

CLASS SIZE AND BIOLOGY STUDENTS' ACADEMIC PERFORMANCE IN OPOBO/NKORO LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

The study's goal was to find out how Biology students in Opobo/Nkoro Local Government Area, Rivers State, Nigeria, performed academically in relation to class size. For the investigation, a quasi-experimental design was adopted. To direct the investigation, three research questions and three hypotheses were developed. One thousand two hundred and thirty (1,230) senior secondary two (SS2) students made up the study's population, while 110 SS2 students made up the sample. Out of the three public secondary schools in the study region, two secondary schools were chosen using the purposive sample approach, and two intact science classrooms delivering Biology with class sizes of 35 and 75 were also chosen. The Biology Achievement Test (BAT) was the tool utilized to gather data. This device underwent pilot testing and validation. Using the Kuder-Richardson formula (20), the dependability coefficient of 0.68 was achieved. While hypotheses were tested using Analysis of Covariance (ANCOVA) at the 0.05 level of significance, research issues were addressed utilizing the mean and standard deviation. The study's conclusions demonstrated that students studying biology in large and small classes performed significantly differently academically. Additionally, there is a notable distinction in the academic achievement of male and female students studying biology in big and small class groups. Smaller class sizes yielded greater performance than larger class sizes in every group that was tested. Among other things, it was suggested that governments and legislators make sure that new classrooms are constructed and that the number of students in a class never exceeds 35. The government is requesting assistance from the Parent Teacher Association (PTA), philanthropists, and other charity groups in order to improve the performance of secondary school pupils in the subject of biology.

Keywords: Class Size, Academic, Biology, Performance, Gender.

Introduction

Biology is a vast field of study that includes everything from the intricate interactions between small molecules inside living cells to the larger ideas of ecosystems and environmental change on a global scale. It is also concerned with the physical traits and behaviors of extant and extinct species, their origins, and their relationships with one another and their surroundings. Biological sciences deal with the in-depth investigation of human brain anatomy,

genetic makeup, and even the operation of the reproductive system. It also goes by a new term these days: Life Sciences (Mamoni, 2021).

The effectiveness and focus of future scientists' development is evident that science (Biology) is crucial for all secondary school students and will play a role in their ability to enter careers like technology, engineering, and other related fields. According to Nnorom and Erhabor (2019), having a solid understanding of

Biology is a requirement for anyone interested in studying medicine, pharmacy, nursing, agriculture, or forestry. Biology education also contributes to the development of future scientists, biotechnology, nanotechnology, and soon other fields (Maduabum, 2014). This demonstrates unequivocally how crucial Biology is to every developing economy. Therefore, Biology education and its significance for comprehending social and personal issues help students grasp the natural world and the principles that govern it (National Research Council, 2012). Biology is naturally learnt in the classroom and the number of students taught at a time makes the class size.

The number of pupils that a teacher is principally in charge of throughout a school year is known as the class size. According to Adeyemi (2018), it's the typical number of pupils in a school's class. It is the population of a class or the number of pupils for each teacher in a certain class (Ajayi, et al., 2017). The Glossary of Education Reform (2015) defines class size as the total number of students enrolled in a course or classroom, specifically (i) the total number of students taught in a course or classroom, or (ii) the average number of students taught by teachers in a school, district, or educational system. One of the key factors influencing academic achievement that teachers in schools have little to no influence over is class size. Class size is a crucial and desired feature of the educational system, according to educators everywhere. One factor that has been hypothesized to affect pupils' academic achievement is class size. There are two aspects to class size: large and small class sizes. When there are more pupils in a class than what the National Policy on Education specifies should be in a class, the condition

is known as large class size. According to the Federal Republic of Nigeria (2014), for better management, control, and effectiveness in teaching and learning, senior secondary teacher-to-pupil ratios should be set at 1:40. A large class size is defined as one in which there is a significant student population, making it difficult for teachers to instruct and manage. The size of the class makes it difficult for the teacher to observe every student's behavior (Magdalene 2014).

Small class size is the number of students below the stipulated number of students in a class which is 40. The increase in population over time has brought about an increase in the number of students that are admitted into schools and consequently outweighs the available infrastructure. Classrooms meant for fewer number of students now accommodated more students. The teacher-student ratio of 1:40, as stipulated in the National Policy of Education, does not reflect class size in reality. Therefore, the bone of contention in the educational system and society, what number of students a teacher is meant to teach to ensure that effective teaching and adequate learning takes place. Also to ensure improvement in the performance of students in their academics, especially in science subjects like Biology.

The performance of students in their academics can be rewarding if the students perform well academically, however, if the reverse is the case, it becomes a thing to worry about and due attention is accorded to the situation to address it as it affects their academic performance and the society. Biology is a very important subject because it enables us to understand ourselves and our immediate environment. It also enables us to be aware of the interaction between living and non-living

things around us. However, in recent times, the academic performance of students in their external examination (Senior Secondary School Certificate Examination) has been very poor as observed in Opobo/Nkoro secondary schools. This could be attributed to the school environment, parents' background, school facilities, school location, Instructional methods and materials and class size. The academic performance of students in their external examination (Senior Secondary School Certificate Examination and Joint Admissions and Matriculation Board) determine whether they will continue to a higher institution to further their studies in Biology related courses. Some have to deviate from their initial course of studies because of their performance in Science (Biology) to Art.

This research seeks to ascertain the effect class size has on Biology students' academic performance in Opobo/Nkoro local government area. Class size is the number of students taught by a teacher in a particular class at a given time. Class size has two dimensions, thus large and small class size. Large class size is a negative situation in the education sector because it influences the academic performance of students from primary to tertiary level. From the results obtained in the public secondary schools in Opobo/Nkoro local government area, the performance of students in Biology can attest to that.

Academic performance is the final outcome of learning, which is generated by the students and their teachers as a result of the instructional activity. Academic performance can be defined as an outcome of education where any student, learner, tutor or institution has attained their educational ambition (Alalwan, et al., 2019). Academic performance is the behaviour

that a person displays after completing a program in a facility or a school, which is a demonstration of the knowledge one has learned after completing a predetermined program in a facility or a school. Though the effect of class size on the academic performance of students has been debated no discernible conclusion as to what extent class size affects the academic performance of students.

However, Moluayonge and Park (2017); Chingos (2013) revealed that a decrease in class size has a positive influence on the academic performance of students, even if the decrease is by one student, there will be increase in the academic performance of students. Small class size allows students to learn effectively without disturbing one another, with one another and work together to learn and study educational material while large class size affects Students' interactions with one another, as well as their engagement in learning, and can make class activities rowdy or cause students to engage in disruptive behavior that takes their attention away from the lesson being taught (Moluayonge & Park, 2017). Bosworth (2014) and Maloney (2020), in different studies, confirmed that students performed better in small classes, this they say is because large class size increases the number of problems that teachers and students must deal with, including students' inability to assimilate what is being taught and distractions from other students in the classroom, which lowers the effectiveness of teaching and learning. Again, Eschool News (2019) article reported that students in small classes exhibit advanced academic performance. It is also necessary to find out if the influence of class size on academic performance could be significant in both genders.

Some academics believe that a student's gender can have an impact on their academic achievement. According to Adigun et al. (2015), gender is one of the factors assumed to have an impact on students' academic achievement, especially in the scientific fields. The range of anatomical, physiological, psychological, and behavioral characteristics that define and differentiate the feminine and masculine (female and male) populations is known as gender. Teachers have been interested in gender as a crucial problem, particularly when it comes to gender equality that addresses all facets. Accordingly, Ho and Kelman (2014) verified that women gain more from smaller class sizes than men do. The main finding of this research is that class size, which can also be influenced by gender, has an impact on students' academic performance in scientific classes, especially biology. In light of this, a study was conducted to determine the impact of class size on the academic achievement of secondary school pupils in the subject of biology. Three research topics and three hypotheses were proposed in order to accomplish this.

Study Questions: i.) What is the difference between students taught biology in large and small classes in terms of mean scores? ii.) What is the difference between the male students' mean scores in large and small biology classes? and iii.) What is the difference between the average scores of female biology students taught in large and small classes?

Research Conjectures: HO1. There is no discernible difference in the academic achievement of biology students taught in big versus small classes. HO2: There is no discernible difference in the male students' academic achievement when taught biology

in big and small class sizes. HO3. The academic achievement of female students taught biology in big and small class sizes is not significantly different.

Methodology

The study was quasi-experimental in design. This is deemed suitable for examining the impact of class size on students' academic achievement. All Government Senior Secondary II Biology students in the Opobo/Nkoro Local Government Areas of Rivers State comprised the study's population. One thousand two hundred and thirty (1230) students from the three senior secondary schools in the local government area made up the study's population.

One hundred and ten (110) senior secondary two (SS2) biology students from two public coeducational senior secondary schools in the Opobo/Nkoro Local Government Area made up the study's sample. Purposive sampling was used to choose the two schools while taking into account their respective class sizes. Whole classes were chosen from each of the two schools, and experimental and control groups were allocated to them, accordingly. Prior to the intervention, the two groups had pretesting. The treatment was followed by a post-test. Both the pre-test and post-test employed the Biology Achievement Test (BAT), which the researcher devised; the questions for the post-test were rearranged. The instrument is divided into two sections: section A contains the student demographics, and section B has the items, which are 50 objective questions. The tool's suitability for content and grammar checks was confirmed. The first term of the SS2 biology curriculum is covered by the ideas taught, which are: pollution; conservation and

natural resources; ecological management and tolerance; and adaptation. The Kuder Richardson-20 formula was applied to guarantee the instrument's internal consistency, and a dependability of 0.68 was attained. The pretest was given before to the four-week treatment (instruction). After administering the post-test, analyses

Results

Variation in the average test results between students taught biology in large and small classes.

Table 1 compares the mean and standard deviation of student performance in large and small class sizes.

| Group | N | Pretest mean | SD | Posttest mean | SD | Mean Gain |
|-------------|----|--------------|------|---------------|------|-----------|
| Large class | 75 | 23.97 | 1.42 | 65.25 | 5.48 | 41.28 |
| Small class | 35 | 22.84 | 1.17 | 82.34 | 7.93 | 59.50 |

Students in small class size have a mean pretest score of 22.84 with a standard deviation of 1.17, and mean posttest score of 82.34 and a standard deviation of the score of 7.93 respectively. Thus, the students have a mean gain score of 59.50 after treatment. On the other hand, the control group has a mean pretest score of 23.97 with an SD of 1.42, and a

posttest mean score of 65.25 and an SD of 5.48 respectively. Thus, the control group had a mean gain score of 41.28. The experimental group scored a higher mean score than the control group. It can therefore be concluded that the students taught Biology in small class size outperformed the students who were taught in large classes.

Difference in the mean scores of the male students taught Biology in large and small class sizes

Table 2: Mean and Standard Deviation on male Students Performance Taught with Large Class Size and Small Class Size

| Class | N | Mean | Std.dev |
|-------------|----|-------|---------|
| Large class | 48 | 64.12 | 6.43 |
| Small class | 23 | 84.28 | 9.17 |

Table 2 reveal that male students taught with large class had a mean of 64.12 with a standard deviation of 6.43 while

those taught with small class size had a mean of 84.28 with standard deviation of 9.17.

Difference in the mean scores of the female students taught Biology in large and small classes

Table 3: Men and Standard Deviation of female students Taught in Large and Small Class Sizes

| Class | N | Mean | Std.dev |
|-------------|----|-------|---------|
| Large class | 27 | 67.52 | .50990 |
| Small class | 12 | 78.61 | 1.70970 |

Table 3 reveals that female students taught in the large class had a mean of 67.52 with a standard deviation of 0.50

while those taught in a small class size had a mean of 78.61 with standard deviation of 1.70.

HO₁: There is no discernible difference in the biology students' performance when taught in large or small classes.

Table 4: Summary of Analysis of Covariance (ANCOVA) for test of significance between the mean scores of students taught Biology in large class size and small class size.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|-----------------|-------------------------|-----|-------------|---------|------|
| Corrected Model | 7299.509 ^a | 2 | 3649.755 | 88.058 | .000 |
| Intercept | 2469.801 | 1 | 2469.801 | 59.589 | .000 |
| Pretest | 33.189 | 1 | 33.189 | .801 | .373 |
| Class size | 5912.168 | 1 | 5912.168 | 142.643 | .000 |
| Error | 4434.864 | 107 | 41.447 | | |
| Total | 568661.000 | 110 | | | |
| Corrected Total | 11734.373 | 109 | | | |

*Significant at sig of $F < .05$

Table 4 shows the F-calculated mean score values for biology students taught in large and small class sizes. The group's F-calculated value is less than the .05. It is 142.64 with a significance level of F at .000. This leads to the rejection of the null

hypothesis at the significance level of .05. This research indicates a significant difference between biology students taught in large and small classes in terms of academic achievement.

HO₂: There is no discernible difference in the performance of male biology students taught in big and small class sizes.

Table 5: Summary of Analysis of Covariance (ANCOVA) for test of significance between the mean scores of male students taught Biology in large class size and small class size.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|-----------------|-------------------------|----|-------------|--------|------|
| Corrected Model | 6711.877 ^a | 2 | 3355.939 | 59.683 | .000 |
| Intercept | 1776.597 | 1 | 1776.597 | 31.595 | .000 |
| Pretest | 34.222 | 1 | 34.222 | .609 | .438 |
| Class Size | 5288.782 | 1 | 5288.782 | 94.057 | .000 |
| Error | 3936.068 | 71 | 56.230 | | |
| Total | 378925.000 | 72 | | | |
| Corrected Total | 10647.945 | 70 | | | |

* Significant when $F < .05$.

The F-calculated mean scores of male students who took biology in large and small class sizes are shown in Table 5. Group's F-calculated value is 94.05, and it is

less than .05. This is in accordance with the significance threshold of F at .000. This leads to the rejection of the null hypothesis at the significance level of .05. This research

indicates that male students' performance differed significantly between large and

small biology classes.

HO₃: There is no significant difference between the performance of female students taught Biology in large class size and small class size.

Table 6: Summary of Analysis of Covariance (ANCOVA) for test of significance between the mean scores of female students taught Biology in large class size and small class size.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|-----------------|-------------------------|----|-------------|---------|------|
| Corrected Model | 1052.923 ^a | 2 | 526.461 | 446.288 | .000 |
| Intercept | 601.583 | 1 | 601.583 | 509.969 | .000 |
| Pretest | .029 | 1 | .029 | .025 | .876 |
| Gender | 947.904 | 1 | 947.904 | 803.549 | .000 |
| Error | 41.288 | 35 | 1.180 | | |
| Total | 194360.000 | 38 | | | |
| Corrected Total | 1094.211 | 37 | | | |

* Significant at sig of F < .05

The data presented in Table 6 shows F-calculated values for mean scores of female students taught Biology in large class size and small class size. The F-calculated value for Group is 803.54 with a significance of F at .000 which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result, there is a significant difference between the performance of female students taught Biology in large class size and small class size.

Discussion

Academic Performance of Students taught Biology in Large and Small Class Sizes

From the data collected for this study on class size and Biology students' academic performance in Opobo/Nkoro local government area in Rivers State. In research question one, the result from the findings when compared indicated that the students taught Biology in small class size outscored the students who were taught Biology in large class sizes. Further application of ANCOVA now showed that there is a significant difference between the

performance of students taught Biology in large class size and small class size. The analysis of the findings showed that there is evidence that class size affects Biology students' academic performance. These are consistent with Bosworth (2014), and Maloney (2020), whose studies, confirmed that students performed better in small classes, this they say is because large class size increases the number of problems that teachers and students must deal with, including students' inability to assimilate what is being taught and distractions from other students in the classroom, which lowers the effectiveness of teaching and learning. However, due to the teacher's focus on the students, students in small classes perform better than those in large classes, this also agrees with the report of Chingos (2013) and Moluayong and Park (2017) that students in small classes learn successfully without interfering with one another, Additionally, since the teacher can control the class and give attention to each student individually, teaching and learning are successful, making student in small

classes consistently outperforming their counterparts.

The answer to research question two indicated that the performance mean score of the male students taught Biology in small class size performed better than those in large classes. Further application of ANCOVA suggested that there is a significant difference between the performance of male students taught in large class size and small class size. The null hypothesis was therefore rejected. These findings are consistent with the e-school News (2019) article which also agreed that students in small classes advanced in performance.

The answer to research question 3 indicated that female students teaching biology performed better in small classes than in large ones. An ANCOVA test conducted fictitiously between the two groups indicated a statistically significant difference in the performance of female students teaching biology. Consequently, the null hypothesis was disproved. This result is in line with the findings of Ho and Kelman's (2014) study, which found that females benefit disproportionately from reduced class sizes.

Conclusion

Based on these results, the study concluded that class size has a considerable impact on Biology students' academic performance, with small classes having a greater impact than large ones. A teacher must be aware of her students' abilities. In a large class, that will be challenging, but in a small class, it is very likely; that the teachers will be able to direct students with high and low abilities and employ teaching techniques to improve learning. The teachers' attention will be focused on the pupils. The teaching methods used by the

teacher are impacted by large class sizes. Although teachers often go above and beyond to make sure that the lesson is provided in a way that the students can understand, the delivery of the lesson should also be complemented by strong student performance, particularly in the sciences. The teacher must make the teaching clear and uncomplicated so that the students would pay attention to him or her. In spite of the fact that both groups of students' academic performance improved, according to the research, the reduced class size was obvious. It is attributable to the teaching techniques (discussion and group work) used by the classroom teachers under the researcher's direction. Both approaches focus on the students.

Although both male and female students performed better when taught in small classes, the performance of the male is slightly better than that of the female. Gender still has a significant impact on a student's academic performance. In essence, regardless of the students' ability and regardless of their gender, there is a noticeable difference in how well they perform in small classes, hence class size matters.

Recommendations

The following suggestions are provided in light of the study's findings and their educational relevance.

* It has been discovered that Biology students perform better academically when their classes are smaller, so the government should work with school-based management committees (SBMC), non-governmental organizations, and other cooperative bodies to build more classrooms and employ more teachers. If this is done then the class size will be in accordance to the NPE-mandated ratio of

students to teachers (FRN, 2014).

* In order to make sure that the students are comprehending what is being taught, the teacher should take into account their own teaching strategies.

* The teacher should take the students' abilities into consideration; in fact, the teacher should identify each student in her class and their ability. And when instructing them, the teacher should make sure to pay attention to the students with high ability as well.

* In order to foster friendly interaction between the teacher and the students during teaching-learning activities and to improve learning, teachers should make an effort to build positive relationships with their students.

* Teachers sent to rural areas should be provided incentives to encourage them to stay and to be interested in staying even when transferred. Teachers frequently balked at moving to rural areas due to the challenges associated with the lack of amenities.

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