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## RELATIONSHIP BETWEEN TEACHERS' CONTENT KNOWLEDGE AND STUDENTS' ACHIEVEMENT IN MATHEMATICS AMONG SENIOR SECONDARY STUDENTS IN JIGAWA STATE, NIGERIA

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### Abstract

This research determined the "Relationship between teachers' content knowledge and students' achievement in mathematics among senior secondary students in Jigawa State, Nigeria." A correlational research design was used for this study. The population of the study comprised 204 senior secondary schools, 217 mathematics teachers and 25,946 students. A Simple random sampling technique was used to select three education zones in which 24 mathematics teachers and 120 students participated in the study. Two research questions were asked and two null hypotheses were formulated and tested at 0.05 levels of significance. Two instruments namely; Teachers' Content Knowledge Test

(TCKT) and Students Mathematics Achievement Test (SMAT) were used to collect data for the study. Pearson Product Moment Correlation and independent t-test were used for data analysis. The findings revealed a significant positive relationship between teachers' content knowledge and students' achievement in mathematics, while no significant gender relationship was found in students' achievement. The study recommended that teachers with professional qualification(s) at higher level should be recruited to teach Mathematics in the senior secondary schools.

**Keywords:** Relationship, Content Knowledge, Achievement and Mathematics

### Introduction

Mathematics is primarily concerned with ideas, processes and reasoning leading to the solution of problems. It is widely recognized as a necessary tool for achieving the

development goal of any society. This is because the development of any nation depends on her scientific and technological advancements. However, there can be no

science and technology without Mathematics (Shittu, 2020).

Achievement in Mathematics in public examination in Nigeria has not been found to be encouraging (Azuka, 2018). According to Azuka (2018), the result of Nigerian students in mathematics west African senior secondary certificate examination for 2020, 2021 and 2022 for Nigeria as published by WAEC office which are 39%, 52% and 59% respectively representing the percentage pass at credit level in mathematics. In another development, the WAEC result for 2023 as released by the chief examiner was just little above 40%. These persistent poor performances in Mathematics call for a concerted effort in alleviating the problems causing this poor performance.

Factors influencing student's achievement have been of interest to Education providers especially those keen to produce knowledgeable and skillful graduates that can contribute to the social and environmental landscape. Ascertaining the factors governing the academic achievement of students is a challenging task as this is a product of

psychological, social-economic and environmental factors. Several studies, established that students' academic achievement is highly influenced by teachers' content knowledge.

The term content knowledge refers to the body of knowledge and information that teachers teach and the students are expected to learn in a given subject. Curriculum content is usually interpreted to mean curriculum aligned with the content standard prepared by the Federal Ministry of Education (FME, 2014).

It is traditionally accepted that for any effective teaching, the teacher should have both the content knowledge and the pedagogy. Teachers' knowledge about the subject matter to be learned or taught and that of content to be covered, the curriculum is very important and when applied well will promote effective teaching and learning. A thorough grounding in college-level subject matter and professional competence in professional practice are necessary for good teaching as it is an essential of creating independent, reflective learners who can plan and assess

their own progress (Bordoh, Bassaw & Eshun, 2018).

On gender issues, the low number of women in scientific professions has become a national concern. It has been proposed that the attitude of girl toward Mathematics is one factor that influences their lack of participation in science related careers. This concern has resulted in a variety of studies designated to identify gender differences that could affect the number of girls in the scientific pipeline (Shittu, 2020).

### **Statement of the Problem**

Achievement in mathematics in public examination in Nigeria has not been found to be encouraging, this persistent poor performance in mathematics calls for a concerted effort in alleviating the problems causing this poor achievement. The result of Nigerian students in Mathematics west African senior secondary certificate examination for 2015 to 2022 as published by WAEC office are 24.94%, 38.93%, 38.81%, 36.57%, 39.28%, 53.31%, 59.41%, 49.13% respectively representing the percentage pass at credit level in Mathematics.

This is consequent upon the fact that without a credit pass in Mathematics learners will not be able to proceed to higher educational institutions where highly skilled work force in sciences, Technology and Engineering for today's global economy are produced.

Although there were several studies carried out in order to alleviate the poor performance in Mathematics but still the poor performance persists. The major concern of the present study was therefore, to investigate the Relationships between teachers' content knowledge and students' achievement in mathematics among senior secondary students in Jigawa State, Nigeria.

### **Objectives of the Study**

The specific objectives of the study were to:

1. determine the relationship between teachers' content knowledge and students' academic achievement in mathematics.
2. find out whether there is a relationship between the achievement of male and female senior secondary school students in mathematics.

## Research Questions

The study had the following research questions:

1. What is the relationship between teachers' content knowledge and students' achievement in mathematics?
2. What is the relationship between the mean achievement scores of male and female students in mathematics?

## Statement of Hypotheses

In this study, the following null hypotheses were tested at 0.05 level of significance.

**HO<sub>1</sub>:** There is no significant relationship between teachers' content knowledge and students' achievement in mathematics.

**HO<sub>2</sub>:** There is no significant relationship between the mean achievement scores of male and female students in mathematics.

## Literature Review

A study conducted by Emmanuel, (2016) investigated effects of teachers' content knowledge and pedagogical skills on achievement in mathematics among secondary schools' students in Kaduna State, Nigeria. He sampled 4 senior secondary

schools consist of 480 students and 70 teachers. Data collected through the use of instrument Teaches' Content Knowledge (TCK) achievement test were analysed (t-test) in line with hypothesis of no significant difference between students mean achievement, teachers' content and pedagogical knowledge in mathematics. The result revealed that students under good content knowledge teacher were significantly better than students under less content knowledge teacher.

Adedoyin (2011) in his study investigated the perception of junior secondary school students on the impact of teachers in depth pedagogical mathematics content knowledge in relation to their academic achievement in mathematics. The study sample consisted four hundred and fifty (450) selected junior secondary school 3 (JSS3) students from Botswana, out of which three hundred and twenty-five (325) students responded to the questionnaire. The questionnaire developed consisted of 40 statements on teacher in-depth mathematical pedagogical content knowledge. The responses of the

questionnaire were amassed using one sample t-test to test for significant effect of teachers' pedagogical content knowledge on their academic achievement in mathematics. The finding revealed that JSS students perceived that mathematics teachers' in-depth pedagogical content knowledge has an impact on their academic achievement. The researcher recommended that teachers training colleges' education should incorporate in their curriculum in-depth mathematics pedagogical content knowledge for mathematics teachers in order to be effective in classroom and thereby improving Botswana junior secondary school students learning outcomes and academic achievement in mathematics.

Although several studies have investigated the effect of teachers' content knowledge on students' achievement, few studies have focused on establishing the nature of the relationship between teachers' content knowledge and students' achievement using correlational approach, particularly in Jigawa State. This study therefore sought to fill this gap.

## **Methodology**

The study adopted a correlational research design using survey methods. This design was considered appropriate because it enabled the researcher determining the relationship between teachers' content knowledge and students' achievement in mathematics without manipulating any variable.

The population of the study comprised all senior secondary schools mathematics teachers and year three students of public senior secondary three (SSIII) students. Jigawa State is situated in the North West geopolitical zone of Nigeria. It has twenty-seven (27) local government areas, three senatorial zones comprising Jigawa North-West, North-East and South-West. There are nine (9) Education zones in the states. Data from Jigawa state ministry of Education shows that there are 204 senior secondary schools in the state with a total of 217 mathematics teachers and 25,946 senior secondary three (SS3) students in which 16,394 male and 9,552 female students at the time of visit.

A random sampling techniques involving balloting was used in selecting three education zones out of the total nine education zones, the selected zones include Hadejia, Ringim and Kafin Hausa education zones. 12 coeducation schools were selected and the population sample of the teachers was drawn from the twelve senior secondary schools selected from the three sampled education zones which include Hadejia zone, Ringim zone and Kafin Hausa zone. Mathematics teachers in the selected school formed the study sample which gave the total number of twenty-four (24) senior secondary schools Mathematics teachers.

Two instruments used for data collection for this study were: Teachers' Content Knowledge Test (TCKT) and Students' Mathematics Achievement Test (SMAT). The instruments were given to the two experts (Professors) in the Department of Science Education, Ahmadu Bello University, Zaria for validation.

The reliability of the instruments (TCKT and SMAT) was found by administering the test after the interval of two weeks. The scripts have been marked and the scores were used to calculate the reliability coefficient. The results of the test were compared using Pearson Product Moment Correlation (PPMC) with value of  $r=+0.71$  and  $r=+0.73$  respectively.

## Result

### Research Question One

What is the relationship between teachers' content knowledge and students' achievement in mathematics?

**Table 1: Relationship Between Mean Achievement Scores and Standard Deviation of Teachers' Content Knowledge and Students' Achievement in Mathematics**

Variable	No.	Mean	Std. Dev.	Mean Dif.
Teachers' Content Knowledge	24	55.08	18.41	
Students' Achievement	120	30.94	9.36	24.14

Table 1 shows that the teachers content knowledge had a mean score and standard deviation of 55.08 and 18.41, the students' achievements had a mean score and standard deviation of 30.94 and 9.36, the with the mean differences of 24.14.

### Null Hypothesis One

**HO<sub>1</sub>:** There is no significant relationship between teachers' content knowledge and students' achievement in mathematics.

**Table 2: Result of Pearson Product Moment Correlation Between Teachers' Content Knowledge and Students' Achievement**

Variable	N	Mean	Std. Dev.	r-cal	p-value
Students Achievement	120	30.94	9.36	0.623*	0.031
Teachers Content	24	55.08	18.41		

Table 2 shows that there exist a good significant positive correlation coefficient between teaches' content knowledge and students' achievement. Since p-value,  $p \approx 0.031$ , which is less than 0.05 level of significance; with r-calculated,  $r \approx 0.623^*$ , it means that the null hypothesis (HO<sub>1</sub>) is rejected and the alternative hypothesis which says There is significant positive relationship between teachers' content knowledge and students' achievement in mathematics is retained. Therefore, the null hypothesis was rejected and it was concluded that there was a positive relationship between mathematics teachers' content knowledge and students' achievement.

### Research Question Two

What is the relationship between the mean achievement scores of male and female students in mathematics?

**Table 3: Relationship Between Mean Achievement Scores and Standard Deviation of Male and Female Students**

Gender	N	Mean	Std. Deviation	Mean Diff.
Male	90	30.79	13.93	0.61
Female	30	31.40	16.21	

Table 3 shows the mean achievement and standard deviation of male was 30.79 and 13.93. While the female mean achievement and standard deviation was 31.40 and 16.21 with their mean difference 0.61.

### Null Hypothesis Two

**HO<sub>2</sub>:** There is no significant relationship between the mean achievement scores of male and female students in mathematics.

**Table 4: Result of Pearson Product Moment Correlation of Male and Female Students' Achievement Scores**

Variable	N	Mean	Std. Dev.	df	r-cal	p-value
Male	90	30.79	13.93	118	0.185*	0.081
Female	30	31.40	16.21			

Table 4 reveals that, there was no significant relationship in mean achievement scores of male and female student in mathematics  $r\text{-cal} = 0.185$  was obtained with associated exact probability value 0.081. Since the associated probability (0.081) is greater than 0.05 set as level of significance, the null hypothesis was not rejected. The result implies that there is no gender difference in students' achievement in mathematics.

### Summary of Major Findings

The findings of study were summarized as follows:

1. There exists a positive significant relationship between the mean score

of students and teachers in mathematics.

2. The mean score of male and female students and p-value indicated that there is no significant relationship in their achievement.

## Discussion of Results

The findings of this study revealed a significant positive relationship between teachers' content knowledge and students' achievement in mathematics among senior secondary school students in Jigawa State. This implies that students taught by teachers with stronger mastery of mathematical content tend to perform better in mathematics. The result underscores the importance of teachers' deep understanding of subject matter as a critical factor associated with effective teaching and improved student learning outcomes. Teachers who possess adequate content knowledge are more likely to present concepts clearly, use appropriate examples, and address students' misconceptions, thereby enhancing students' achievement in mathematics.

This finding is consistent with earlier studies such as Emmanuel (2016), who reported that students taught by teachers with high content knowledge performed significantly better in mathematics than those taught by teachers with weaker content knowledge. Similarly, Adedoyin (2011) found that teachers' in-depth content knowledge was positively associated with students' academic achievement in mathematics. The present study extends these findings by providing empirical evidence from Jigawa State using a correlational approach, thereby reinforcing the view that teachers' content knowledge is

an important correlate of students' mathematics achievement.

The study also found no significant relationship in the achievement of male and female students in mathematics. This result suggests that gender does not significantly influence students' achievements in mathematics at the senior secondary school level in Jigawa State. The implication is that both male and female students possess comparable abilities and potential for achievement in mathematics when exposed to similar learning conditions and instructional quality.

This finding aligns with previous studies that reported no significant gender difference in mathematics achievement among secondary school students (Shittu, 2020). The result, however, contrasts with some earlier studies that reported gender disparities in mathematics achievement, often attributing such differences to socio-cultural factors, attitudes, or classroom practices. The absence of a significant gender difference in this study may indicate increasing gender equity in access to mathematics instruction and learning opportunities in senior secondary schools in Jigawa State.

Overall, the findings of the study highlight the central role of teachers' content knowledge in students' achievement in mathematics, while also suggesting that gender may not be a determining factor in students' performance at this level of education.

## Conclusions

This study determined the relationship between teachers' content knowledge and students' achievement in mathematics among senior secondary school students in Jigawa State, Nigeria. The findings of the study revealed that there is a significant positive relationship between teachers' content knowledge and students' achievement in mathematics. This indicates that teachers' mastery of mathematical content is an important factor associated with improved students' academic achievement in mathematics at the senior secondary school level.

The study also revealed that no significant relationship between the achievement of male and female students in mathematics, suggesting that gender does not significantly influence students' performance in mathematics in the study area. This implies that both male and female students have comparable potential to achieve in mathematics when provided with similar instructional opportunities and learning environments.

Based on these findings, it can be concluded that strengthening teachers' content knowledge remains a crucial consideration in efforts aimed at improving students' achievement in mathematics. Enhancing teachers' subject matter competence through appropriate training and professional development may therefore contribute

positively to mathematics learning outcomes in senior secondary schools

## Recommendations

The following recommendations were made:

1. Teachers with professional qualification(s) at higher level should be recruited to teach Mathematics in the secondary schools.
2. Practicing Mathematics teachers who are not professional should undergo in-service training such as seminars, postgraduate diploma in education for effective discharge of their duties.

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