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**STUDENTS' ABILITIES, CLASS SIZE AND ACADEMIC PERFORMANCE OF STUDENTS
IN BIOLOGY**

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ABSTRACT

The study's objectives were to look at Biology students' academic performance in the Opobo/Nkoro Local Government Area of Rivers State, Nigeria, as well as student abilities and class sizes. For the investigation, a quasi-experimental design was adopted. To direct the investigation, two research questions and two hypotheses were developed. A total of 1,230 senior secondary 2 pupils from Opobo/Nkoro LGA made up the study's population, and 110 senior secondary 2 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 collect the data. Pilot testing and validation were done on this instrument. Using the Kuder-Richardson-20 formula, a 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 a noteworthy disparity in the academic achievement of gifted and low ability biology students in big and small classrooms. In small class sizes, there is a notable disparity in the academic achievement of low ability pupils taught biology. Among other things, it was suggested that governments and policymakers make sure that more classrooms are constructed and that classes should not have more than 35 kids. The government is urging the Parent Teacher Association (PTA), philanthropists, and other charity organizations to support its efforts to improve secondary school student performance.

Keywords: Students' Abilities, Academic, Biology, Performance, Class Size.

Introduction

Class sizes in Nigeria, especially in Rivers State, are become alarmingly large, making it difficult for teachers to provide each student with the individualized attention they require. According to Ajayi et al. (2017), there has been a significant rise in student enrollment, and in senior

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secondary schools in Nigeria, the average classroom size has increased from 30 to 40 pupils to 60 to 75 students or even more. Because of this, it is challenging for the teacher to look at every student in the class while instructing, and as a result, students cluster toward the rear of the room, creating distractions. According to Eatough (2021), maintaining eye contact is crucial during a conversation to determine whether the other person is following the topic of conversation. Because the students' attention will be focused on the teacher if the teacher maintains eye contact, the teacher will be able to tell if the pupils are actively listening to the teacher. However, a teacher cannot in a huge class. Additionally, it makes marking challenging, which discourages teachers from assigning homework given the volume of books they have to grade. Teachers are essentially overworked and unable to maintain a patient and upbeat attitude as a result of the pressure they are under. As a result, they are reluctant to provide additional time to support and assist students who are struggling academically and who face similar issues as low ability kids. Student abilities are critical to achieving academic brilliance. Teachers also play a critical impact in determining pupils' abilities.

Ability is the capacity to do something or applying it to a situation. Dibakar (2021) explained ability as the power or capacity to do or act physically, mentally, legally, morally, financially, etc. He also added that it is the manifestation of confidence. The potential and natural capacity of a student to perform or apply knowledge on a task, as well as their rate of assimilation in academic settings are, thus, what the research defines as students' ability. There are the high ability students and the low ability students. The ability of the students can greatly affect their academic performance if in large class especially for the low ability students. High ability students are those who in one or more domains have abilities that are superior to those of their own age. The domains are intellectual, physical, creative and advanced social ability (High-ability toolkit 2021). According to Unachukwu and Okoli (2020), high ability student is a student with consistent and persistent high score while low ability student is the student with persistent poor or low score.

Large class size has negative impact on the academic performance of students and the test of knowledge cannot be achieved in this situation. When juxtaposed with small class size, the benefits are enormous, students obtained high test scores, better behaviour and discipline. Also the teacher feels accomplished that their efforts to provide more individual attention were actualized. The teachers have idea of the students' class participation and records for each student, and also their full performance. On the other hand, with large class sizes (with more than 40 pupils) the motivation of learning and the assessment of learning cannot be at the right level, because in most of the time assessment is made only through test and essay as teacher does not have an idea in advance or assessment for her students during the academic year (Organization for Economic Co-operation and Development-OECD, 2020).

This is because students cheat in class exercise, test and examination in large class sizes. This translates that the actual performance of the students cannot be seen or reflected in their class scores and thus could subsequently affect them adversely in any external examination. The poor academic performance of students in Biology as indicated in the report of West African Examination Council (WAEC) and National Teachers Institute (NTI) has become a source of concern as regards the falling standard of Biology education and other science subjects. Biology is a very

important subject therefore it has to be given more priority. It enables one to understand herself and her intermediate environment. Nevertheless, the knowledge acquired in Biology subject can also be applied in many fields such as Medicine, Biochemistry, Pharmacy, Microbiology and Agriculture among others. There are many factors that have been linked to students' poor performance, including class size, school facilities, teaching strategies and materials, learning environment, parental background, students' abilities, and gender. However, Dinah (2013) reasoned that students who have a positive attitude towards the subject perform better than those who have a negative attitude. People with positive outlook are driven to work hard, regardless of their abilities. They have optimistic outlook and are motivated to perform better, and their academic performance particularly for those with low abilities has improved as evidenced by the excellent exam scores they earn. Therefore, when teaching a group of students, the class size should be taken into account. Depending on the class size, the teacher may overlook the students' abilities, and in most cases, one group will suffer at the expense of the other. Often times teachers' pay more attention to low ability students, and sometimes pair high and low ability students in groups. But less attention is given to high ability students. However, teacher can ensure that High-ability students benefit from like-ability or above-ability interactions. These interactions can increase the challenge, effort, and satisfaction gained from engaging with tasks. If like-ability peer interactions are not possible, the teacher can create opportunities for interactions.

Regarding the abilities of the students, class size is very important. This class size would ensure a higher level of academic success for all students, especially low ability students (Maloney 2020), he concluded that having small classes is advantageous for all sorts of students (i.e. those with low, medium, and high abilities). According to him, low-ability students appear to gain more from being in small classes for particular grades in reading and science. Teachers are more likely to recognize low-ability students in small classes, which increases the likelihood that they will give these students lessons that will be beneficial to them. On the other hand, low ability students are more likely to engage in learning and interact with the teachers in small classes. This implies that students of all academic achievement levels, and low ability students in particular, do better when there are fewer students in the class. The research of Bosworth (2014), who looked at class size information for the 4th and 5th grades provided by the North Carolina Educational Research Data Centre, is consistent with the findings of Maloney (2020). "Class size reductions appear to both enhance average attainment and assist shrink the achievement gap," said Bosworth in his conclusion. It follows that smaller class sizes improve student performance at all academic achievement levels, but especially for students with low ability.

In large class size, research indicates that high-ability students are growing academically at a slower rate than their peers (Shin et al., 2013). This is because lower ability students receive more attention from their teachers (High-ability toolkit, 2021). Additionally, teachers can believe that high-ability students would advance on their own, as well as advance by supporting low ability students, and might not be sure how to best meet the needs of high-ability students. All of this was predicated on the idea that high-ability students are skilled in all learning processes and comprehend all they learn in the classroom. Contrary to popular belief, therefore designing and differentiating activities should take high-ability students' demands into account. According to Post (2016), the myth that all students with high abilities are high achievers is untrue, though most high

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ability students are vivacious, curious, intense, and motivated. Reality then strikes. They battle the constraints of school, peer pressure, expectations from others, and their own fears. Their natural enthusiasm for learning seems to have disappears overnight.

Teachers and parents may not have any immediate concerns about a high-achieving student, but it is still their responsibility to make sure that pupil doesn't grow complacent. In order to prevent a lack of motivation, this kind of learner should continue to get regular attention and evaluation (Promethean, 2022). For even pupils who can correctly answer a question may not be aware of their own methods. Therefore, it is essential to provide instructional activities that go beyond results-focused learning. They must to be very aware of the processes and strategies used to get the desired outcome. In a large class, this might be difficult, but in a small class, it will be manageable. Students with high and low ability levels should receive the same attention. The demands of high-ability pupils were described as follows in the High-ability Toolkit (2021): High-ability kids require demanding assignments, resources available when needed, chances to connect with other high-ability students, and chances to develop their critical thinking, problem-solving, and metacognitive skills. High achievers require objectives that are reasonable and acceptable.

Students' abilities can affect their performance since they can determine how quickly they absorb new material. While low ability individuals learn at a slower pace, this does not necessarily portend future difficulties. Teachers should therefore be aware that these children might be more proficient in certain areas, and if they can use various teaching techniques based on the students' abilities, it will encourage the students to be engaged in the session (Promethean, 2022). Because low-ability pupils need greater attention, teachers should focus on boosting their own confidence. Because of their academic standing or because of unfavorable outside events, they can feel demotivated. Instructors must to evaluate each student's aptitude in order to determine the circumstances influencing their motivation. Some gifted children believed that they should not have to work as hard or receive lower grades simply because they were gifted. They felt that this was unfair. According to certain research, some students, however, were also quite driven when they were given learning chances that they felt challenged them (Johnston, 2022).

Students classified as low ability typically have higher learning demands and a slower learning rate. Although this group of pupils might not be as talented academically as their peers, they might succeed and outperform them in other particular areas. This will serve as a reminder that, under no circumstances, should this set of kids be treated as a disadvantaged group (Suganthi et al., 2020). Students with low ability levels need to understand that having limits is totally acceptable. When they are able to see this and come up with solutions and alternatives, the situation becomes even more ideal. Learning and advancement also involve asking for help, particularly for students with lower ability levels. According to the High-ability Toolkit (2021), low-ability students can improve their performance and enhance their skills by implementing the following strategies: Developing new ideas and methods to devote more firmly to a particular topic, self-regulating their actions and assessing the results, slowing down reading or thinking about information that appears dense, complex, or incomprehensible, and giving themselves some time are all made possible by self-monitoring. Low ability students sometimes learn better visually, so creating diagrams can also be helpful. The goal of the current study is to determine how students'

talents and class size affect biology students' academic performance. This study was guided by the following hypotheses and research questions:

Research Inquiries: i. How does the performance mean score of high and low ability students studying biology in large class sizes differ from one another? ii. How does the performance mean score of the low and high ability students studying biology in small classes differ from one another?

Research Conjectures: HO1: When teaching biology in large class sizes, there is no discernible difference in the performance of high and low ability pupils. HO2: When teaching biology in small classes, there is no discernible difference in the performance of high and low ability pupils.

Research Method

The design of the study was quasi-experimental. This is considered appropriate to investigate the effect of class size and students' ability on the academic performance of students. The population of this study was made up of all Government Senior Secondary II students studying Biology in Opobo/Nkoro Local Government Areas of Rivers State. The population of this study was one thousand two hundred and thirty (1230) from the Senior Secondary Schools in the local government area.

The sample for this study consisted of one hundred and ten (110) Biology students from senior secondary two (SS2) in two public co-educational senior secondary schools in the Opobo/Nkoro Local Government Area. The two schools were chosen using Purposive sampling technique. In each of the two schools selected intact classes were used. The two groups were pretested before the treatment. Post-test was later conducted after the treatment. The Biology achievement test (BAT) developed by the researcher was used for both the pre-test and post-test, for the post test the questions were reshuffled. The instrument consists of two sections, section A consists of demography of the students and section B consists of the items which are 50 questions in objective form.

For content validation, the instrument was given to the supervisors and experts in the department of science education. The researcher ensured that the items reflected the specific concepts needed to be measured. To ensure the internal consistency of the instrument Kuder Richardson- 20 formula was used and a reliability of 0.68 was obtained. Mean, standard deviation and Analysis of Covariance (ANCOVA) were used to analyze the research questions and hypothesis at 0.05 level of significance. The researcher employed the assistance of the Biology teachers in each school used for the study. The instrument (Post-test) was administered three weeks after the treatment to the two groups.

Results

The tables below report the results from the study and discuss the findings in line with the focus of the study.

Research Question 1: What is the difference in the performance mean score of the high and low ability students taught Biology in large class size?

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Table 1: Mean of Pretest and Post-test Scores of High Level Ability Students and Low Level Ability Students Taught Biology in Large Class Size

| Ability level | N | Pretest mean | SD | Posttest mean | SD | Mean gain |
|---------------|----|--------------|------|---------------|------|-----------|
| High Ability | 46 | 23.97 | 1.43 | 69.68 | 3.60 | 45.71 |
| Low Ability | 29 | 23.96 | 1.42 | 33.82 | 8.66 | 9.86 |

According to the data in Table 1, students with high level ability scored an average of 23.97 on the pretest and 69.68 on the posttest, resulting in a pretest gain of 45.71. On the other hand, students with low level ability scored an average of 23.96 on the pretest and 33.82 on the posttest, resulting in a pretest gain of 9.86.

Research Question 2: What is the difference in the performance mean score of the high and low ability students taught Biology in small class size?

Table 2: The average score on the pretest and posttest for both high- and low-achieving students studying biology in a small class size

| Ability level | N | Pretest mean | SD | Posttest mean | SD | Mean gain |
|---------------|----|--------------|------|---------------|------|-----------|
| High Ability | 21 | 22.77 | 1.15 | 88.18 | 6.89 | 65.41 |
| Low Ability | 14 | 22.93 | 1.23 | 40.57 | 7.72 | 17.64 |

According to Table 2's data, students with high level ability scored an average of 22.77 on the pretest and an average of 88.18 on the posttest, resulting in a pretest gain of 65.41. Conversely, students with low level ability scored an average of 22.93 on the pretest and an average of 40.57 on the posttest, resulting in a pretest gain of 17.64.

H₀₁: There is no significant difference between the high and low ability students taught Biology in large class size.

Table 3: Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean achievements scores of High Ability students and Low Ability Students Taught Biology in large class size

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|-----------------|-------------------------|----|-------------|--------|------|
| Corrected Model | 808.546 ^a | 2 | 404.273 | 15.918 | .000 |
| Intercept | 980.311 | 1 | 980.311 | 38.598 | .000 |
| Pretest | 3.212 | 1 | 3.212 | .126 | .723 |
| Ability level | 804.862 | 1 | 804.862 | 31.690 | .000 |
| Error | 1752.440 | 69 | 25.398 | | |
| Total | 325903.000 | 72 | | | |
| Corrected Total | 2560.986 | 71 | | | |

a. R Squared = .316 (Adjusted R Squared = .296)

F-calculated results for the mean scores of High Ability students and Low Ability students taught biology in large class sizes are displayed in Table 3. For Group, the F-calculated value is 31.69

with a significance level of F at .000, meaning that it is less than .05. As a result, the null hypothesis is rejected at the significance level of .05. This finding indicates that there is a substantial gap in the biology classes with big class sizes between high and low ability students.

H₀₂: There is no significant difference between the performances of high and low ability students taught Biology in small class size.

Table 4: Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean achievements scores of High Ability students and Low Ability Students Taught Biology in small class size

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|-----------------|-------------------------|----|-------------|--------|------|
| Corrected Model | 1222.360 ^a | 2 | 611.180 | 11.695 | .000 |
| Intercept | 1137.184 | 1 | 1137.184 | 21.760 | .000 |
| Pretest | 64.159 | 1 | 64.159 | 1.228 | .275 |
| Ability level | 1114.640 | 1 | 1114.640 | 21.329 | .000 |
| Error | 1829.113 | 35 | 52.260 | | |
| Total | 267830.000 | 38 | | | |
| Corrected Total | 3051.474 | 37 | | | |

a. R Squared = .401 (Adjusted R Squared = .366)

F-calculated values for the mean scores of High Ability and Low Ability Students Taught Biology in Small Class Sizes are displayed in Table 4. Group's F-calculated value is 21.32, with a significance level of F at .000, which is below the threshold of .05. As a result, the null hypothesis is rejected at the significance level of .05. This finding indicates that the capacity of high and low ability students studying biology in small classes differs significantly.

Discussion

The performance of high and low ability students in large class size were compared. The result indicated the variability in performance between the two variables was statistically significant with students in high ability students performing better than low ability students. When tested further using ANCOVA, the test revealed that academic performance of high and low ability students increased. The null hypothesis was therefore rejected. This is not consistent with Post (2016) research, which is in line with Shin, et al. (2013), they contended that high ability students experience academic difficulties and progress more slowly than their peers. This is because teachers gave lower ability students more attention and thought high ability students could grow both independently and by helping lower ability students (High-ability toolkit, 2021).

In research question two, from the result of the pretest the high ability students performed slightly higher than the low ability students but after the post- test the performance of the ability of the students were subjected to further tested using ANCOVA, the result of the analysis showed that there was a remarkable significant difference, especially in the low ability students. Therefore, the null hypothesis was rejected. This finding is consistent with Maloney (2020) which was that small classes benefits low ability students, they gained more because teachers will recognize them and give them lessons that will be beneficial to them. And they can engage in learning and interact with the teacher in class. Bosworth (2014) findings bolster the argument that low ability students do better when there are fewer students in the class.

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Conclusion

Based on these results, the study came to the conclusion that class size has a considerable impact on Biology students' academic performance, with small classes having a greater impact than large ones. It is crucial for a teacher to be aware of her students' abilities. And in a large class, that will be challenging, but in a small class, it is very likely; the teachers will be able to direct students with high and low ability and employ teaching techniques to improve learning. The teachers' attention should be focused on the pupils and the delivery of the lesson should also be complemented by strong student performance, particularly in the sciences. In spite of the fact that both groups of students' academic performance improved, according to the research, performance the reduced class size was quite obvious. In essence, regardless of the students' ability, 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.

* 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.

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