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Basic Science and Technology and Students' Biology Achievement in Odukpani Local Government Area of Cross River State, Nigeria

[1]**Effiom Etim Effiong, Ph.D**
effiome70@gmail.com
https://orcid.org/0009-0007-8744-9191

[1]**Inyene-Obong Sunday Umoh**
inyeneobongumoh@gmail.com
[1]*Department of Biology Education*
University of Calabar, Calabar

Nyebuk Aniekan Etukudo
etukudonyebuk18@gmail.com
Department of Science Education
University of Uyo, Uyo

Abstract
The study investigated the relationship between students' achievement in Basic Science and Technology (BST) in Basic Education Certificate Examination (BECE) and their achievement in Biology in secondary schools in Odukpani Local Government Area of Cross River State, Nigeria. The survey research approach was employed and 150 senior secondary school I (SS 1) students constituted the sample. The instruments used for data collection were the Biology Achievement Test (BAT) and the Basic Science and Technology BECE results of the sampled students. A reliability of 0.80 was obtained for the instrument using Richard Kuderson 21. Regression analysis was used for data analysis. The results showed that a relationship exists between how students achieve in Basic Science and Technology in BECE and their results in Biology. It was recommended, amongst others, that students' placement in Biology classes should be determined by their achievement in Basic Science and Technology, as may be reflected in their BECE results.
Keywords*:* science education, basic science and technology, biology subject, students' achievement, secondary education.

Introduction

Science education is an essential component of every student's academic development. It plays a vital role in cultivating a deeper understanding of the world and equipping

individuals with the necessary skills to address current and future challenges. Basic Science and Technology (BST) and Biology stand out as two key disciplines that facilitate scientific literacy and drive technological advancements and thus help to shape future generations (Stuckey et al., 2013).

Basic Science and Technology (BST) is a junior secondary school subject in Nigeria that provides students with the fundamental knowledge and skills related to building various scientific disciplines in preparation for senior secondary school science education (Igbokwe, 2015). Therefore, this subject helps prepare and expose students to basic scientific concepts, experimental methods, and critical thinking skills from a young age. This is achieved through hands-on activities and experiments, encouraging students to learn early how to explore, analyze, and draw evidence-based conclusions. The subject fosters in students, a sense of curiosity and creativity, enabling them to think critically and solve problems effectively (FRN, 2012).

Technology is rapidly evolving, and understanding its principles is essential for survival in the 21st century science education (Waters, 2016). Consequently, BST education plays a fundamental role in familiarizing junior secondary school students to technological advancements as they familiarize themselves with basic technological concepts, such as coding, robotics, and information technology, while ensuring they remain competitive and adaptive to the ever-changing technological landscape.

Biology, the study of life, is a fundamental branch of science that explores the complexities of living organisms and their interactions with the environment. Biology education therefore enables students to appreciate the intricate mechanisms of the body system, ecosystems, and evolution. As a senior secondary school science subject, it equips learners with the foundational knowledge necessary for pursuing careers in medicine, pharmacy, biotechnology, research, conservation, among others.

Biology education has far-reaching implications in numerous facets of life. It enables individuals to make knowledgeable decisions about their health and well-being. By understanding concepts like genetics, nutrition, and disease prevention, students develop a strong foundation for lifelong health management. Moreover, Biology as a subject in secondary schools encourages ethical considerations, fostering responsible decision-making related to topics such as genetic considerations in marriage and breeding, animal welfare, and environmental conservation.

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Being a very broad subject, Biology helps learners to appreciate the interaction between the living world and the components of the non-living world, thereby promoting in learners the virtue of self-awareness and understanding, such that is necessary to comprehend the physiological changes inherent to them. Furthermore, secondary school Biology education helps learners to compprehend the interconnectedness of all life forms and the relationship to their habitat. It instils the belief in environmental stewardship and compels individuals to invest in the preservation of biodiversity and the sustainable use of natural resources. This knowledge is crucial in tackling global challenges like climate change, habitat destruction, and loss of biodiversity. To effectively engage learners in this subject will therefore require a sound foundation in BST, which is a junior secondary school subject that serves as a prerequisite for senior secondary school science education. It is on these grounds that this research sought to investigate whether a significant relationship exists between students' Basic Science and Technology (BST) achievement at the Basic Education Certificate Examination (BECE) and their Biology Achievement.

Sequel to the aforementioned relevance of Biology as a senior secondary school subject, it has become a necessity that education stakeholders in Nigeria take seriously how students achieve in this subject to guarantee quality senior school science education in this area. Nwabuaku (2023) asserted that students' poor Biology performance in Nigeria may be related to several challenges that require immediate attention; and that some of these challenges include teacher commitment, unclear programme objectives, ineffective teaching methods, insufficient laboratory resources and experience, assessment difficulties, and the absence of students' motivation. However, there is no doubt that addressing these difficulties is vital to refining the quality of secondary school Biology education and ensuring that students are well-equipped to compete in today's global job market.

Oyedokun (2012) discovered that students' scores in Basic Science and Technology were indicative of their future success in SSCE Biology in Kontagora, Niger State, Nigeria. Adewale (2016) opined that students' underperformance in Biology during senior secondary certificate examinations is linked to their insufficient grasp of Basic Science. Furthermore, the research findings by Enemarie et al. (2019) revealed a minimal variation in students' achievement in Basic Science in BECE, concerning their achievement in Biology. The study highlighted that students' achievement held a predictive power of 17.5%. As a result, students' academic accomplishments in Basic Science could potentially forecast their achievement in Biology, although it may not be the exclusive determining factor.

In another study, Ellah and Achor (2017) observed a significant correlation between students' achievement in basic science and technology and their subsequent achievement in biology,

chemistry and physics. They found that students who excelled in basic science and technology were more likely to maintain high achievement if they maintained an interest in these science subjects. Therefore, they emphasized the importance of prioritizing biology education at all levels to ensure prosperous and sustainable accomplishments for the nation. They recommended addressing any obstacles that hinder the successful implementation of the Biology curriculum to achieve this goal. Furthermore, their research suggests that gaining insight into students' academic achievement in Basic Science and Technology can offer valuable guidance for improving their academic performance in Biology. Additionally, Dike and Garba (2017) conducted a similar study and found that students' academic achievement in Basic Science and Technology successfully predicted their performance in SSCE Biology, highlighting the significance of a strong foundation in science education.

Osokoya (2013), and Olatoye and Afuwape (2004) in their studies observed that students' performance in Basic Science and Technology not only serves as a reliable indicator of their future success in Biology but also has implications for their achievements in Chemistry and Physics. Conversely, Adebayo (2012), and Afolabi and Adewale (2018) independently concluded that students' performance in the Basic Education Certificate Examination (BECE) inadequately reflects their success in the Senior Secondary Certificate Examination (SSCE).

Moreso, while Istifanus and Aliyu, (2022) reported their study to show that students' achievement in Basic Science and Technology BECE is a moderate predictor of their performances in Biology in Senior School Certificate Examination (SSCE); Njigwum and Longjohn (2019) reported their findings indicating that the Junior School Certificate Examination in Basic Science and Technology is not a strong indicator of success in SSCE Biology within the public schools in Port Harcourt City.

Given these many findings, there is an obvious need to prioritize biology education at all levels. This entails addressing any barriers that hinder the effective implementation of the Biology curriculum to ensure the nation's prosperous and sustainable future.

Research question

1. To what extent does a relationship exist between students' achievements in Basic Science and Technology BECE and their achievement in Biology?

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Hypotheses

Ho1: There is no significant relationship between students' achievement in Basic Science and Technology BECE and their achievement in Biology in Odukpani Local Government Area of Cross River State.

Methodology

The survey approach was employed to determine whether students' achievement in Basic Science and Technology in the Basic Education Certificate Examination (BECE) relates to their achievement in Biology in Odukpani Local Government Area of Cross River State. This design was appropriate since it describes the relationship of events at the time of the research. The study utilized purposeful and simple random sampling techniques to select five schools from all the public senior secondary schools in Odukpani LGA. Furthermore, 150 senior secondary school one (SSS 1) students were selected from the five public secondary schools to serve as the sample of the study.

The instrument used in the study to gather data is the Biology Achievement Test (BAT). The BAT is a twenty (20) item multiple choice test on SSS 1 Biology following the government-approved scheme of work for secondary schools and adapted from the Cross River State Ministry of Basic and Secondary Education past questions. The BAT covered two topics which include the classifications of living things, and structure and functions of the cell. A reliability of 0.8 was obtained for the instrument using Richard Kuderson 21. The content validity of the instrument was ascertained by two experts in Biology Education from the Department of Science Education, University of Calabar, Nigeria. Secondary data from the sampled students' achievement in the Basic School Certificate Examination (BECE) was also collected and analyzed. Regression analysis was used for data analysis.

Presentation of results

Research question 1: To what extent does a relationship exist between students' achievements in Basic Science and Technology in BECE and their achievement in Biology?

Table 1: Regression analysis of students' achievement in Basic Science and Technology in BECE and their achievement in BAT

Model	N	B(Reg. Weight)	R	Regression Square (R^2)
1	150	0.165	0.346	0.130

Table 1 displays the results of the regression analysis, illustrating the relationship between students' achievement in Basic Science and Technology BECE and their achievement in BAT. The findings reveal a positive regression weight for the variables of students' BECE and BAT. Specifically, the measure of students' achievement in Biology, as indicated in the BAT, demonstrates a regression weight of 16.5% (0.165), and the coefficient of determination R^2 is 0.130. This implies that only 13.0% of the variation in students' achievement in the BAT can be accounted for by their achievement in Basic Science and Technology in BECE. Thus, one can deduce that a positive relationship exists between students' achievement in Basic Science and Technology in BECE and their achievement in Biology.

Ho1: There is no significant relationship between students' achievement in BECE Basic Science and Technology and their achievement in Biology in Odukpani Local Government Area of Cross River State.

Table 2: ANOVA of regression of relationship between students' achievement in Basic Science and Technology in BECE and their achievement in BAT

Source of Variation	Sum of Squares	df	Mean Square	F
Between Groups	272.56711	1	272.56711	
Within Groups	109290.27	148	369.224	0.738
Total	109562.84	149		

The data analysis in Table 2 shows the regression ANOVA, testing the relationship between students' achievement in Basic Science and Technology BECE and their achievement in BAT. The table clearly shows that the predictor variable has an F value of 0.738 and the significance of the null hypothesis is determined at the $P < 0.05$ significant level. This result indicates that students' achievement in Basic Science and Technology BECE significantly relates to their achievement in Biology, as reflected in the BAT, leading to the rejection of the null hypothesis.

Discussion of the findings

The study focused on examining the relationship between achievement in Basic Science and Technology (BST) in BECE and the academic achievement of biology students in Odukpani Local Government Area of Cross River State. The findings of the study show a positive regression weight of 16.5% for the variable of students' Basic Science and Technology BECE and BAT. Furthermore, the study discovered that students' achievement in Basic Science and Technology BECE, as reflected in the BAT, significantly influences their achievement in Biology in Odukpani Local Government Area of Cross River State.

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This result agrees with Enemarie et al. (2019), and Istifanus and Aliyu, (2022) whose studies showed that students' achievement in Basic Science and Technology BECE is a moderate predictor of their performances in Biology in Senior School Certificate Examination (SSCE), thereby establishing a significant relationship between the two subjects. In any case, the finding disagrees with Njigwum and Longjohn (2019) whose findings indicated that the Junior School Certificate Examination in Basic Science and Technology is not a strong indicator of success in SSCE Biology within the public schools in Port Harcourt City.

Conclusion

The findings of this study indicate that a relationship exists between students' achievement in Basic Science and Technology and their academic accomplishment in Biology in the Odukpani LGA of Cross River State. This suggests that a high-quality encounter in Basic Science and Technology can improve students' achievement in senior school Biology. The study thus addresses the existing information gap and fortifies the significance of Basic Science and Technology as a means of establishing success in Biology classes.

Recommendations

The study recommends that students' placement in biology classes should be determined by their overall basic science and technology achievement, as mirrored in their Basic Education Certificate Examination (BECE) results. Furthermore, the study recommends that the adaptation of the Basic Science and Technology pedagogical process should reflect students' learning differences to guarantee that all students can perform well in future Biology classes.

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