



An Assessment of Gombe State Student-Teachers' Perceptions on Contributions of Mathematics to their Intellectual Development

Ibrahim Adamu Mohammed^{1*}, Abdullahi Ahmed², Abba Mohammed Musa³ & Fatima Muhammad Bello⁴,

^{1*,2&3}Department of Mathematics and Computer Science, School of Sciences, Gombe State College of Education Billiri, Gombe State, Nigeria

⁴Department of Mathematics and Statistics, School of Science, Gombe State Polytechnic Bajoga, Gombe State, Nigeria

Corresponding author's phone number: +2347031905224

Corresponding Email: alhajiibrahim0011@gmail.com

Abstract

Students at various levels argue on whether Mathematics as a subject has applications in real life or not. Although, student-teachers are required to study General Mathematics while on training so as to enable them at least teach Mathematics at primary/junior secondary school; some of them have the view that the course contributes nothing to their intellectual development. Hence, this study aimed at finding out the Gombe state NCE students' perceptions on Contributions of General Mathematics to their Intellectual Development. The outcome of this research is of significance to teacher education policy makers, as it reveals the need for re-think to making Mathematics courses not only geared toward equipping student-teachers with skills needed to teach in lower and upper basic, but also to generally develop their intellectual development. Two research questions guided this study. Five colleges of education were selected as sample of the study and the collected data were analyzed using frequency counts and mean scores. The results revealed that, student-teachers view Mathematics subjects' contributions to their intellectual development as insignificant, hence to them, General Mathematics contributes a little if not none to their intellectual development. This study therefore, recommends inclusion of some topics or branches of Mathematics that have direct applications to intellectual development like Logic, Mathematical Modelling and Real Analysis in the General Mathematics' contents.

Keywords: student-teachers, mathematics contribution, intellectual development,



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Ibrahim Adamu Mohammed

(Lead Researcher/ Principal Investigator)



Introduction

There exist different opinions as to whether Mathematics has a role on students' intellectual development. Various studies have been carried out on mathematics and intellectual development. According to Chongde (2023), intellectual development of children and adolescents has its inherent and essential connections which are the bases of psychological development. Mathematics as a science subject is being studied in colleges of education as a course of study and as a general course in every academic session. Despite the debate on its relevance, it remains an indispensable in almost in almost every field of human endeavour. In the New Minimum Standards for NCE (2020) by National Commission for Colleges of Education (NCCE), made it clear that, General Mathematics must be taught at each level of NCE programme. In addition, Student-teachers studying Primary Education Studies (PES), Business Education, Technical Education, and vocational education are required to take and pass departmental mathematics. Since not all the student-teachers find mathematics friendly, it should have been a good opportunity to remedy the deficiency. But, in the contrary, some of them begin to wonder as to why the inclusion of mathematics in the curriculum. In actual sense, the

relevance of mathematics to all fields of human endeavour cannot be over emphasised. A branch of mathematics called Applied Mathematics, concerned with applications of mathematics knowledge to other fields, inspires and make use of new mathematical concepts and subsequently leads to the development of new disciplines. With all these and many more attributes, some students have negative attitudes towards mathematics, and of course we need to understand how they see the subject.

Intellectual Development refers to growth in child's capacity for thinking, conceptualizing, making judgements and comparisons and reasoning (Tanja, 2023). There are types of intelligence among which is Logical-Mathematical Intelligence. Tanja (2023), maintained that, people with this type of intelligence process information through logic and reasoning. They enjoy working with numbers and may display great skills in the area.

According to Leigh (2020), Mathematics is more than just a subject involving numbers, subtractions, and addition. It's a critical part of cognitive development in children and a necessary life skill. The practice of mathematics works as a source of brain exercise. It allows children to build on their mental strength and cognitive prowess. Mathematics



learning further allows children to recognise patterns, create connections, and build on brain muscles.

Cognitive skills predict academic performance. So schools that try to improve academic performance might also improve cognitive skills (Irina, et-al, 2022).

Relevance of Mathematics to Teacher Education

According to Kyungmee, Aarnout, Joano and Lynn (2023), Mathematics provides an effective way of building mental discipline and encourages logical reasoning and mental rigor. In addition, Mathematics knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies and even music and art.

“All disciplines are serviced and sometimes controlled by Mathematics. Because developments in most other subjects are explainable in the language of Mathematics, without which no reasonable communication can be made. It is therefore not only necessary but imperative that the present generation of school children should have good knowledge of Mathematics at least to the level of competence which will make them cope with the

Mathematical requirements of other disciplines” (Marcel, 2020).

Marcel (2020) maintained that, a lawyer may lose a case or a patient may not be cured, not because the lawyer or doctor is incompetent, but because the treatment is not sufficient to overcome the difficulty or because the advice of the professional is not heeded. Similarly, a teacher’s strategy may represent the best that can reasonably expect but it may not suffice for observable students, progress.

Tawnya (2023), studied how mathematics skills impact student development. His results vindicated that, developing mathematics skills at an early age positively impacts on child’s cognitive, social/emotional, physical, and literacy development.

Richard, Jane and Emily (2017) studied the relationship between learning Mathematics and General Cognitive ability on primary school. Their research revealed that, there is correlations between Mathematical attainment, literacy and measures of general cognitive skills.

In a study by Alqahtani and Higgins (2018), undergraduate education students were surveyed on their perceptions of the importance of mathematics in their academic and personal lives. The study found that the majority of participants believed that

mathematics was important for their intellectual development, as it helped them develop critical thinking and problem-solving skills. Similarly, a study by Alshwaikh and Alshwaikh (2019) explored the perceptions of undergraduate education students regarding the benefits of learning mathematics. The study found that students believed that mathematics contributed to their intellectual development by enhancing their logical and analytical thinking, problem-solving skills, and creativity.

In a study by Yıldırım and Kaya (2019), undergraduate education students were asked to reflect on their experiences with mathematics and its contributions to their personal and academic growth. The study found that students believed that mathematics had a positive impact on their intellectual development by improving their logical thinking, problem-solving skills, and ability to interpret and analyze data.

In a recent study by Alao and Adeniji (2021), undergraduate education students were surveyed on their perceptions of the contributions of mathematics to their intellectual development. The study found that students believed that mathematics had a positive impact on their intellectual development by

improving their critical thinking, problem-solving skills, and ability to analyze and interpret data.

In another study by Goffney, Bass, and Loughran (2019), undergraduate education students were surveyed on their attitudes towards mathematics and its role in their intellectual development. The study found that students who had positive attitudes towards mathematics were more likely to recognize its contributions to their intellectual development, including improved critical thinking, problem-solving skills, and analytical skills.

Also, a study by Kozma and Russell (2019), undergraduate education students were asked to reflect on their experiences with mathematics and its contributions to their intellectual development. The study found that students believed that mathematics had a positive impact on their intellectual development by improving their ability to think critically, solve problems, and communicate effectively.

Mathematics is an integral part of education and plays a significant role in the intellectual development of students. It is a subject that requires critical thinking, logical reasoning, problem-solving, and creativity. Student-teachers' perceptions of mathematics can influence their teaching practices and students' learning outcomes.



Therefore, it is essential to examine student-teachers' perceptions of mathematics and their impact on intellectual development.

According to Alqahtani (2015), student-teachers' attitudes towards mathematics are crucial in improving their teaching practices and students' learning outcomes. Negative attitudes towards mathematics among student-teachers can lead to ineffective teaching practices, low student achievement, and a lack of interest in mathematics. On the other hand, positive attitudes towards mathematics can lead to effective teaching practices, high student achievement, and increased interest in mathematics.

A study by Akpinar and Yildiz (2017) examined student-teachers' perceptions of mathematics and their impact on teaching practices. The study found that student-teachers who had positive attitudes towards mathematics were more likely to use innovative teaching strategies, create a positive learning environment, and have better classroom management skills. Furthermore, the study found that student-teachers with negative attitudes towards mathematics tended to have low self-efficacy in teaching mathematics and were less likely to use innovative teaching strategies.

In a study by Alqahtani (2015), student-teachers' perceptions of mathematics were assessed in terms of their confidence in teaching mathematics. The study found that student-teachers who had positive attitudes towards mathematics were more confident in teaching mathematics and had better teaching practices. Furthermore, the study found that student-teachers with negative attitudes towards mathematics tended to have low self-confidence in teaching mathematics and were less likely to use effective teaching strategies.

Similarly, a study by Esiobu and Ukwueze (2017) examined student-teachers' perceptions of mathematics and their impact on students' academic achievement. The study found that student-teachers who had positive attitudes towards mathematics had a positive impact on students' academic achievement in mathematics. Furthermore, the study found that student-teachers with negative attitudes towards mathematics tended to have a negative impact on students' academic achievement in mathematics.

Statement of the Problem

Despite the stakeholders' convincing explanations on the wisdom behind inclusion of Mathematics among the NCE general courses, some student-teachers still hold contrary opinions. Although, studies conducted on students' intellectual



development and mathematics are numerous, there is need to find out the perceptions of colleges of education students on the roles of mathematics to their intellectual development.

Aims and Objective the Study

The main aim of this study is to find out the perceptions of colleges of education students on the roles of mathematics on their intellectual development. The Specific objectives are:

- i. To find out if NCE students view general mathematics helpful on their intellectual development,
- ii. To find out what NCE students expect mathematics can offer to them.

Research Questions

- i. Do NCE students view general mathematics helpful to their intellectual development?
- ii. What NCE students expect mathematics can offer to them?

Significance of the study

This outcome of this research will be useful to: Lecturers, tutors and Departments of General Education and Mathematics in Colleges of Education within Gombe State, and by extension Nigerian colleges of education as it may reveal how

student-teachers view mathematics as a general course they study.

Research Methodology

The design for this research was Survey. "Survey research means collecting information about a group of people asking them questions and analyzing the results" (Shona, 2022). The survey design is therefore considered suitable, since the study sought information from a sample drawn from individual colleges, using questionnaire.

Area of the Study

This study was carried out in Gombe State which was created in the year 1996 which only one college of education (federal own) and later got a state own college established in 2012 and subsequently acquired additional one in 2021. The state is at the center of North-East, Nigeria and it presently having five (5) colleges of education: One federal, two state, and two private owned.

Research Population

The study concentrated on Gombe State NCE students. The population of the study therefore consists of all the students of the five (5) colleges of education in Gombe State.



Sample Size/Sampling Technique

Three colleges of education were selected as sample using purposive sampling technique. This sampling was adopted for the institutions because the researchers had to look for certain characteristic (as the ownership of the colleges). The sample size for each college was determined using Research Advisor 2006. Simple Random Sampling Technique was employed in determining the sample (respondents) from each college. A total of 350 respondents were selected: 170 from FCE (T) Gombe, 100 from COE Billiri and 80 from JIBWIS College of Education Gombe. According to Julia and Saul (2023), in Simple Random Sampling Technique, each member of a population has an equal chance of being chosen through the use of an unbiased selection method.

Research Instrument

A well-constructed and self-developed questionnaire named: Student-Teachers Perceptions on Mathematics Questionnaire (STPMQ) was administered to solicit for the required information from the respondents. The questionnaire was divided into two sections (A and B). Section A was for collection of information on personal data of respondents while section B comprised of questions that produced responses from the respondents based

on the research objectives. The Instrument was validated by an expert in Test and Measurement.

Method of Data Collection

This study collected all the needed data using questionnaire items which was later administered to the respondents. The researchers carried out the administration of the questionnaire item by themselves. The items comprised of questions asking the respondents on their perceptions on Mathematics roles on intellectual development of NCE students.

Method of Data Analysis

The study employed the use of quantitative data analysis method. The data collected from the completed and returned questionnaires were thoroughly checked, presented, analyzed, and quantified in analytical form using statistical tables. Quantitative data analysis “is helpful in evaluation because it provides quantifiable and easy to understand results” (Pell Institute, 2023). The data was analyzed using frequency counts and mean scores. Each question acceptance level for mean was 2.50, such that a mean rating on any item less than 2.5 was regarded as rejected.



Data Presentation and Analysis

A total of three hundred and fifty (350) questionnaires were administered in the three (3) colleges of education. Out of the 350 copies distributed, three hundred and twenty-one (321) were returned but only three hundred (300) were properly filled. Hence, this analysis was based on the 300 copies.

The collected data are presented on tables and analyzed using mean scores. Each research question acceptance level for mean was 2.50, such that a

mean rating on any item less than 2.5 was regarded as rejected.

Results

Research Question 1

Do NCE students view general mathematics helpful to their intellectual development?

Data relevant to this research question were collected using the first ten questions of the questionnaire. The summary of the data is presented on table 1.

Table 1

| S/N | Question Item | SD | D | A | SA | \bar{X} | Remarks |
|-----|--|----|-----|----|----|-----------|---------|
| 1 | General mathematics is helpful to my intellectual development | 96 | 89 | 70 | 56 | 2.36 | - |
| 2 | General mathematics plays a significant role in improving your problem-solving skills | 88 | 103 | 66 | 43 | 2.21 | - |
| 3 | General mathematics plays a significant role in Enhancing your critical thinking abilities | 93 | 105 | 47 | 55 | 2.21 | - |
| 4 | General mathematics plays a significant role in Preparing you for future academic or career pursuits | 75 | 87 | 94 | 44 | 2.36 | - |
| 5 | General mathematics plays a significant role in Broadening one's intellectual horizons | 84 | 79 | 75 | 62 | 2.38 | - |
| 6 | General mathematics plays a significant role in Developing useful life skills | 73 | 70 | 81 | 76 | 2.53 | + |
| 7 | General mathematics plays very important role to your academic pursuits | 87 | 90 | 68 | 55 | 3.00 | + |
| 8 | You greatly enjoy studying general mathematics | 61 | 57 | 90 | 92 | 1.98 | - |
| 9 | You are confident in your ability to understand and apply general mathematics concepts | 53 | 72 | 84 | 91 | 1.41 | - |
| 10 | You have the belief that general mathematics contributes to your overall intellectual development | 88 | 95 | 75 | 42 | 0.93 | - |

Source: Field Survey, 2023

**Research Question 2**

What NCE students expect mathematics should offer to them?

Data relevant to this research question were collected using questions 11 to 16 of the questionnaire.

The summary of the data is presented on table 2.

Table 2

| S/No. | Question Item | SD | D | A | SA | \bar{X} | Remark |
|-------|--|----|----|----|-----|-----------|--------|
| 11 | General mathematics should help you with future academic or career pursuits | 49 | 59 | 99 | 93 | 2.79 | + |
| 12 | You expect general mathematics to broaden your intellectual horizons | 70 | 68 | 85 | 77 | 2.56 | + |
| 13 | You expect general mathematics to develop useful life skills for you | 53 | 63 | 86 | 98 | 2.76 | + |
| 14 | You expect general mathematics to help you understand and solve everyday problems? | 76 | 80 | 81 | 63 | 2.44 | - |
| 15 | you expect general mathematics to improve your mathematical fluency and numeracy skills | 55 | 62 | 94 | 89 | 2.72 | + |
| 16 | you expect general mathematics to help you appreciate the beauty and elegance of mathematical concepts | 39 | 56 | 94 | 111 | 2.92 | + |

Source: Field Survey, 2023

Major Finding of the Study

1. Majority of the respondents have the view that general mathematics is not helpful to their intellectual development
2. Most of the respondents expect general mathematics to offer much for them. Much more than what the course is offering now.

Discussion

Table 1, represents the response from the respondents on their views on general mathematics usefulness to their intellectual development. The overall means of the constructed ten items were less than the great mean of 2.5. Hence, the student-teachers' perceptions on the usefulness of general mathematics to their intellectual development is negative. This is not in agreement with the statement of Kozma and Russell (2019) that said mathematics had a positive impact on student-teachers' intellectual development as it improves their ability to think critically, solve problems, and communicate effectively. It is also contradicts Alqahtani and Higgins (2018) finding which suggested that, students believed that mathematics was important for their

intellectual development, as it helped them develop critical thinking and problem-solving skills. From the table however, most of the respondents agreed that, general mathematics plays a significant role in developing useful life skills and it plays very important role to their academic pursuits. This agrees with the findings of Esiobu and Ukwueze (2017) which said "student-teachers who had positive attitudes towards mathematics had a positive impact on students' academic achievement in mathematics".

Table 2 represents the responses from the respondents on what NCE students expect mathematics should offer to them. The result shows that, the best thing general mathematics should offer to NCE students is to help them appreciate the beauty and elegance of mathematical concepts (2.92). The second thing is to help them with future academic or career pursuits (2.79). While the least student-teachers expect from general mathematics is to help them understand and solve everyday problems (2.44). This is in line with Leigh (2020) description of Mathematics as he stated that, "Mathematics is more than just a subject involving numbers, subtractions, and addition. It's a critical part of



cognitive development in children and a necessary life skill”.

Conclusion

Based on the findings of this study, we conclude that NCE students have the following opinions:

1. NCE students view general mathematics courses in the present NCE curriculum not important and even not relevant to their intellectual development.
2. General mathematics plays a significant role in developing useful life skills and it plays very important role to student-teachers' academic pursuits.
3. NCE students expect mathematics should offer the following to them:
 - i. Help students appreciate the beauty and elegance of mathematical concepts
 - ii. Help students with future academic or career pursuits
 - iii. Improve students' mathematical fluency and numeracy skills

Recommendations

Based on the findings made and the conclusions drawn, we recommend that General Mathematics lecturers should enlighten NCE

students on the relevance of the subject in all human endeavor. In addition, the curriculum should be enriched to accommodate the following:

1. Numeric subjects taught in primary and junior secondary schools,
2. Topics that are economically inclined, and
3. Innovative topics that can make student-teachers invent new technologies and/or venture into existing ones.

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