EFFECTS OF HANDS-ON-INSTRUCTIONAL STRATEGY ON ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN BIOLOGY IN ONDO STATE

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Abstract
Examining how gender and school location influenced students' academic performance with a hands-on instructional technique was the specific focus of this study. The study employs a quasi-experimental design with a control group, a post-test, and a pre-test. Every single biology student in Ondo State's secondary schools (SSII) served as the study's population. We used a sample of 69 high school students who were majoring in biology. A multi-stage sample approach was used for the sampling technique. The twenty-five (25) multiple-choice questions that made up the Biology Performance Test were the instrument that was utilized to gather data. Professionals in the area of science education validated the instrument's content and face validity. The reliability coefficient for the instrument was 0.81, as calculated by the test-and-retest procedure. To address the research topic, the researchers utilized descriptive statistics, namely the mean and standard deviation. On the other hand, hypotheses were tested using inferential statistics of the t-test at a significance level of 0.05. Students' pre-test mean scores in the hands-on-instructional method group were not significantly different from those in the control group, according to the study's results. Furthermore, this study's results showed that students' academic performance improved following treatment while using the hands-on instructional technique. Also, when comparing the academic achievements of male and female pupils, no significant difference is seen. In addition, pupils from urban and rural areas do not significantly differ in their performance. Teachers should be motivated to provide students with proper instruction and promote equity in students' approaches, according to the findings. To help students better grasp biological principles, the curriculum should use the hands-on-instructional approach.

Keywords: Hands-on- instructional, Strategy, Performance, Students Gender.

Introduction

Education is a process by which students acquire relevant knowledge, skills, and values to ensure proper intellectual and character development for self-reliance. Education is attentive to the process of imparting all that is good and useful in any culture, this includes the knowledge, skills, attitudes, and values that individuals need to live in the environment. Teaching cannot be separated from learning; the study of science is so important that emphasis is laid on teaching and learning science as contained in the National Policy of Education. The policy statement is to equip effectively all students in this present age. FME (2014).

Teachers should use effective techniques of instruction to lead, guide, and inspire their students. The impact of instructional method on student learning is good, as stated by Rajagopalan (2019). Therefore, it is necessary to find, create, and implement suitable teaching tactics that could improve students' academic performance. Adedayo and Owolabi (2021) state that pupils whose instructors

possess superior knowledge and expertise outperform their peers whose instructors possess inferior knowledge and expertise. Further evidence that pupils fare better in Biology classes taught by certified educators is mounting. If a teacher is competent in their subject area, it does not appear to matter what gender they are as long as they are able to influence their students' learning.

As agents of educational change, educators confront the challenge of how to best teach and learn biology. The main point is that when a teacher focusses on the instructor, the kids don't learn nearly as much. Consequently, educators in the field of science should focus less on the course material and more on the process of guiding students from their current level of knowledge and understanding to the desired level. Active learning is the most effective method of instruction for students. Because it is more likely to inspire pupils by capturing their interest, student-centered learning is a superior method of instruction. The way biology is taught in Nigeria is very teacher-centered, with students not being actively involved in what they are learning (Obodo, 2017). The desired outcomes were not achieved by using this approach.

An approach to education known as "hands-on instruction" encourages students to gain knowledge by doing. Students learn more effectively and retain more information when they work on projects that directly apply to their lives. Since a hands-on approach to education emphasises pupils learning via doing, it keeps their bodies and minds actively involved in the learning process. Students actively participate in the learning process by applying what they have learnt to real-world problems or projects, rather than merely receiving information from a teacher.

According to Ekwueme, Ekon, and Ezenwa-Nebife (2015), students are led to acquire knowledge by experience in the hands-on learning approach. Students benefit from a deeper understanding of the material, improved memorisation skills, a sense of personal achievement, and the ability to apply what they've learnt in different contexts when they engage in hands-on learning activities. Compared to more passive forms of education, the hands-on approach encourages and facilitates active student participation in the classroom, which in turn improves students' capacity for critical thinking.

Students' academic performance can be significantly enhanced through the use of activity-based instructional strategies, such as hands-on learning. The idea behind it is that by letting students work with physical items, they may better grasp abstract scientific concepts, which in turn improves their academic performance. Students are able to participate in realistic situations and see the impact of changing different variables through the use of a hands-on instructional style. Students are more likely to understand and retain information when they are actively involved in the learning process, as shown by Alkan (2016). In addition, Fuad, Deb, Etim, and Gloster (2018) argued that students are more likely to develop a love of learning and a thirst for knowledge when they participate in hands-on activities. Even when it comes to the science underlying "do it yourself" projects, this learner-centred approach encourages students to use their sense of sight, touch, and manipulation in addition to hearing when studying biology.

Gender was described by the United Nations as "socially constructed differences in attributes and opportunities associated with being female or male, and to the social interactions and relations between women and men." Given the volume of research in this subject, gender concerns in science education continue to garner substantial attention. All throughout the globe, people are starting to really care about gender inequalities. Researchers

nevertheless often take gender differences into account; for example, it is thought that, seemingly due to sex hormones, the brains of men and women can react differently to the same event. Two studies found no statistically significant difference in how well male and female students performed in scientific classes: Adigun, Onihuwa, Irunokhai, Sada, and Adesina (2015) and Agommuoh & Nzewi (2017). Everyone from parents and educators to researchers and policymakers is interested in how students of different genders are doing in the classroom. According to Kolawole (2019), there are still studies that find substantial gender inequalities in how well students do. There is no statistically significant difference between the academic achievements of male and female secondary school students, according to Ajaja & Erawwoke (2010) and Olasehinde & Olatoye (2014). Gender considerations in scientific inquiry, particularly in the biological sciences, are crucial. A number of studies have linked pupils' levels of underachievement to their level of academic achievement. Everything surrounding the physical site of the school is considered part of its location. Also included is maintaining the area immediately surrounding the school. Students in urban regions performed better than those in rural areas in science and mathematics, according to Nnenna & Adukwu (2018), Umar (2017), and Olutola (2016). The location of the school has little bearing on the academic performance of the students, according to Awodun and Oyeniyi (2018). While it's true that not all rural schoolchildren will have access to the same basic facilities as their urban school peers, at least they'll be spending more time in nature. Forests, trees, and aquatic life are more common in rural areas than in cities. Biology curricula ought to be more engaging and inventive in light of ongoing technological innovation.

Statement of the Problem

Biology students' dismal showing on the West African Certificate Examination in Nigeria is now a major problem. Students' low performance on both internal and external exams appears to be a direct outcome of their difficulties grasping a wide range of biological concepts, according to the researcher's interactions with them. A lack of hands-on activities, instructors who aren't qualified, students who don't engage with one another, and ineffective teaching methods are just a few of the many possible causes of this dismal academic performance. The majority of the previous research found that traditional classroom instruction was ineffective in raising students' test scores in biology and other science classes taken in high school. Therefore, it is important to investigate cutting-edge, contemporary approaches to education, of which hands-on learning strategies are an integral component.

Purpose of the Study

The research team in Ondo State set out to find out how high school seniors in Biology fared after implementing a more hands-on approach to the subject. More especially, this research:

i. Used a hands-on approach to teaching biology and evaluated the students' progress.
ii. Investigated the impact of school location on students' academic achievement through the use of a hands-on instructional technique.
iii. Identified gender disparities in students' performance using a hands-on learning approach.

Research Question

One question that guided the research for this study was:

1. How did students do in Biology both before and after the intervention?

Research Hypotheses

The following null hypotheses will be formulated:

Ho1. Students in Ondo State's senior high schools who were taught biology via a hands-on approach had no statistically significant improvement over those who were taught the subject through more traditional means.

Ho2. Students in Ondo State's senior high schools who were taught biology using a hands-on approach did not significantly outperform their male and female counterparts.

Ho3. The mean performance ratings of students taught Biology utilising a hands-on instructional technique in Ondo State's senior secondary schools do not vary significantly by school location.

Methodology

The study adopted a pre-test, post-test control group of quasi-experimental design from both rural and urban school locations. It also assessed the effect of the pre-test relative to the post-test and also assessed the homogeneity of the groups before administration of the treatment.

The population for the study consisted of all secondary school (SSII) biology students in Ondo State. The sample for the study consisted of 69 Senior Secondary School II Biology student

As a preliminary step, one of Ondo State's three senatorial districts was chosen at random from a pool of candidates. Then, two LGAs were chosen from within the senatorial district and eighteen LGAs were also chosen at random. A three-year running total of the Biology Performance Test (BPT) based on previous SSCE, WAEC, and NECO questions served as the research instrument for data collecting. Both the pre- and post-tests were administered using the BPT. Professionals in the fields of biology and science education checked the tests for validity. The test-retest procedure was used to determine the instrument's reliability. At a significance level of 0.05, data was analysed using Pearson's Product Moment Correlation (PPMC). Twenty students who were not part of the original sample were given the instrument, and then the same set of respondents were given it again two weeks later. The obtained coefficient was 0.81. Descriptive and inferential statistics were used to examine the gathered data. The study topics were addressed using descriptive statistics such as percentages and frequency counts. To evaluate the hypotheses set at a significance level of 0.05, the inferential statistics of Analysis of the t-test were employed.

Results and Discussion

1. Research Question 1: How did students do in Biology both before and after the intervention?

To address this research issue, we compared the average performance of students who participated in traditional classroom education with those who participated in hands-on learning. The result is presented in Table 1.

Table 1: Mean and Standard Deviation of Students in the Experimental and Control Groups.

Strategy	***N***	***Pre-test***		***Post-Test***		***Mean Difference***
		Mean	***SD***	***Mean***	***SD***	
Hands-On Instructional	47	12.53	2.77	19.28	2.18	6.75
Conventional	22	13.36	2.97	14.23	2.72	0.87

Prior to treatment, students in the Hands-On Instructional Strategy group averaged 12.53 points, whereas those in the Control group averaged 13.36 points (Table 1). Prior to the treatment, the group seems to be homogeneous. Following the intervention, the control group's mean score was 14.23 and the Hands-On Instructional Strategy group's score was 19.28. Therefore, the results of the pre- and post-test mean differences and standard deviations differ, as shown in the table above, suggesting that the therapy had an effect.

Testing of Hypotheses.

Hypothesis 1: Students in Ondo State's senior high schools who were taught biology via a hands-on approach had no statistically significant improvement over those who were taught the subject through more traditional means.

To test this hypothesis, the post-test mean scores of students in the experimental group and the control group were computed for statistical significance using T test at 0.05 level of significance level.

Table 2: t-test Summary of the Post-test Mean Scores of Students in the Experimental and Control Groups.

Source of variations	N	Mean	STD Deviation	df	T	p
Hands-on strategy	47	19.28	2.18	67	8.2745	0.0001
Conventional	22	14.23	2.72			

p value 0.0001. Since p, value is<0.05 then Ho should not be accepted

The results in Table 2 shows that there is a significant difference in the post-test mean scores of students in the experimental and control groups (t = 8.2745, p = 0.0001 since the p-value is less than the level of significance. This implies that the treatment improved and enhanced the academic performance of the students.

Hypothesis 2: Students in Ondo State's senior high schools who were taught biology using a hands-on approach did not significantly outperform their male and female counterparts.

Table 3: t-test comparing the different mean scores of male and female students in hands-on learning Experimental Group.

Gender	N	Mean	Std. Deviation	df	T	P-value
FEMALE	29	19.48	1.920	45	0.818	0.417
MALE	18	18.94	2.578			

Accept H_0 Since p-value > 0.05

Table 3 displays the average score disparity between male and female students in Ondo State senior high schools who were taught biology through a hands-on approach. There are 29 females and 18 males in the group; the average score for the men is 19.48 and the average score for the females is 18.94. The results of the t-test indicate that the mean scores of male and female students taught utilising a hands-on teaching technique are not significantly different (t = -0.818, p-value = 0.417). Therefore, we do not reject the null hypothesis.

Hypothesis 3: The mean performance ratings of students taught Biology utilising a hands-on instructional technique in Ondo State's senior secondary schools do not vary significantly by school location.

Table 4: T-test comparing the difference mean score of rural and urban in hands-on learning Experimental Group

Location	N	Mean	Std. Deviation	Df	T	p-value
Rural	12	19.17	2.368	45	0.1895	0.983
Urban	35	19.31	2.153			

Accept H_0 Since p-value > 0.05

To examine the mean score difference of rural and urban students taught Biology utilising hands-on learning methodologies in Senior Secondary Schools in Ondo State, Table 4 presents the summary of the scores and an independent sample t-test. Twelve students from rural areas and thirty-five from metropolitan areas make up the group; their average scores are 19.17 and 19.31, respectively. The results of the t-test indicate that the mean scores of students in rural and urban areas who were taught biology using a hands-on approach were not significantly different ($t = -0.1895$, p-value = 0.983). Therefore, we do not reject the null hypothesis.

Discussion

The results demonstrated that both the experimental and control groups of pupils were similar prior to the intervention. This demonstrates that the two groups of pupils have historically performed at comparable frequencies. Their differences were insignificant.

In contrast to the traditional approach, students' performance improved significantly following the implementation of the hands-on educational strategy. The results were in line with those of other studies that found that students learnt more, retained more information, and had a deeper understanding of the material when they participated in hands-on activities. These studies included Ekwueme, Ekon, and Ezenwa-Nebife (2015), Alkan (2016), and Fuad, Deb, Etim, and Gloster (2018).

According to the study's results, male and female students who were taught via hands-on methods performed similarly. Overall, this result lends credence to the conclusions drawn from previous research by Adigun, Onihuwa, Irunokhai, Sada, and Adesina (2015) and Agommuoh & Nzewi (2017), which demonstrated that students' performance did not differ according to their sexual orientation.

This study found no statistically significant difference between rural and urban students' mean performance scores when using the Hands-on Instructional Strategy. This confirms what Awodun and Oyeniyi (2018) have found: that kids' academic performance is unaffected by the school's location. Urban pupils outscored rural students in science and mathematics, according to Umar (2017) and Olutola (2016), although this fact is heavily contradicted by this.

Conclusion.

The study's findings suggest that students' biology grades are improved when teachers use a hands-on instructional strategy. Furthermore, male and female pupils do not differ much in their academic performance.

Recommendations

It is advised that, when teaching biology, educators should

- Take a proactive approach, to keep biology teachers abreast of this new method of instruction, seminars and workshops should be scheduled.
- Incorporate this method into teacher training programs; promote good student attitudes; enhance teacher-student contact; and treat all students equally, regardless of gender.

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