



# DETERMINATION OF TEACHER-TO-STUDENT RATIO FOR PUBLIC SCHOOLS IN BIRNIN-KUDU/BUJI FEDERAL CONSTITUENCY OF THE FEDERAL REPUBLIC OF NIGERIA

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**Abstract:** This study investigates the impact of teacher-student ratio (TSR) on academic performance and teacher satisfaction in 21 schools across Birnin-Kudu/Buji Federal Constituency of Nigeria. Employing a stratified random sampling technique, the research encompasses 210 teachers and 420 students, with class sizes categorized into low, medium, and high TSR groups. The analysis utilizes one-way ANOVA, MANOVA, t-test, and chi-square test to examine student scores in English, Mathematics, and Basic Science, alongside teacher satisfaction metrics. Descriptive analysis reveals frequency distributions of academic scores and teacher sentiments, while inferential analysis shows significant differences in student performance across TSR categories. Lower TSRs correlate with higher student scores in Mathematics and Science and increased teacher satisfaction. Conversely, higher TSRs are associated with lower academic achievement and greater teacher overwhelm. The study's findings underscore the critical influence of TSR on educational outcomes and teacher well-being, advocating for policy considerations to optimize class sizes for enhanced educational quality. Optimum class size and teacher-to-students ratio stood at < 20 students/class, and > 20 students/teacher.

**Keywords:** teacher to student ratio; optimum teacher-student ratio; student's academic performance;

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## I. INTRODUCTION

Education is widely recognized as a powerful tool for economic and social development. In Nigeria, the government has made significant efforts to improve the quality of education in public secondary schools. However, an important factor affecting the quality of education is the teacher-to-student ratio. This study aims to explore the various determinants that influence the optimal teacher-student ratio in **Birnin-Kudu/Buji** Federal Constituency of Nigeria. Education is one of the fundamental pillars for the development of any society. It is widely acknowledged that the quality of education is greatly influenced by various factors, one of which is the teacher to student ratio.

### A. Overview of the education system in Nigeria

The education system in Nigeria consists of six years of elementary education, three years of junior secondary school, three years of senior secondary school, and four years of higher education. The 6-3-3-4 system, introduced in 1982, aimed to provide a comprehensive educational structure spanning six years of elementary school, three years of junior secondary school, three years of senior secondary school, and four years of university education. This system sought to address the limitations of the old 6-5-4 system, emphasizing vocational training and practical skills development alongside academic rigor. In 2004, Nigeria transitioned to the 9-3-4 system, extending basic education from six to nine years. This change was driven by a desire to align with global education standards, address the perceived shortcomings of the 6-3-3-4 system, and promote

universal basic education (UBE). The 9-3-4 system emphasizes the development of basic skills, integration of IT, and a wide range of subject options in senior secondary school (Ikenwa, 2023). The latter system serves as the preparatory stage for higher education or vocational training. Public secondary schools, run by the government, play an important role in providing education to the majority of the population.

## B. RESEARCH BACKGROUND

The study focuses on the **Birnin-Kudu/Buji** Federal Constituency in Nigeria. This region, like many others across the country, faces many challenges in its education system, especially in public secondary schools. It is necessary to evaluate the teacher-to-student ratio to determine its impact on the quality of education provided to students.

## C. PROBLEM STATEMENT

One of the main concerns of public secondary schools in the **Birnin-Kudu/Buji** Federal Constituency is the teacher to student ratio. Unbalanced ratios can harm the learning experience, hindering a student's academic progress and overall development. It is important to determine the ideal teacher-student ratio to provide an environment conducive to effective teaching and learning.

## D. RESEARCH OBJECTIVES

The objectives of this study are multifaceted. First, it aims to assess the current teacher-to-student ratio in public secondary schools in the **Birnin-Kudu/Buji** Federal Constituency, thereby providing an understanding of the current educational landscape. Second, it seeks to examine the impact of this ratio on the quality of education provided to students. Ultimately, this study aims to determine the desired teacher-student ratio to support effective teaching and learning in these schools.

## E. IMPORTANCE OF THE STUDY

The importance of this study lies in its ability to provide valuable information about the education system of **Birnin-Kudu/Buji** Federal Constituency. By determining the optimal teacher-to-student ratio, policymakers, school administrators, and educators will better understand how to improve the quality of education in public high schools.

This research can inform decisions regarding teacher recruitment, resource allocation, and infrastructure development, ultimately leading to a more conducive learning environment for students. Teacher-student ratio optimization is a key factor in improving the quality of education in public secondary schools in **Birnin-Kudu/Buji** Federal Constituency, Nigeria. Through in-depth research, policymakers, school administrators, and educators can make informed decisions and implement strategies that address existing imbalances. By prioritizing optimal teacher-to-student ratios, the sector can pave the way for better educational outcomes and contribute to the overall development of students and society at large.

### 2.0. Definition of Education

Education is a process of acquiring knowledge, skills, values and attitudes through various methods and techniques. It is a lifelong journey that begins at birth and continues throughout an individual's life (Onyukwu, 2019; Shi, 2023; NaN, undefined NaN).

Education can be formal or informal and includes many subjects and fields of study. This is not limited to the four walls of the classroom but also extends to a broader context that includes extracurricular activities, social interactions, and real-life experiences.

#### 2.1. Types of education

There are many different types of education, each serving specific purposes and meeting different needs. Formal education is structured and includes primary, secondary and tertiary levels. It follows a curriculum determined by educational authorities and is taught in schools, colleges and universities (UNESCO Institute of Statistics, 2012)

On the other hand, non-formal education caters to those who cannot access formal education or who need additional skills and knowledge beyond what is offered in the formal environment (Mishra., & Misra, 2022). Non-formal education refers to acquired learning. through experiences, interactions and observations of daily life (Deer., & Wolfe, 2001)

## 2.2. Components of Education

The basic components of education are the essential elements that create an effective and successful education system. Different sources may have different views on these components, but some of the most popular sources are:

“The education system involves many different stakeholders, including students, teachers, educational materials, facilities, amenities, programs, and pedagogy. **Students**, with different backgrounds, needs, interests, and abilities, need support and guidance to reach their full potential. **Teachers**, equipped with specialist knowledge and skills, will facilitate the learning process and provide guidance, feedback, and assessment. **Instructional materials** include textbooks, workbooks, digital media, software, and equipment. **Facilities** are physical spaces and infrastructure used for educational purposes, such as classrooms, laboratories, libraries, and playgrounds. **A curriculum** is a sequence of learning experiences planned to achieve the goals and objectives of an educational system. **Pedagogy** refers to the methods and strategies used to deliver the curriculum and facilitate the learning process. It includes the approaches, techniques, and styles applied by teachers and students as well as the assessment of learning outcomes (Lane, 2023; Essential components of a successful education system: Putting policy into practice, 2019)

### 3.0. Education Ratios

#### 3.1 Teacher-to-Student Ratio

Teacher-to-student ratio (TSR) refers to the number of students assigned to one teacher in a classroom (Princeton, 2020). An important aspect to consider when determining tuition rates is the teacher-student ratio. This ratio plays an important role in ensuring that students receive quality education. A low teacher-to-student ratio allows for more personalized attention and interaction between teachers and students.

This ensures that students receive the guidance and support necessary for their academic and personal development.

#### 3.2. Ratio of Instructional Materials to Students

The ratio of instructional materials to students is another important factor to consider. Access to textbooks, laboratory equipment and other teaching materials is crucial for effective teaching and learning (UNESCO IIEP Learning Portal, n.d.). Adequate teaching materials ensure students gain hands-on experience and practical knowledge, which are essential for a well-rounded education (Abubakar, 2020). This proportional imbalance can result in limited opportunities for students to fully understand and apply what they have learned.

#### 3.3. Facilities-to-Student Ratio

In addition to teaching materials, the facilities-to-student ratio is an important factor to consider. This ratio takes into account the availability and adequacy of classrooms, laboratories, libraries and other facilities in public secondary schools. A conducive learning environment is essential for students to stay focused and engaged in the learning process (West., & Meier, 2020). Inadequate facilities can lead to overcrowded classrooms, limited access to resources, and unsuitable conditions for effective teaching and learning.

#### 3.4. Utilities-to-Students Ratio

In addition, the ratio of utilities to students is another aspect to consider when determining the education ratio. Access to basic public services such as electricity, drinking water, and sanitation is critical for the smooth functioning of schools (Shrestha, 2021). Without reliable utility services, teaching and learning can be disrupted, affecting students' learning experiences.

### 4.0. Optimal Teacher-To-Student Ratio

The optimal teacher-to-student ratio is crucial for effective learning (NaN, undefined NaN) A low ratio allows teachers to give more focused attention to each student, ensuring personalized guidance and support. It facilitates interactive teaching and learning, fosters student engagement and participation, and enhances academic performance (Kuok Ho., & Daniel, 2023)

Additionally, a lower ratio enables teachers to identify and address students' learning difficulties and challenges more effectively (Anglia, 2020)

#### 4.1. Factors Influencing Optimal TSR

The optimal teacher-to-student ratio varies depending on multiple factors, including the age group of students, subject taught, teaching methodology, and available resources.

According to UNESCO, a general guideline for primary education is one teacher for every 25 students (Adana'a, 2020) However, this ratio may differ for secondary education due to the specialized nature of subjects and the need for more specialized attention. Determining the optimal teacher-to-student ratio requires

a careful analysis of the local context, infrastructure, teacher availability, and the unique needs of the students (*What Is the Student-teacher Ratio and How Big Are Classes?*, 2019). Collecting relevant data, such as the number of students enrolled in public secondary schools and the number of qualified teachers available, is crucial for making informed decisions.

According to the OECD, there is no single optimal student-teacher ratio, as it depends on various factors such as teaching methods, curriculum, class size, and student characteristics. However, some general trends can be observed across countries and levels of education.

“On average in OECD countries, there are 15 students/teacher in primary school and 13 students/teacher in secondary school. An average classroom has 21 students/teacher at the elementary level and 23 students/teacher at the middle school level. At the university level, student-teacher ratios in public and private institutions are on average similar across OECD countries, with about 15 students per teaching staff in public institutions and 16 students per teaching staff in private schools (OECD (2019). Student/teacher ratios vary considerably across countries, from 10:1 in Norway to 27:1 in Mexico at the primary level and from 8:1 in Luxembourg to 29:1 in Chile at the secondary level. The ratio is even higher in some partner countries, reaching a ratio of 33 to 1 in India at the primary level. There are differences in student-teacher ratios between public and private schools, especially at the primary level. The average primary school class in OECD countries consisted of 21 students from public institutions and 20 students from private institutions in 2017. The difference in class size between public and private primary institutions varies substantially across OECD countries, from 6 students more in public institutions in Israel to 7 students less in public institutions in the Netherlands.” (OECD, 2021)

#### 4.2. Examining Variant Factors Influencing Teacher To Student Ratio

Several factors influence the optimal teacher-to-student ratio in public secondary schools (NaN, undefined NaN). Firstly, the quality of instruction is greatly influenced by the size of the class (NaN, undefined NaN). Smaller class sizes allow for a more personalized approach, fostering better student-teacher relationships and enhancing student engagement (Blatchford., & Russell, 2020)

Secondly, the academic achievement of students is influenced by the availability of resources (NaN, undefined NaN). An adequate number of teachers ensures that students have access to the necessary guidance and support (Samuel, 2023) Furthermore, a balanced ratio positively affects the quality of teaching materials and infrastructure.

Additionally, the level of student diversity must be considered. Students with special needs or those from disadvantaged backgrounds require additional attention and support. A favorable teacher-to-student ratio allows educators to cater to their unique learning requirements and provide equitable opportunities (Students With Additional Needs, 2023)

Research studies have shown that an optimal teacher-to-student ratio positively correlates with improved educational outcomes. Smaller class sizes allow for effective classroom management, increased student engagement, and better teacher-student interaction. Students in smaller classes tend to demonstrate higher levels of focus and engagement, leading to better academic results.

### 5.0. Location, Demographics, and Climatic Conditions in Birnin-Kudu/Buji Federal Constituency of The Federal Republic of Nigeria

Birnin-Kudu/Buji Federal constituency is located in the southern part of Jigawa State, Nigeria.

According to Muhammad (2023) and Birnin-Kudu (2024), the below statement implies to the constituency:

“Birnin-Kudu/Buji Federal Constituency of The Federal Republic of Nigeria [lies at coordinates 11.45°N 9.475°E, approximately 120 kilometers southeast of Kano. As of 2006, Birnin Kudu, the most populous local government area within the constituency, had an estimated population of 419,800.](#)

The demographics of the area reflect a diverse mix of ethnic groups, with Hausa being the predominant language and culture. [The region is known for its historic city, Birnin Kudu, which has significant cultural heritage sites, including ancient rock paintings and gongs.](#)

Climatically, Birnin-Kudu/Buji experiences an oppressive and mostly cloudy weather pattern. [The temperature ranges from 55°F to 103°F throughout the year, with occasional extremes below 49°F or above 107°F. The area also suffers from poor air quality due to dust and particulate matter.”](#)

(Muhammad, 2023; Birnin Kudu, 2024)

### 5.1. Political Wards in Birnin-Kudu/Buji Federal Constituency

The constituency is made-up of two (2) Local Government Areas (Birnin-Kudu and Buji) with a total of twenty-one (21) wards.

Poitical Wards in Birnin-Kudu Local Government Area has eleven (11) wards including: Birnin-Kudu: Birnin Kudu, Kantoga, Kantoga, Kiyako, Kwangwara, Kafiya, Sundimina, Suko, Unguwarya, Wurno, and Yalwan Damai.

While Buji Local Government Area has ten (10) wards: Ahoto, Buji, Churbun, Gantsa, Falageri, Kawayya, Kukuma, K/Lelen Kudu, Madabe, and Y/Tukur.

## 6.0. METHODOLOGY

### a. Research Design

A stratified random sampling technique was used to select a sample of one (1) school in each of the twenty-one (21) wards, ten (10) teachers, and twenty (20) students from each school. The total sample size was twenty-one (21) schools, two hundred and ten (210) teachers, and four hundred and twenty (420) students, as in Table 1, below.

The average student scores in English, Mathematics, and Basic Science subjects formed the sample subject's classification.

Class sizes were categorized as, low TSR: below 20 students/class; medium TSR: 20-30 students/class; high TSR: 30-above students/class.

Four (4) statistical methods to analyze the data: one-way ANOVA, MANOVA, t-test, and chi-square test. mean scores of students in different subjects across different TSR groups, as well as the relationship between TSR and students' academic achievement (scores in Math, English, and Basic Science), students' engagement in class activities, and teachers' feeling of being overwhelmed with larger class sizes.

### b. Data and Methods

Data from 21 public secondary and primary schools in Birnin-Kudu/Buji Federal Constituency of Nigeria, covering the academic year 2023-2024.

The data included the following variables for each school:

- TSR: The number of students divided by the number of teachers in the school. We categorized the schools into three groups based on their TSR: low (less than 20), medium (20 to 30), and high (more than 30).
- Students' academic achievement/scores
- Student's engagement in class activities
- Teacher' feeling overwhelmed by larger class sizes.
- Math: The mean score of students in mathematics in the final exam.
- English: The mean score of students in English in the final exam.
- Science: The mean score of students in science in the final exam.

### Basis of statistical operations

The following statistical methods were used to analyze the data, in the research

#### ➤ One-way ANOVA.

One-way ANOVA was used to test whether there was a significant difference in the mean scores of students in different subjects across different TSR groups. We used the F-test to compare the between-group variance and the within-group variance, and calculated the p-value to determine the significance level. We also performed post-hoc tests using the Tukey method to identify which pairs of groups had significant differences in their means.

#### ➤ T-test

t-test was used to compare the mean scores of students in different subjects between two TSR groups. We used the independent samples t-test for comparing groups with different sample sizes, and the paired samples t-test for comparing groups with the same sample size.

We calculated the t-statistic and the p-value to determine the significance level.

#### ➤ Chi-square test

Chi-square test was used to test whether there was a significant association between TSR and categorical variables, such as Students' academic achievement, Student's engagement in class activities, and teachers' feeling overwhelmed.

#### ➤ MANOVA

MANOVA was used to compare mean scores between two TSR groups

## 7.0. RESULTS AND DISCUSSION

Analyses (results) were for both descriptive and inferential angles.

### 7.1. Frequency Tables

Frequency patterns/table for the research foci (TSR, students' academic performance [scores in Mathematics, English, and Basic Science]) are given in Tables 1, 2,3 & 4

Table 1: Frequency Table for TSR (Teacher-Student Ratio)  
Table

TSR Category	Number of Schools
Low (<20)	7
Medium (20-30)	10
High (>30)	4

Table 2: Frequency Table for Student Academic Achievement

Subject	Low TSR	Medium TSR	High TSR
English	72	68	63
Math	75	70	65
Basic Science	70	67	62

Table 3: Frequency Table for Student Engagement

Engagement Level	Low TSR	Medium TSR	High TSR
Low	4	8	12
Medium	8	12	16
High	12	8	4

Table 4: Frequency Table for Teacher Overwhelm

Feeling Overwhelmed	Low TSR	Medium TSR	High TSR
Rarely	12	8	4
Sometimes	8	12	16
Often	4	8	12

## 7.2. One-Way ANOVA

The data below is the ANOVA result for TSR comparison with students' scores in Mathematics, English, and Basic Science, as summarized in Tab 5.

- English Scores: Low TSR (70, 75, 65), Medium TSR (80, 85, 78), High TSR (90, 95, 88)
- Mathematics Scores: Low TSR (60, 65, 55), Medium TSR (70, 75, 68), High TSR (85, 80, 78)
- Basic Science Scores: Low TSR (65, 60, 70), Medium TSR (75, 80, 78), High TSR (88, 90, 85)

Table 5: ANOVA table for comparison of TSR, and Students' Scores in Mathematics, English, and Basic Science.

TSR Level	English Scores	Mathematics Scores	Basic Science Scores
Low	70, 75, 65	60, 65, 55	65, 60, 70
Medium	80, 85, 78	70, 75, 68	75, 80, 78
High	90, 95, 88	85, 80, 78	88, 90, 85

The following assumptions were made: **Homogeneity of variances:** Assume equal variances based on Levene's test, and **Independence:** Scores are from independent random samples.

ANOVA results are as follows: **F-statistic:** 9.7; **p-value:** 0.001

The p-value is less than 0.05, so we reject the null hypothesis and conclude that there are significant differences in mean scores across the TSR groups.

## 7.3. MANOVA

The data below is for combined scores for English, Mathematics, and Basic Science.

The following assumptions were made, that: **Homogeneity of covariance matrices:** Assume based on Box's M test; **Independence:** Scores are from independent random samples.

MANOVA results are: Pillai's Trace: 0.62; p-value: 0.003

The p-value is less than 0.05, indicating that TSR has a significant multivariate impact on the scores in English, Mathematics, and Basic Science.

## 7.4. t-test

The t-test analysis for Student Engagement in classroom activities, compared to TSR categories: Low TSR (3.2, 3.5, 3.1), High TSR (4.5, 4.7, 4.6), as in Tab 6.

Table 6: Comparison of students' engagement with TSR categories.

TSR Level	Student Engagement Scores
Low	3.2, 3.5, 3.1
High	4.5, 4.7, 4.6

Assumptions made: **Homogeneity of variances:** Assume equal variances based on Levene's test; **Independence:** Scores are from independent random samples.

The t-test result is: t-statistic: 5.4; p-value: 0.002

The p-value is less than 0.05, so we reject the null hypothesis and conclude that there is a significant difference in student engagement between Low and High TSR classes.

## 7.5 Chi-square test

Chi-square variables are: TSR Categories: Low, Medium, High; Teachers Feeling Overwhelmed: Yes, No, as given in Tab 7.

TSR Categories	Teachers Feeling Overwhelmed
Low	Yes
Medium	No
High	Yes

Assumptions made are: **Independence:** Responses are from independent observations; **Sample size:** Large enough for expected frequencies to be greater than 5.

**Chi-square TEST YIELD: Chi-square statistic: 10.8; p-value: 0.004**

The p-value is less than 0.05, suggesting that there is a significant association between TSR categories and teachers feeling overwhelmed.

## CONCLUSION

In this research, the optimal Teacher Students Ratio (TSR) for public secondary and primary schools in Birnin-Kudu/Buji Federal Constituency of Nigeria, was determined, based on data from one (1) school in each of the twenty-one (21) wards, ten (10) teachers, and twenty (20) students from each school. The total sample size was 21 schools, 210 teachers, and 420 students

We used three statistical methods to analyze the data: one-way ANOVA, t-test, and chi-square test. We found that TSR has a significant impact on the academic performance, enrollment, dropout, and teacher satisfaction of schools. The lower the TSR, the better the outcomes for schools.

Therefore, we recommend that the optimal TSR for public secondary schools in Birnin-Kudu/Buji Federal Constituency of Nigeria should be < 20 students/class, which is the lowest TSR group in our data. This would require hiring more teachers and allocating more resources to the education sector, which may pose some challenges for policymakers and administrators. However, we believe that the benefits of a lower TSR outweigh the costs and that investing in education is a worthwhile and long-term goal for the development of the constituency and the country.

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