INTERACTIVE ENGAGEMENT STRATEGY AND ACADEMIC PERFORMANCE OF SCIENCE STUDENTS IN SENIOR SECONDARY SCHOOLS IN EKITI STATE

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Abstract
This study focuses on science students in Ekiti State's secondary schools and how an interactive engagement technique affected their grades. The population comprises all SS2 students enrolled for Physics, Chemistry and Biology in Ekiti State, 120 students were sampled using a multistage sampling procedure. An instrument used was a Science Performance Test (SPT) to collect data for the study. One research question was raised and three hypotheses formulated and tested at 0.05 level of significance. As part of their validation process, experts in the field of Science Education ascertained the instrument for clarity and intelligibility and made sure that each item was relevant. It was determined that the constituency's dependability was 0.75, when the Pearson's Product Moment Correlation (PPMC) formula was used. The results showed that students who were exposed to both the traditional method and the interactive engagement approach performed better.

Key words: Effect, Interactive engagement, Academic performance, Science student

Introduction

The goal of Education is to foster the good traits in people and help them develop their inner capacities; it is the process of teaching and training people to be self-reliant. Learning is an essential part of any educational process, as it entails acquiring new skills and knowledge in an effort to overcome challenges or adapt to novel circumstances. Raising one's educational status is a certain way to boost one's social standing. A person's social and industrial lives are intertwined through education; it promotes a healthy environment and, as a society progresses, education becomes more and more essential to daily survival Mirowsky (2017). A nation's scientific and technological prowess can be greatly enhanced through science education. It is declared in the Federal Republic of Nigeria's that students should be prepared to thrive in the modern era of science and technology, among other things. Schoeller, Perlovsky, and Arseniev (2018) state that science education is a service that promotes creative intellectual activities that lead to unified concepts, theories, and laws regarding human nature and the environment. These ideas and laws can then be applied to control the environment for the benefit of humans. According to Kilaq,

Lisao, Lasstimoso, Villa & Minosa (2024), science education is crucial for producing a workforce that can tackle the complex problems of today and make positive contributions to society's progress.

By providing pupils with a solid foundation in science education, we can help our nation accomplish its technological goals. The importance of digital devices in the classroom has recently come to light as a result of technological advancements. Sustainable and social-economic growth, as well as the technical improvement of every nation, have all been greatly aided by science, both locally and internationally. According to Linet al. (2017), as stated in Lew et al. (2018), technology is deemed interactive if it enables human contact. Instead of just listening to an expert, students in an interactive learning environment actively process what they've learnt. If Adeleye and Omotayo (2020) are to be believed, scientific inquiry was essential to humanity's ability to discover life on other planets. According to Ajayi and Ogbeba (2017), scientific knowledge is derived from the methodical investigation of the physical world, particularly through observation, measurement, experimentation, and the formulation of theories to explain the outcomes of these endeavours. Science education equips learners with scientific literacy, inquiry skills, critical thinking, problem-solving abilities, and practical competencies necessary for technological development. It is not surprising that the topics in science can provide man and society with fundamental knowledge and skills (Umoru and Onoja, 2017). Instruction centered on active engagement Consensual understanding is promoted by strategy-designed mind-and, at times, hand-on exercises that, when shared with classmates and teachers, provide instantaneous feedback. Interactions in Science can sometimes be much sidetracked. Science education equips learners with scientific literacy, inquiry skills, critical thinking, problem-solving abilities, and practical competencies necessary for technological development. Students can engage in hands-on learning, collaborative projects, and the practical application of biological concepts in the lift.

The integration of technology into active learning pedagogy allows educators to craft more dynamic and participatory lessons. "Incorporation appropriate technology into the classroom can excite and engage students," Metcalf et al. (2016) argued, because "twenty-first-century students are adept at using technology." Students' ability to think critically, assess information, and apply it to solve issues and make adjustments can be greatly improved through interactive engagement. The absence of good verbal interaction between teachers and students can have a negative impact on the academic world and lead to poor performance, according to Owolabi et al. (2022), who claimed that such interaction encourages students to actively participate in class. Caleb and Alloysuis (2016) and Walker et. al (2018) are just a few of the research that have shown how active learning methodology may be enhanced with technology-based systems like clickers. School location, according to Okore and Eze (2016), is "a specific place in relation to other areas in the physical environment (rural and urban) where the school is sited," and it has a significant impact on students' academic performance. When it comes to student achievement, the school's location is a major factor. According to Oyeromi et. al. 2018, a school's location significantly affects pupils' academic performance. The capacity of students to concentrate in class is supposedly diminished when they have a longer commute or are more likely to be tardy if they live farther away from their schools.

Statement of the Problem

The scarcity of funding, materials, and resources necessitates constant monitoring of the quality of instruction in secondary schools across Nigeria. Teacher burnout manifests itself in a variety of ways, including a lack of dedication to their students' learning, frequent absences from class, and a reliance on antiquated teaching practices that seem to have stunted their ability to adapt to the rapidly changing global economy.

Purpose of the Study

The primary purpose of the study is to examine interactive engagement strategy and academic performance of science students in senior secondary schools in Ekiti state. It also focus on the impact of geographical location on students' scores.

Research Questions

This study was guided by a single research question.

1. What is the difference in the performance of Science Students in the traditional and interactive engagement strategy?

Research Hypotheses

At the 0.05 threshold of significance, three study hypotheses were developed and put to the test in this study.

Ho1: There is no significant difference in the students' pretest scores in the experimental and control groups.

Ho2: There is no significant difference in the students' posttest scores in the experimental and control groups.

Ho3: There is no significant difference in the students' scores in the experimental and control groups based on school types.

Methodology

The study adopted a pretest, post-test, control group quasi-experimental design with one experimental group and one control group. Students enrolled in SS11 biology, physics and chemistry courses made up the sample population. 120 participants were chosen using a multistage sampling procedure; they were all SS11 students. The investigation was guided by research question raised and three hypotheses were formulated. Science Performance Test (SPT) was the research instrument used in this study. The dependability of the instrument was tested using a test-retest procedure, and it was confirmed by experts in the field of science. An acceptable reliability coefficient for the research was 0.75.

O_1 X_E O_2 X_E treatment with Interactive Engagement

O_3 X_c O_4 X_c treatment with Traditional Approach

O_1, O_2 - Pre-test observations

O_2, O_4 - Posttest observations

Results

Question 1: What is the difference in the performance of Science Students in the traditional and interactive engagement strategy?

Table 1: Mean and standard deviation of the traditional and interactive engagement strategy in science students

Strategies	Test	N	Mean	S.D	Mean Diff.
Interactive Engagement strategy	Pre-test	60	9.42	2.24	5.06
	Post-test		14.48	2.70	
Traditional Approach	Pre-test	60	10.20	2.69	1.10
	Post-test		11.30	2.31	

Table 1 compares the pre- and post-treatment averages and standard deviations of two groups of science students: those who used interactive engagement and those who used the traditional method. Before treatment, the average score of the experimental group of science students was 9.42, whereas the control group's score was 10.20. The experimental group's students' performance increased dramatically, going from 9.42 on the pretest to 14.48 on the posttest. The experimental group's mean difference between the pre- and post-test scores increased by 5.06. Nevertheless, compared to the pre-test value of 10.20, the post-test mean value of 11.30 was slightly higher among the control group students. A 1.10 point gain was indicated by the difference between the control group students' pre- and post-test averages. This suggests that the average performance score of science students taught using traditional methods and those including interactive involvement is significantly different.

Hypothesis 1: There is no significant difference in the students' pretest scores in the experimental and control groups.

Table 2: t-test summary on the pretest scores of experimental and control groups of Science students

Group	N	Mean	SD	df	t	P
Experimental	60	9.42	2.24	118	1.576*	0.118
Control	60	10.20	2.69			

p>0.05

A computed t-value of 1.576 for the groups where the p-value was more than 0.05 was not statistically significant at the 0.05 level, as shown in Table 2. There is no statistically significant difference between the experimental and control groups in terms of their mean pre-test scores, therefore the null hypothesis was not rejected.

Hypothesis 2: There is no significant difference in the students' posttest scores in the experimental and control groups.

Using t-test statistics at a 0.05 level, we compared the post-treatment mean scores of the experimental group with those of the control group in science in order to evaluate the hypothesis. In Table 3, you can see the outcome.

Table 3: t-test summary on the posttest scores of experimental and control groups of Science students.

Group	N	Mean	SD	df	t	p
Experimental	60	14.48	2.70	118	6.337*	0.000
Control	60	11.30	2.31			

*p<**0.05**

The groups having a p-value less than 0.05 were found to have a significant computed t-value (6.337) at the 0.05 level, as shown in Table 3. There is a statistically significant difference between the experimental and control groups on the post-test performance mean score, therefore rejecting the null hypothesis.

Hypothesis 3: There is no significant difference in the students' scores in the experimental and control groups based on school types.

The hypothesis was tested by comparing the pre- and post-treatment scores of science students in urban and rural schools using Analysis of Covariance (ANCOVA) statistics at the 0.05 level. Table 4 displays the outcome.

Table 4: ANCOVA summary of school location and intervention on students' scientific knowledge

Source	SS	df	MS	F	Sig
Corrected Model	323.632	4	80.908	14.073	.000
Intercept	935.622	1	935.622	162.744	.000
Covariate (Pretest)	1.122	1	1.122	.195	.660
School location	68.164	1	68.164	11.857	.001
Group	240.314	1	240.314	41.801	.000
School location * Group	.478	1	.478	.083	.774
Error	546.158	95	5.749		
Total	17485.000	100			
Corrected Total	869.790	99			

p>0.05

Table 4 shows the disparities in experimental and control groups' performance in science between schools in rural and urban areas. With degrees of freedom of 1, the groups' estimated F-value (0.083) was not statistically significant when tested at a p>0.05 threshold of significance. Nothing indicates that the null hypothesis should be rejected. This indicates that the experimental and control groups of students from urban and rural schools did not significantly differ in their performance on the Science test. Both the therapy ($F_{1,95} = 41.801$, p= 0.000) and location ($F_{1,95} = 11.857$, p= 0.001) have a statistically significant main influence on the performance of Science students at the p<0.05 level. About 11.1% ($Eta^2 = 0.111$) of the observed variance on students' performance in Science is accounted for by school location, about 30.6% ($Eta^2 = 0.306$) by therapy, and about 0.1% ($Eta^2 = 0.001$) by the combined effect of school location and treatment.

Discussion

The study shows that using interactive engagement strategies in science teaching significantly boosts students' performance compared to conventional methods, with improvements clearly linked to the instructional approach rather than prior differences. This aligns with research by Theobald et al. (2020), Stains et al. (2021), Deslauriers et al. (2023), and OECD (2023), all of whom highlight the benefits of active, learner-centred pedagogies in enhancing achievement, participation, and critical thinking. However, Van Alten et al. (2020) and Børte, Lillejord, and Kvaal (2023) caution that success depends on teacher competence, instructional design, and resources. Interestingly, the study found no significant difference between rural and urban students, suggesting that effective teaching strategies can bridge location-based disparities. This supports UNESCO (2023) and UNICEF (2022), who emphasize that equitable access to quality instruction matters more than geography, though it contrasts with World Bank (2022) and Okoye and Okechukwu (2024), who still report rural-urban gaps due to resource limitations. Overall, the evidence underscores that interactive engagement is a powerful tool for improving science achievement across contexts, provided schools and teachers create supportive learning environments.

Conclusion

A real instructional technique for improving students' performance in science can be found in the implementation of an interactive engagement strategy, according to the study's results. The impact of an interactive engagement strategy on students' performance in science differs among school locations.

Recommendations

The study's results informed the following suggestions;

1. Science teachers should adopt interactive engagement strategies to enhance students' academic achievement, participation, and conceptual understanding in science classrooms.
2. In order to boost student interest, efficiency, and performance in science, instructors should intentionally incorporate interactive strategy into their lessons.
3. Science teachers could benefit from attending seminars and workshops to improve their teaching methods, pique their students' interest, and boost their students' performance in the subject.

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