



Comparative Analysis of Mathematics Performance among Public and Private Senior Secondary School Students in Obio-Akpor LGA of Rivers State

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Abstract

The study examined the level of Mathematics performance of senior secondary students in public and private schools in Obio-Akpor LGA of Rivers State, Nigeria. Data from the mathematics midterm test scores of SS2 students in four purposefully selected schools-two public and two private- were used in an ex-post facto research design. An independent-samples t-test was performed using SPSS. Results indicated pupils in public and private schools differed significantly in mathematics ($t(226) = -6.86, p < .001$). Public-school students' average scores ($M = 40.88, SD = 24.66$) were significantly lower than those of private-school students ($M = 70.26, SD = 12.78$). The results show that class size has a considerable effect on senior high school Mathematics proficiency. The statistically significant and practically important differences in performance between children in tiny private classes and those in extremely packed public schools underscore the need to consider class congestion as an issue of educational justice and quality. The report advised that the government should promptly address classroom overcrowding in public schools by providing additional classrooms, hiring more trained mathematics instructors, and providing instructional tools equivalent to those in private schools.

Keywords: Class Size, Mathematics Performance, Public Schools, Private Schools, Senior Secondary Students.

Introduction

Mathematics has always been a major help in the advancement of any nation. It forms the cognitive basis for economic activity, scientific research, and technological progress. To this end, the Federal Republic of Nigeria (FRN, 2004) made mathematics a core obligatory subject in its national education policy, and all secondary school students are required to study it irrespective of their preferred field of specialty. There are a lot of criteria for the subject, because it is mandatory, especially for Mathematics teachers. Mathematics is an important part of almost all streams of academics. In higher education and most vocations, it is vital. However, the academic performance of Nigerian secondary school students in mathematics has not been encouraging, as evidenced by the continuous low pass rates in the National Examination Council (NECO) and the West African Senior School Certificate Examination (WASSCE) over the past few decades.

Among the various characteristics recognised as linked to low mathematics performance, class size has received relatively less systematic study focus than topics like teacher quality, instructional method, or student involvement (Bandiera et al., 2014). Therefore, the learning environment remains a critical issue to be studied and handled

efficiently in an effort to improve students' academic performance. Academic results, student engagement, and quality of instruction directly affect the learning environment, and the number of pupils that a teacher must teach at the same time has a major impact on the quality of instruction. The learning environment is said to have a great impact on the academic achievement of pupils (Williams et al., 2008 in Sabiha Ehgin, 2017).

Public and private schools, as their names imply, are owned institutions. Private schools in Nigeria are owned by individuals, associations, or organisations, while public schools are held by the federal, state, and municipal governments. Private schools vary from school to school, and each private school has different levels of parental involvement. Parents must select a private school that possesses qualities that correspond with their family's choices. Parents who pay to send their children to private schools tend to be more engaged in what the schools have to offer than parents of children in public schools. Public and private secondary schools in Nigeria teach the same external exams under the same national curriculum, yet their teaching environments are significantly diverse. Private schools are generally characterised by smaller and more manageable class sizes, in accordance with the national policy recommendation of 35 students per class. Public schools are often characterised by significantly overcrowded classrooms and class sizes often over 60 kids. This structural difference allows for the examination of the effect of class size on arithmetic performance (Olashhinde & Olatoye, 2014).

The student-teacher ratio is one of the critical factors in the quality of education (Cuban, 2004), and the lower the student-teacher ratio, the greater is the possibility of improving instructional effectiveness and fulfilling institutional academic goals. Esiegebe (2017) found that pupils who would score about 63% in a mathematics test when taught individually scored only about 37% in a class of 40 students, showing the dramatic attenuating effect of class size on performance. Likewise, Bennett (1987, quoted in Esiegebe, 2017) analysed findings of research and concluded that:

- i. Smaller classes make classroom management easier (fewer discipline problems).
- ii. Smaller courses = Less stress, better instructor morale.
- iii. Individualisation is more likely to occur in smaller classrooms.
- iv. A reduction in class size does not necessarily result in the use of markedly different teaching styles.
- v. Class size appears to influence student attitudes, motivation, interest and attentiveness more than academic success. Why students in very small courses (5 or fewer) do so much better.

Consequently, this study is motivated by the need to provide empirical evidence on the correlation between students' mathematical performance and the disparity in class sizes between public and private secondary schools in Obio-Akpor Local Government Area (LGA), Rivers State, Nigeria. The initiative seeks to deliver evidence-driven policy and educational development strategies through a direct comparison of test score results.

Class size refers to the number of students allocated to a single teacher or classroom at a scheduled teaching time. It is different from the student-teacher ratio, which is an administrative measure at the school or system level, and school size, which is the total enrolment of a school. At least part of the research on class size and student achievement begins with the seminal Tennessee Students/Teachers Achievement Ratio (STAR) study, which experimentally demonstrated that students in smaller classes (13-17 students) outperformed their peers in larger classes (22-26 students) in reading and math from kindergarten through third grade (Mosteller, 1995). Research by the Nigeria Centre for Technical Education (NCTE) (1986, as cited in Sule, 2016) indicated that the following good outcomes follow when class numbers are reduced and teaching tactics are improved:

- i. There is more interaction between teachers and students in smaller classrooms.
- ii. Students in smaller classes are more willing to participate in class activities and exhibit higher respect for one another.
- iii. There are more learning activities in smaller classes.
- iv. Students engage more in smaller classes, which improves mutual understanding and motivates them to support one another.
- v. Potential disciplinary issues can be found and fixed faster in smaller classes.

Other research has added to the evidence-based approach and has shown complexities. Bandiera et al. (2014) use administrative data from a large UK university and find a strong, albeit very non-linear, inverse relationship between class size and academic performance. Their data suggest that high-achieving students in big classes were most disadvantaged and that the effect of class size was most apparent at the extremes of the class size distribution. These

findings suggest that class size impacts can be dependent on topic matter, educational context, and student ability level.

Esiegbe (2017) studied the influence of class size on mathematics achievement in a sample of secondary schools in Ota, Ogun State, Nigeria, and found that kids in overcrowded classes performed significantly worse than students in smaller classes. Afolabi et al. (2020), in a similar study, explored the effect of class size on the teaching and learning of mathematics in Nigerian secondary schools. The study concluded that a reduction in class size was associated with measurable improvements in student results and quality of instruction. Olatunde (2010) extended this data to southwestern Nigeria and found a significant effect of class size on the Mathematics achievement of senior secondary school children.

Sule (2016) found that the effect of class size and assignment on secondary school students' mathematical achievement showed that students in small classes received more frequent feedback, were more actively involved in problem-solving activities, and obtained higher mean scores than students in larger classes. The findings support Bennett's (1987, as cited in Esiegbe, 2017) conclusion that smaller classes lead to increased student participation, more teacher-student interaction, and better handling of disciplinary issues, all of which promote better mathematics learning.

In the Nigerian educational system, private schools are owned by private individuals, religious organisations, or non-governmental organisations, whereas public schools are owned by federal, state, or local government agencies. Students in both categories follow the same national curriculum framework and sit for the same external examinations (WAEC, NECO and JAMB). But the conditions of teaching and learning are very different. Olasehinde and Olatoye (2014) examined the science achievement of secondary school students in public and private schools in Katsina State and discovered that private school kids scored better than their public-school counterparts routinely. The authors noted greater facilities, smaller class sizes, and increased parental participation as significant causes of these differences linked with private education. Private schools in Nigeria charge tuition in general to keep student-teacher ratios low and to invest in amenities. But free public schools serve a far bigger and often poorer population; therefore, enrolment numbers far surpass their physical and human resource capabilities.

The problem of shortage of classrooms in the Nigerian public schools is due to population growth, rural-urban movement, and the Universal Basic Education (UBE) program, which has considerably increased school attendance without commensurate investment in facilities. Rivers State is one of the economically vital oil-producing states in Nigeria, and it has peculiar challenges. The Obio-Akpor LGA is one of the most urbanised LGAs in the state, with high population density, which leads to increased demand for secondary school places in public institutions and significant classroom congestion.

This study is based on Vygotsky's (1978) Sociocultural Theory of Cognitive Development, which argues that learning is fundamentally a social activity mediated through interaction between learners and more knowledgeable persons in the Zone of Proximal Development (ZPD). If the class size is smaller, teachers may determine each student's ZPD and tailor instruction to meet individual needs. In a packed classroom, the teacher is unable to assess the learning needs of each student, provide constructive criticism, or individualise explanations, therefore undermining the social mediation that Vygotsky identified as important to cognitive growth.

Another useful paradigm is the Input-Process-Output (IPO) model of educational production (Walberg, 1981). The class size is an input variable that ultimately impacts the output (student academic achievement) and dictates the instructional process (quality of teacher-student interaction, personalised attention, and classroom management). In this approach, the instructional process worsens, and achievement outcomes reduce as class sizes surpass an optimal threshold. This is the same relationship that our study sought to explore.

You have to be good at Mathematics to go into a STEM (science, technology, engineering and Mathematics) job in higher education and the workforce. One of the challenges that has hindered the development of mathematics in the majority of our schools is the number of classes, even though it is recognised to be important. The performance of students in mathematics in Nigerian secondary schools, especially in public schools, has been poor for decades.

Nigeria is not immune to this constant problem plaguing the global education system, and it impacts public schools more than private ones. Reports from the National Examination Council (NECO) and the West African Examination Council (WAEC) show that less than 50% of candidates in several states, including Rivers State, pass mathematics at credit level.

More pupils are in all levels of education in Nigeria, and this is causing class sizes to continue to grow as a consequence of increased school enrolment. This is much more challenging in the absence of the infrastructure to deal with the annual rise. When there aren't enough classrooms, students are crowded into the limited instructional areas. There is a need for a critical analysis of the teaching and learning of the subject to be able to fully understand the impact of teaching mathematics in large classes. Mathematics is important to the individual student and to the development of the country. Class size is an essential yet understudied component of this continuous underperformance. The National Policy on Education enunciates a student-teacher ratio of 35:1, which has long been exceeded in Nigerian public secondary schools, with many classrooms having over 60 children (FRN, 2004). Such conditions hamper the teacher's ability to pay personalised attention to each student, carry out formative assessments, control classroom dynamics, and apply innovative teaching methods. In contrast, private schools tend to have small classes and a better organised and well-equipped environment for learning.

Nigeria's educational system has three sectors: public, private, and missionary schools. They all follow the same curriculum but have different learning settings. Students also sit for the same external examinations such as the Joint Matriculation Examination Board (JAMB), National Examination Council (NECO), and the West African Examination Council (WAEC) exams. The discrepancy in class size between public and private schools therefore raises important issues of educational justice. If class size is a primary determinant of arithmetic proficiency, then students from lower-income homes who cannot afford private education are probably systematically disadvantaged by the overcrowded public-school setting. This study attempts to evaluate experimentally whether class size accounts for the observed difference in mathematics performance between pupils in public and private senior secondary schools in Obio-Akpor LGA, Rivers State.

The study's primary goal was to compare the mathematics performance of SS2 students in public and private secondary schools in relation to class size in Obio-Akpor LGA, Rivers State. The following was the particular goal:

- To determine the difference in mathematics performance between SS2 students in public and private secondary schools in Obio-Akpor LGA, Rivers State.

The following research questions guided the study:

- What difference exists in the mathematics performance of SS2 students in public and private secondary schools in Obio-Akpor LGA, Rivers State?

The following hypothesis was tested.

H01: There is no statistically significant difference in the mathematics performance of SS2 students in public and private secondary schools in Obio-Akpor LGA, Rivers State..

Methodology

The study used an ex-post facto approach to identify the variations in the Mathematics performance of SS2 students in the public and private schools involved in the study. This was done with the help of each school's mathematics teacher, using students' scores from the last midterm test. The study population comprised all Senior Secondary School II (SS2) students and mathematics teachers in public and private secondary schools in Obi-Akpor LGA, Rivers State. The public school population comprised teachers and pupils from the selected schools. According to data from the Planning, Research and Statistics (PRS) Department of the Rivers State Senior Secondary School Board (RSSSSB, 2019), the LGA had 20 public senior secondary schools with a total of 8,252 SS2 students. Two (2) secondary schools were selected from the twenty public senior secondary schools in the L.G.A. One had 100 SS2 students, and the other had 93 students in each SS2 class, with one teacher covering all the arms.

The number of private secondary schools in the LGA was much higher and more difficult to measure accurately

because not all private schools were registered with the National Association of Proprietors of Private Schools (NAPPS), Rivers State Chapter. The LGA has several private schools, but this study considers only two. The two private schools had 35 SS2 students.

The researcher used a purposive sampling strategy for this investigation. The sample consists of four Mathematics teachers from the four schools under investigation - two public and two private - who met certain study-relevant criteria such as having SS2 first-term Mathematics midterm test score records, cooperation of school administration, and representativeness of typical class-size conditions in the LGA. These students had spent a full year in the Senior Secondary Certificate Examination (SSCE) preparatory program, so their performance statistics better reflected cumulative instructional exposure. Hence the choice of the SS2 cohort. Data were collected using the Mathematics Achievement Test (MAT), a proforma tool that consisted of test results directly from the Mathematics teachers in each of the four schools. The results were from the latest midterm exam, which included the end-of-term exam and continuous assessment (CA). The instrument used in the study was the Mathematics Achievement Test (MAT), also called a proforma, which was administered to the Mathematics teachers of the four (4) schools that were the object of the study. The test findings in this study are authentic measures of student performance under typical examination conditions and were obtained from the official records of the Mathematics teachers at the four schools. These scores were designed to assess the full SS2 mathematics curriculum and were marked by trained Mathematics teachers. The results were regarded as legitimate measures of Mathematics achievement, as they were the main source of institutional data. The data's legitimacy was ensured because the scores were taken directly from official school records, eliminating transcription errors. This is congruent with the ex-post facto design used. By nature, an ex-post facto design relies on naturally existing data, which is reliable because it is received directly from the Mathematics teachers.

The researcher obtained student scores from the senior secondary school mathematics teachers (SS2) in the most recent third-term examination. This included continuous assessment test scores and examination scores from the four (4) schools under investigation after obtaining permission from the pertinent authorities in the four (4) schools under investigation. The test results of a student were taken as an indication of his/her level of achievement. The data were analysed using an independent-samples t-test. The data were processed and analysed using statistical software (SPSS) to compile and calculate the overall scores of each private and public school, and to code and analyse the data using an independent-samples t-test in SPSS to determine whether school type influences students' performance in mathematics.

Results

Table 1: Summary of group statistics on the difference between the mean rating of private and public schools on the mathematics performance of senior secondary school students due to class size in Obio-Akpor Local Government Area of Rivers State.

		N	Mean	SD	Std. Error Mean
Performance	Public	193	40.88	24.66	1.78
	Private	35	70.26	12.78	2.16

Table 1 above shows the Summary of group statistics on the difference between the mean rating of private and public schools on the mathematics performance of senior secondary school students in Obio-Akpor Local Government Area of Rivers State. The results show that the mean score for students in public schools ($n = 193$) was 40.88 ($SD = 24.66$, $SE = 1.78$), while the mean score for students in private schools ($n = 35$) was 70.26 ($SD = 12.78$, $SE = 2.16$). Students in private schools had much higher levels of mathematical proficiency, as indicated by a mean difference of almost 29.38 percentage points.

Table 2: Summary of independent-samples t-test on the difference between the private and public schools on the mathematics performance of senior secondary school students in Obio-Akpor Local Government Area of Rivers State.

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% CID	
		F	Sig.	T	df	p-value	MD	SED	Lower	Upper
Performance	Equal variances assumed	16.009	.000	-6.87	226	.000	-29.38	4.27	-37.80	-20.96

From the Table 2 above shows the summary of an independent-samples t-test on the difference between the private and public schools on the mathematics performance of senior secondary school students in Obio-Akpor Local Government Area of Rivers State. It reveals that the degrees of freedom were 226 and the p-value was 0.000, while the computed t-value was -6.87 for equal variances assumed. The aforementioned finding showed that senior secondary school pupils in Rivers State's Obio-Akpor local government area performed significantly differently in mathematics in private and public schools. According to the above result, H_{01} and H_{02} are rejected at the 0.05 significance level since the significance value is $0.000 < 0.05$.

Discussion

The results of this study showed that school type had a substantial effect on mathematics achievement at senior secondary school level in Obio-Akpor LGA, Rivers State, Nigeria. Students in private schools, taught in groups of 15 to 20, averaged 70.26 per cent in mathematics, which is a credit pass or above in external exams. Public school students were taught in groups of 93 to 100 and achieved a mean score of only 40.88% - well below the credit threshold. The magnitude of the difference-approximately 29.38 percentage points-is educationally and practically important, and it is consistent with the theoretical expectations regarding the negative effects of overcrowding on instructional quality.

These results are consistent with the results of Esiegebe (2017), who reported that pupils taught in groups of 40 to 50 students achieved about 37% in a Mathematics test, while those taught individually achieved about 63%. The present study extends this data to even greater class sizes (93–100 students per class) in which performance attenuation is proportionately more severe. The results are in agreement with Afolabi et al. (2020), Olatunde (2010), and Sule (2016), who all established a negative relationship between math achievement and class size in secondary schools in Nigeria. The findings are in line with the IPO model presented by Walberg (1981) and the sociocultural theory proposed by Vygotsky (1978). With class sizes ranging from 93 to 100, the instructor is almost incapable of providing the kind of scaffolded, individualised contact that Vygotsky recognised as essential to learning within the ZPD. Predictably, Walberg's model's teaching process variable deteriorates dramatically under these circumstances, with adverse impacts on achievement outcomes. It is important to note that 10% of kids in public schools did not take the test. The researcher attributes this to disengagement caused by classroom overcrowding. Students who can't follow directions in a noisy classroom may start to hate Mathematics and miss tests. Although both factors seem to be considerably impacted in this study, it agrees with Bennett's (1987, cited in Esiegebe, 2017) finding that class size has a more dramatic effect on student attitudes, attentiveness, and motivation than on raw achievement alone.

Conclusion

This study provides solid empirical evidence that school type significantly influences the Mathematics achievement of senior secondary school pupils in Obio-Akpor LGA, Rivers State, Nigeria. The performance gap between children in severely overcrowded public schools and those in small-class private schools is statistically substantial and practically vast, highlighting the urgent need to address classroom congestion as a matter of educational fairness and quality. Public schools must immediately work to meet the national policy recommendation of no more than 35 students per class. Until public school class sizes are within policy-mandated boundaries, Nigeria will not attain the

goal of egalitarian, high-quality mathematics instruction. However, The following limitations were observed in the course of the study:

1. Non-representative small sample size;
2. The assumption that all public schools in the LGA have large class sizes and all private schools have small class sizes;
3. Purposive selection of schools to obtain small and large class sizes.
4. The use of existing examination results as the source of data.

Recommendations

Based on the findings of the study, the researcher recommends the following:

1. The Rivers State Government and Local Government Education Authorities should immediately improve classroom infrastructure in all public secondary schools in the Obio-Akpor LGA to a maximum class size of pupils in conformity with the national policy on education.
2. There is an urgent need for the Rivers State Senior Secondary School Board (RSSSSB) to employ more qualified teachers of mathematics to reduce the student-teacher ratio and to enhance effective teaching and learning.
3. Educational planners should carry out a comprehensive needs assessment to determine the infrastructural and human resource deficiencies in public secondary schools in Rivers State. They should next come up with a time-specific implementation strategy with concrete financing to back it up.
4. Future research should employ randomised controlled designs or quasi-experimental techniques to more comprehensively establish the causal relationship between class size and Mathematics performance in the Nigerian context, controlling for confounding variables such as teacher qualification, socioeconomic background, and school resources.

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