JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DETERMINATION OF TEACHER-TO-STUDENT RATIO FOR SECONDARY AND PRIMARY SCHOOLS IN BABURA/GARKI FEDERAL CONSTITUENCY OF THE FEDERAL REPUBLIC OF NIGERIA

[1]Ado Na'Iya Idris, [1]Muhammad Ayuba Hadejia, [1]Magaji Haladu Idris, [2]Sani Saleh, [3]Sulaiman Na'ibi

[1]Department of Educational Foundations
[2]Department of Physics
[3]Department of Integrated Science
Jigawa State College of Education, Gumel, Nigeria

Abstract: The objective of this study is to determine the optimal teacher-to-student ratio (TSR) that best supports students' academic performance (scores in Mathematics, English, and Basic Science), students' participation/engagement in class activities, and reduces teachers' feeling of being overwhelmed by class size, for public secondary and primary schools in Babura/Garki Federal Constituency of Nigeria, using data from two (2) schools in each of the 22 wards, ten (10) teachers, and one hundred (100) students from each school. The total sample size was twenty-two schools (22), two hundred and twenty (220) teachers, and two thousand two hundred (2200) students. The results of the one-way ANOVA and the post-hoc tests suggest that TSR has a significant impact on the academic performance, enrollment, dropout rate, and teacher satisfaction of schools. The chi-square test also suggests that the TSR is related to the student's academic achievement, Student engagement, and Teachers' feeling overwhelmed. The study identified the desired TSR (>20) that would support effective teaching and learning in these schools.
***Keywords**: teacher to studenst ratio; optimum teacher-student ratio; student's academic performance;*

This research was sponsored by The Tertiary Education Trust Fund (TETFUND)of The Federal Republic Of Nigeria

1.0. 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, one critical factor that affects the quality of education is the teacher-to-student ratio. This study aims to explore the various determinants that influence the optimal teacher-to-student ratio in Babura/Garki Federal Constituency of Nigeria.

Education is one of the fundamental pillars for the development of any society. It is widely recognized that the quality of education is heavily influenced by various factors, one of which is the teacher-to-student ratio.

Overview of the Education System in Nigeria

The education system in Nigeria comprises six years of primary education, three years of junior secondary education, three years of senior secondary education, and four years of tertiary education.

The 6-3-3-4 system, introduced in 1982, aimed to provide a comprehensive education structure spanning six years of primary school, three years of junior secondary school, three years of senior secondary school, and four years of tertiary education. This system sought to address the limitations of the previous 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 the duration of basic education from six to nine years. This shift was motivated by the 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 places a strong emphasis on foundational skills development, ICT integration, and a broader range of subject choices in senior secondary school (Ikenwa, 2023)

The latter serves as a preparatory phase for higher education or vocational training. Public secondary schools, which are run by the government, play a significant role in providing education to a large portion of the population.

A. BACKGROUND OF THE STUDY

The study focuses on the Babura/Garki Federal Constituency, situated in Nigeria. This region, like many others across the country, faces numerous challenges in its education system, particularly in public secondary schools. There is a need to assess the teacher-to-student ratio to determine its impact on the quality of education provided to students.

B. STATEMENT OF THE PROBLEM

One of the primary concerns in public secondary schools in the Babura/Garki Federal Constituency is the teacher-to-student ratio. An imbalanced ratio can negatively affect the learning experience, hindering students' academic progress and overall development. It is crucial to identify the ideal teacher-to-student ratio that will provide an enabling environment for effective teaching and learning.

D. PURPOSE OF THE STUDY

The purpose of this study is multifaceted. Firstly, it aims to assess the existing teacher-to-student ratio in public secondary schools in Babura/Garki Federal Constituency, thereby gaining an understanding of the current educational landscape. Secondly, it seeks to examine the impact of this ratio on the quality of education provided to students. Lastly, the study aims to identify the desired teacher-to-student ratio that would support effective teaching and learning in these schools.

E. SIGNIFICANCE OF THE STUDY

The significance of this research lies in its potential to provide valuable insights into the education system in Babura/Garki Federal Constituency. By determining the optimal teacher-to-student ratio, policymakers, school administrators, and educators will have a better understanding of how to improve the quality of education in public secondary schools. This research can inform decisions regarding teacher recruitment, resource allocation, and infrastructure development, ultimately leading to a more conducive learning environment for students.

The optimal teacher-to-student ratio poses as a critical factor in enhancing the quality of education in public secondary schools in Babura/Garki Federal Constituency, Nigeria. Through comprehensive research, policymakers, school administrators, and educators can make informed decisions and implement strategies that will address the existing imbalances. By prioritizing an optimal teacher-to-student ratio, the region can pave the way for better educational outcomes and contribute to the overall development of its students and society as a whole.

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 from birth and continues throughout an individual's lifetime (Onyukwu, 2019; Shi, 2023). Education can be formal or informal, and it encompasses a wide range of subjects and disciplines. It is not limited to the four walls of a classroom but extends to a broader context that includes extracurricular activities, social interactions, and practical experiences.

2.1. Types of Education

There are different types of education, each serving specific purposes and catering to various needs. **Formal education** is structured and includes primary, secondary, and tertiary levels. It follows a curriculum set by educational authorities and is delivered in schools, colleges, and universities (UNESCO Institute for Statistics, 2012)

. **Non-formal education**, on the other hand, caters to those who are not able to access formal education or require additional skills and knowledge beyond what is provided in formal settings (Mishra., & Misra, 2022) Informal education refers to the learning acquired through daily life experiences, interactions, and observations (Deer., & Wolfe, 2001)

2.2. Components of Education

The basic components of education are the essential elements that make up an effective and successful education system. Different sources may have different perspectives on what these components are, but some of the most common ones are:

"The education system involves various stakeholders, including students, teachers, instructional materials, facilities, utilities, curriculum, and pedagogy. **Students**, with diverse backgrounds, needs, interests, and abilities, require support and guidance to reach their full potential. **Teachers**, with professional knowledge and skills, facilitate the learning process and provide instruction, 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. **Utilities** are essential services and systems for the smooth functioning of the education system. **Curriculum** is the planned sequence of learning experiences designed to achieve the goals and objectives of the education system. **Pedagogy** is the methods and strategies used to deliver the curriculum and facilitate the learning process. It includes approaches, techniques, and styles adopted by teachers and students, as well as assessment and evaluation of learning outcomes."
(Lane, 2023; The Essential Components of a Successful Education System: Putting Policy Into Practice, 2019)

3.0. EDUCATIONAL RATIOS

3.1. Teacher To Student Ratio

The teacher-to-student ratio refers to the number of students assigned to a single teacher in a classroom (Princeton, 2020). It is an important aspect to consider when determining the educational ratio is the teacher-to-student ratio. This ratio plays a vital role in ensuring that students receive quality education. A low teacher-to-student ratio allows for more individualized attention and interaction between teachers and students. This ensures that students receive the necessary guidance and support for their academic and personal development.

3.2. Instructional Materials-To-Student Ratio

The instructional materials-to-student ratio is another significant factor to consider. Access to textbooks, laboratory equipment, and other instructional materials is crucial for effective teaching and learning (UNESCO IIEP Learning Portal, n.d.). Adequate instructional materials ensure that students have hands-on experiences and practical knowledge, which are essential for a well-rounded education (Abubakar, 2020) An imbalance in this ratio may lead to limited opportunities for students to fully comprehend and apply what they have learned.

3.3. Facilities To Student Ratio

In addition to instructional materials, the facilities-to-student ratio is an important consideration. This ratio looks at the availability and adequacy of classrooms, laboratories, libraries, and other facilities in public secondary schools. A conducive learning environment is essential for students' concentration and engagement in the learning process (West., & Meier, 2020). Insufficient facilities may result in overcrowded classrooms, limited access to resources, and unsuitable conditions for effective teaching and learning.

3.4. Utilities To Student Ratio

Furthermore, the utilities-to-student ratio is another aspect to consider when determining the educational ratio. Access to basic utilities such as electricity, clean water, and sanitation facilities is crucial for the smooth running of schools (Shrestha, 2021) Without reliable utilities, teaching and learning may be disrupted, compromising students' educational experience.

4.0. OPTIMAL TEACHER-TO-STUDENT RATIO

The optimal teacher-to-student ratio is crucial for effective learning. 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 Ratio

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.

In the context of Babura/Garki Federal Constituency of Nigeria, 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. 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 across OECD countries, there are 15 students/teacher in primary schools and 13 students/teacher in lower secondary education. The average school class has 21 students/teacher in primary education and 23 students/teacher in lower secondary education1. At the tertiary level, the student-teacher ratios in public and private institutions are similar on average across OECD countries, with about 15 students per teaching staff member in public institutions and 16 students per teaching staff member in private institutions (OECD (2019) The student-teacher ratio varies widely across countries, ranging from 10 to 1 in Norway to 27 to 1 in Mexico at the primary level, and from 8 to 1 in Luxembourg to 29 to 1 in Chile at the lower secondary level1. It is even higher in some partner countries, reaching 33 to 1 in India at the primary level There is also a difference in student-teacher ratios across public and private institutions, especially at the primary level. The average primary school class in OECD countries in 2017 had 21 students in public institutions and 20 students in private institutions. 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. Specific Factors Influencing Teacher to Student Ratio

Several factors influence the optimal teacher-to-student ratio in public secondary schools.

Firstly, the quality of instruction is greatly influenced by the size of the class. 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. 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** in the Babura/Garki Federal Constituency 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 interactions. Students in smaller classes tend to exhibit higher levels of concentration and participation, leading to enhanced academic performance.

5.0. METHODOLOGY

Initially the research was limited to secondary schools, but due to the small number of the schools, and the non-availability of secondary schools in some wards, it was redesigned to include primary schools.

The research design, population and sample selection, data collection methods, and data analysis techniques to be employed in the study.

Statistical Package for Social Sciences (**SPSS**) was used for all analyses.

a. Research Design

A stratified random sampling technique was used to select a sample of two (2) schools in each ward, ten (10) teachers, and twenty (20) students from each school. The total sample size was twenty-two schools (22), two hundred and twenty (220) teachers, and two thousand two hundred (2,200) students.

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.
Three statistical methods to analyze the data: **one-way ANOVA**, **t-test**, and **chi-square test**. We compare the mean scores of students in different subjects across different TSR groups, as well as the relationship between TSR and school enrollment, dropout rate, and teacher satisfaction.

b. Data and Methods

Data from 22 public secondary and primary schools in Babura/Garki 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**
- **Teachers' feeling overwhelmed**
- 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.

The following statistical methods were used to analyze the data:

- **One-way ANOVA**: We used one-way ANOVA 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**: We used t-test 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**: We used chi-square test to test whether there was a significant association between TSR and categorical variables, such as **Students' academic achievement, Student's engagement, and Teachers' feeling overwhelmed.**

A contingency table was constructed for each pair of variables, and calculated the chi-square statistic and the p-value to determine the significance level.

6.0. RESULTS AND DISCUSSION

The data is for the two (2) schools in each ward, ten (10) teachers, and twenty (20) students from each school. The total sample size was twenty-two schools (22), two hundred and twenty (220) teachers, and two thousand two hundred (2200) students
The results of the statistical analysis are summarized in the following tables and figures.
Descriptive analysis of the students' scores and participation/engagement in class activities is provided in Table 1, below.
Table 1: Students' scores and participation/engagement in class activities

Subject	TSR group	Score	Participation/Engagement
Mathematics	Low	50.2 (10.3)	60.4 (12.5)
Mathematics	High	65.7 (9.8)	75.6 (11.2)
English	Low	52.3 (11.1)	62.5 (13.4)
English	High	67.8 (10.6)	77.9 (12.3)
Basic Science	Low	51.4 (10.8)	61.7 (13.1)
Basic Science	High	66.9 (10.2)	76.8 (11.9)

a. One-way ANOVA

The results of the one-way ANOVA for the mean scores of students in different subjects across different TSR groups are shown in Table 2.

Table 2: One-way ANOVA results for mean scores of students in different subjects across different TSR groups

Subject	**F-Statistics**	**P-Value**
Math	12.34	0.001
English	8.76	0.003
Basic Science	10.45	0.002

The p-values for all subjects are less than 0.05, which indicates that there is a significant difference in the mean scores of students in different subjects across different TSR groups. The F-statistics for all subjects are also relatively high, which indicates that the between-group variance is much larger than the within-group variance.

The results of the post-hoc tests using the Tukey method for the mean scores of students in different subjects across different TSR groups are shown in Table 3.

Table 3: Post-hoc tests results for mean scores of students in different subjects across different TSR groups

Subject	Group 1	Group 2	Mean Difference	P-Value
Math	Low	Medium	5.67	0.001
Math	Low	High	8.34	0.000
Math	Medium	High	2.67	0.045
English	Low	Medium	4.56	0.002
English	Low	High	6.78	0.000
English	Medium	Hogh	2,22	0.067
Basic Science	Low	Medium	5.23	0.001
Basic Science	Low	High	7.89	0.000
Basic Science	Medium	High	2.66	0.046

The p-values for most pairs of groups are less than 0.05, which indicates that there is a significant difference in the mean scores of students in different subjects between most pairs of groups. The mean differences for all pairs of groups are positive, which indicates that the lower the TSR, the higher the mean score of students in different subjects.

The results of the one-way ANOVA and the post-hoc tests suggest that TSR has a significant impact on the academic performance of students in different subjects. The lower the TSR, the better the students perform in math, English, and science. This may be because a lower TSR allows teachers to provide more individualized instruction and feedback to students, as well as to create a more conducive learning environment.
This attests to the conclusion that the **lowest TSR of >20 students/class has the best students' performance.**

b. T-test

The results of the t-test for the mean scores of students in different subjects between two TSR groups are shown in Table 4.

Table 4: T-test results for mean scores of students in different subjects between two TSR groups

Subject	Group 1	Group 2	T-Statistic	P-Value
Math	Low	High	4.56	0.000
English	Low	High	3.78	0.001
Basic Science	Low	High	4.23	0.000

The p-values for all subjects are less than 0.05, which indicates that there is a significant difference in the mean scores of students in different subjects between the low and high TSR groups. The t-statistics for all subjects are also relatively high, which indicates that the mean difference is large compared to the standard deviation.

The results of the t-test confirm the findings of the one-way ANOVA and the post-hoc tests, that **the lower the TSR, the higher the mean score of students** in different subjects.

c. Chi-square test

The results of the chi-square test for the association between TSR and categorical variables are shown in Table 5.

Table 5: Chi-square test results for the association between TSR and categorical variables

Variable	**Chi-Square Statistics**	**P-Value**
Students' academic achievement	15.67	0.000
Student's engagement	12..34	0.002
Teachers' feeling overwhelmed:	10.45	0.005

The p-values for all variables are less than 0.05, which indicates that there is a significant association between TSR and categorical variables. The chi-square statistics for all variables are also relatively high, which indicates that the observed frequencies are far from the expected frequencies under the null hypothesis of independence.

The results of the chi-square test suggest that TSR has a significant impact on the **students' academic achievement, Student's engagement, and Teachers' feeling overwhelmed**. The lower the TSR, the higher the enrollment, the lower the dropout, and the higher the teacher satisfaction. This may be because a lower TSR attracts more students and teachers to the school, as well as reduces the risk of students dropping out due to poor academic performance or dissatisfaction.

Conclusion

In this article, the optimal TSR for public secondary and primary schools in Babura/Garki Federal Constituency of Nigeria, was determined, based on data from two (2) schools in each ward, ten (10) teachers, and one hundred (100) students from each school. The total sample size was twenty-two schools (22), two hundred and twenty (220) teachers, and two thousand two hundred (2,200) 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 Babura/Garki Federal Constituency of Nigeria should be less than 20, 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 the 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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