. Preference for learning activities that are less tasking could serve to explain why student dislike some topics in mathematics such as geometry, bearing and trigonometry.

Gender is found not to be impacting on students' preference for mathematics topics. These findings corroborate with the view of Mangal [11] Rao, Moely, & Sachs [16]; Zimmerman [21]; Huit [8]; Sadker & Sadker [18] that sitting in same classroom, reading the same textbook, listening to the same teacher, boys and girls perceive thing same ways. The findings also support the position of Honey and Hawkins [6] that female and male perceived mathematics in related topics in related manners.

11. Recommendations

The following recommendations are proffered

1. There is the need for the NCE and degree Mathematics curriculum to be reviewed by NCCE and NUC. More O level topics should be included in the reviewed curriculum review, as a way to reduce the difficulties being experienced by student teachers.
2. Mathematics teachers should be encouraged to attend seminars, workshops and conferences so as to expose them to new findings in Mathematics.
3. Mathematics teachers and teachers in training should re-double their efforts in the teaching of Mathematics topics to ensure coverage of syllabus and its application so as to demystify the topics
4. Professional bodies like Mathematics Association of Nigeria (MAN) and National Educational Research

Development Council (NERDC) should come with recommended textbooks in Mathematics that will assist teachers to overcome the difficulties they experience in the teaching of Mathematics.

5. Mathematics teachers are encouraged to do frequent revision exercises with their students in order to enhance student's mastery/retention of various knowledge and skills gains in previous lessons.

12. Conclusions

Based on the findings and discussion it would therefore be concluded that Mathematics teachers perceived that about half of the mathematics topics were difficult. The study revealed that teachers' teaching experience influence their perception of mathematics topics while gender difference of the teachers has no influence on teachers' perception of Mathematics topics.

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