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ATTITUDE OF UNDERGRADUATE BIOLOGY EDUCATION STUDENTS OF IGNATIUS AJURU UNIVERSITY OF EDUCATION TOWARDS MATHEMATICS AND THEIR ACHIEVEMENT

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Abstract
This study investigated the attitudes of undergraduate Biology Education students at Ignatius Ajuru University of Education towards mathematics and its impact on their achievement in Biology. The research was guided by two research questions and two hypotheses, employing analytic descriptive survey and correlation research designs. A total of 186 students were selected using stratified random sampling and simple random sampling techniques. Data were collected through the Biology Education Students Attitude to Mathematics and Achievement Questionnaire (BESAMAQ), which demonstrated good reliability ($\alpha = 0.79$). The study's findings indicated that a majority of the students held positive attitudes towards mathematics. Moreover, a significant difference was observed between the percentages of students with positive and negative attitudes towards mathematics. Furthermore, a significant but negative and relatively weak relationship was detected between students' attitudes and their achievement in Biology. Based on these findings, it is recommended that mathematics instructors who teach Biology Education students should present mathematical concepts in a manner that highlights their relevance to Biology and daily life. This approach aims to stimulate interest among students with negative attitudes and alleviate their apprehensions regarding mathematics. By fostering a deeper understanding of the subject's practical application, instructors can contribute to improved attitudes and academic performance among Biology Education students.

Keywords: Achievement, Attitude, Biology Education, Mathematics, Undergraduates.

Introduction
Mathematics holds a central and obligatory role within the secondary education framework of Nigeria, serving not only as a compulsory subject but also as a prerequisite for admission into tertiary institutions (Federal Republic of Nigeria (FRN, 2008). This mandated inclusion of mathematics within the curriculum can be traced back to its profound and far-reaching significance across various domains of human knowledge, with a particular emphasis on its pivotal role in scientific discoveries and innovations. Gauss (1996) as cited in Offiah and Esiana (2013), fittingly characterized mathematics as the "queen of the sciences," highlighting its indispensable function in conferring quantitative and predictive capabilities upon scientific inquiry. Awofala and Nneji (2012) aptly described mathematics as the driving force behind scientific and technological progress.

Dan'inna (2017) posited that mathematics serves as the foundational cornerstone for all scientific breakthroughs, while Iji (2008) delineated mathematics as a cognitive framework that facilitates observation, logical reasoning, and effective communication in the context of problem-solving, thus rendering it an invaluable tool in scientific endeavours.

Furthermore, Rubinow in Akinbuwa (2001) as cited in Odili (2006) underscored the profound interconnectedness between mathematics and the field of Biology, elucidating a plethora of mathematical techniques and methodologies intricately interwoven with biological investigations. These mathematical tools encompass a diverse array of biological phenomena, including but not limited to cell growth, enzymatic reactions, physiological tracers, biological fluid dynamics, and diffusion, all of which find comprehensive elucidation through the application of elementary differential equations. Moreover, Roberts (2005) emphasized the paramount significance of possessing substantial mathematical proficiency for the precise quantification of organismal growth. Concurrently, Soper (2005) accentuated the widespread utilization of mathematical models in unravelling the intricate mechanisms governing biological control systems, particularly within the domains of plant and animal physiology. Soper further expounded that a comprehensive understanding of the fundamental principles underpinning control systems serves as a prerequisite for delving into the intricate self-regulatory mechanisms inherent in living organisms.

Within the realm of Biology, mathematics assumes a pivotal role, offering a versatile and indispensable toolkit for comprehending, dissecting, and advancing various facets of biological sciences (Pitt, 2020). It plays a pivotal role in enabling biologists to execute precise quantitative analyses, transforming biological observations and measurements into meaningful and actionable data (Allesina & Wilmes, 2011). Statistical methodologies, in particular, facilitate the generation of valid inferences from experiments and observational studies, enabling the evaluation of the significance of research findings and the formulation of robust predictions (Strogatz, 2018).
Moreover, mathematical modelling stands as a fundamental cornerstone in Biology, serving as a powerful tool for simulating and comprehending intricate biological processes (Strogatz, 2018). These models capture the dynamic intricacies of ecosystems, the propagation of diseases, and the behaviour of biological molecules. Notably, differential equations, a mathematical construct, enable the depiction of temporal changes, proving crucial in understanding population dynamics and biochemical reactions (Yang, 2014).

In the realm of genetics and genomics, mathematics assumes a pivotal role in the analysis of genetic data and the unravelling of the complexities inherent in genomes (Gusfield, 2015). Algorithms are extensively employed for tasks like sequence alignment, gene prediction, and the construction of phylogenetic trees (Hofmeyr, 2019). Furthermore, mathematical techniques find application in the exploration of genetic variations and hereditary mechanisms (Hastings & Gross, 2019).

Furthermore, mathematical ecology emerges as a valuable asset for comprehending ecosystems, interactions within populations, and environmental transformations (Hastings & Gross, 2019). This branch of mathematics facilitates the development of population models, the analysis of food webs, and the application of ecological network theory. These mathematical tools empower researchers to scrutinize the dynamic behaviours of ecosystems and make informed predictions about their responses to various perturbations and disruptions. In summary, mathematics serves as an indispensable and unifying language within the biological sciences, offering a powerful lens through which researchers can delve into the intricate workings of the natural world. It empowers biologists to quantify, model, and make predictions about diverse biological phenomena, spanning from the molecular level to entire ecosystems.

Mathematics is essential for modelling neural networks, analyzing brain function, and interpreting neuroimaging data (Ermentrout & Terman, 2010). These mathematical models help elucidate complex neurological phenomena and contribute to advancements in neuroscience (Gusfield, 2015). Mathematical tools, such as phylogenetics and population genetics, assist in exploring evolutionary processes (Gusfield, 2015). These methods help researchers reconstruct the evolutionary history of species, study genetic diversity, and analyze the mechanisms driving evolution (Yang, 2014). Mathematical modelling is crucial in pharmacokinetics and drug dosage determination (Yang, 2014). These models assist in optimizing drug administration, assessing drug efficacy, and understanding drug interactions within biological systems.

Mathematics facilitates the study of biological systems as interconnected networks of genes, proteins, and metabolites (Strogatz, 2018). Systems Biology employs mathematical techniques to analyze and model these networks, revealing emergent properties and aiding in drug discovery and disease understanding (Strogatz, 2018).

In sum, mathematics serves as an essential bridge between the theoretical and practical aspects of Biology, enhancing our ability to interpret biological phenomena, make predictions, and formulate hypotheses. The ongoing integration of mathematics and Biology continues to drive discoveries and innovations across numerous subfields, advancing our understanding of life on Earth (Hasting & Gross, 2019). The importance of mathematics in the field of Biology cannot be overstated, as it plays a fundamental role in quantitative analysis, modelling biological phenomena, and making predictions in various biological disciplines.

One prevailing concern within the realm of education revolves around the reluctance towards mathematics exhibited by a significant cohort of secondary school students. This demographic frequently perceives mathematics as an exceedingly formidable subject, as noted by Adesoji (2008, as cited in Abulude 2016; Dan'inna

2017; Mazana et al., 2019). This apprehension towards mathematics also extends to students who possess a penchant for Biology and aspire to pursue careers within the biological sciences. Often, they remain oblivious to the inherent relevance of mathematics in the pursuit of biological knowledge. Consequently, this subgroup of secondary school students grapples with attaining passing grades in mathematics, largely motivated by the belief that mathematics will cease to be a pertinent component of their academic trajectory upon entering university. Dan'inna (2017) elaborated upon the widespread struggle with mathematics encountered by secondary school students, while Awofala and Nneji (2012) observed the avoidance of mathematics-related courses and career paths stemming from these sentiments.

Upon embarking on their college journey, students majoring in Biology often encounter the daunting prospect of enrolling in mathematics courses, rekindling the apprehensions reminiscent of their high school experiences. Abulude (2016) references the perspectives of Strogatz (2018) and Berg (2005) as cited in Abulude (2016) who elucidate this phenomenon and its potential to cultivate a negative disposition towards mathematics. In this context, "attitude" denotes a learned inclination through which individuals react either positively or negatively to an object, concept, or another individual (Sarmah & Puri, 2014, as cited in Mazana et al., 2019). A positive attitude towards mathematics signifies a favourable emotional predisposition, whereas a negative attitude signifies an unfavourable emotional predisposition (Zan & Martino, 2008, as cited in Mata et al., 2012).

The dread associated with mathematics and the resultant negative attitudes exhibited by students can impede their active engagement in class. This lack of interest can detrimentally affect their comprehension of mathematical concepts, subsequently impacting their understanding of certain facets of Biology that necessitate mathematical proficiency. A lack of mathematical proficiency and a negative attitude toward mathematics among students may consequently hinder their comprehension of biological concepts that rely on mathematical foundations (Pitt, 2020). Consequently, this can lead to subpar performance in Biology. Strogatz's (2018) findings underscore the well-established relationship between students' mathematical proficiency and their attitudes towards the subject.

In recent years, there has been a growing concern within the field of education regarding the declining interest and proficiency in mathematics among secondary school students.
This issue stems from a complex interplay of factors, including a pervasive fear of mathematics acquired during secondary education, which often results in negative attitudes towards the subject (Anderson, 2007; Berg, 2005, as cited in Abulude, (2016)

This issue has far-reaching implications, particularly in the context of undergraduate Biology education. A weak foundation in mathematics can potentially lead to poor academic performance in Biology-related courses and hinder the pursuit of careers in biological sciences. Therefore, the central problem addressed in this study can be distilled into the following concise statement:

"How does the persistent fear of mathematics among secondary school students, driven by the university admission requirement, influence their subsequent negative attitudes towards mathematics, and how does this, in turn, impact their comprehension of mathematical concepts essential for the study of Biology, ultimately resulting in diminished academic performance in Biology courses during their university education?"

Furthermore, previous research endeavours, including those conducted by Abakpa and Anyagh (2015), Abu and Leong (2014) as cited in Ayob and Yasin (2013), and Mensah and Kurancie (2013) as referenced in Mazana et al. (2019), consistently emphasize the evident nexus between attitudes and academic achievements. Against this backdrop, the present study embarked on the task of assessing the attitudes of undergraduate students specializing in Biology Education at Ignatius Ajuru University of Education towards mathematics and its potential ramifications on their performance in Biology.

Purpose of the study

The purpose of the study was to determine the attitude of undergraduate Biology Education students' attitude towards mathematics and their achievement in biology. Specifically, the objectives of the study are

1 To determine the percentage of Biology Education students with positive and negative attitudes respectively towards Mathematics.

2 To determine the relationship between the attitude of Biology Education students towards Mathematics and

their achievement in Biology.

Research Questions
The study was guided by the following research questions;

1) What percentage of Biology Education students have positive and negative attitudes respectively towards mathematics?
2) What is the relationship between the attitude of Biology Education Students toward mathematics and their achievement in Biology?

Hypotheses

1) There is no significant difference between the percentage of Biology Education students with positive and negative attitudes respectively towards mathematics.
2) There is no significant relationship between the attitude of Biology Education Students towards mathematics and their achievement in Biology.

Methodology

The research employed a combined research design, integrating both an analytic descriptive survey design and a correlation research design methodologies. The adoption of these two approaches was guided by the existing body of literature. According to Nwankwo (2013), the analytic descriptive survey design involves gathering data from a substantial population to elucidate specific characteristics of that population at the time of the study. Additionally, this design allows for group comparisons through hypothesis testing. Furthermore, the correlation research design, as outlined by Nworgu (1991) and cited in Nwankwo (2013), was employed to investigate relationships between two or more variables within the study context.

The study sample comprised undergraduate Biology Education students spanning three academic levels: 200-level with 140 participants, 300-level with 250 participants and 400-level with 246 participants, resulting in a total population size of 636 students. To ensure the representativeness of the sample, a subset of 186 students was systematically selected from these three academic levels. The sampling strategy encompassed a dual approach, incorporating both stratified random sampling and simple random sampling techniques. This rigorous methodology aimed to accurately mirror the distribution of students across the various academic levels within the university.

Data collection for the research was conducted using a researcher-designed instrument titled "Biology Education Students' Attitude to Mathematics and Achievement Questionnaire" (BESAMAQ). This comprehensive questionnaire featured three distinct sections: Section A focused on collecting demographic information, Section B encompassed 21 items related to students' attitudes toward mathematics, and Section C was dedicated to recording students' academic achievement scores in Biology courses.

The research instrument underwent validation for both face and content validity to ensure its suitability for the study. Additionally, the instrument's reliability was assessed using Cronbach's alpha coefficient, yielding a commendable reliability coefficient of $r = 0.79$. This outcome underscores the instrument's robust internal consistency.

The collected research data underwent comprehensive analysis through the application of diverse statistical methods. To address the research questions, descriptive statistics such as frequency counts, percentages, and means were meticulously computed to provide valuable insights into the collected data. In addressing the research hypotheses, inferential statistics, including chi-square tests and Pearson product-moment correlation analysis, were expertly deployed to explore relationships and associations between the variables examined within the study. These analytical techniques were instrumental in deriving meaningful findings and facilitating the drawing of well-founded conclusions from the research dataset.

Results
Research question 1: What is the percentage of Biology Education students with positive and negative attitudes respectively towards mathematics?

Table 1: Percentage analysis of Biology Education students' attitude towards mathematics

Attitude	**Number(n)**	**Percentage (%)**
Positive	140	75.3
Negative	46	24.7
Total	186	100

Table 1 presents the distribution of students' attitudes towards mathematics, revealing that 75.3 percent of the students hold a positive attitude, while 24.7 percent exhibit a negative attitude. This data demonstrates that a substantial majority of the students in the study possess a positive outlook towards mathematic.

Ho_1: There is no significant difference between the percentage of Biology Education students with positive and negative attitudes respectively towards mathematics.

Table 2: Chi-square analysis of percentage difference between students with positive and negative attitudes respectively toward mathematics.

Attitude	Observed n	Sample %	Expected E	0 – E	X^2	Df	Sig	Decision
Positive	140	75.3	93.0	47.0	47.505	1	0.000	Sig
Negative	46	24.7	93.0	-47.0				
Total	186	100	186	0				

*Significant, P(0.00)<0.05 level of significance.

Table 2 provides a concise summary of the chi-square test conducted to assess whether there is a significant difference in the attitudes of Biology Education students towards mathematics. The table illustrates that a majority of the students, precisely 75.3 percent, hold a positive attitude towards mathematics, while 24.7 percent showed a negative attitude. Upon further testing with chi-square (X^2) analysis, the calculated X^2 value, amounting to 47.51 with 1 degree of freedom (df 1), yielded a significant p-value of 0.00. This p-value is notably less than the chosen level of significance set at 0.05, signifying statistical significance. Consequently, the null hypothesis, as initially stated, is unequivocally rejected. The outcome of the chi-square test confirms that there exists a statistically significant difference between the percentages of students who maintain positive and negative attitudes towards mathematics.

Research question 2: What is the relationship between the attitude of Biology Education students towards mathematics and their achievement in Biology?

Table 3: Pearson correlation analysis between students' attitude toward mathematics and their achievement in Biology.

Variable	N	$\bar{\bar{X}}$	Sd	r-value
Attitude	186	42.45	3.78	- 0.27
Achievement	186	52.12	10.77	

Table 3 displays the correlation coefficient between the attitudes of Biology Education students and their achievements in Biology, revealing a correlation coefficient of -0.27. This finding signifies a negative and weak relationship between students' attitudes and their academic achievements. In other words, the result indicates that there exists an inverse relationship between students' attitudes towards mathematics and their academic

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achievements in the field of Biology.

H0₂: There is no significant relationship between the attitude of Biology Education students towards mathematics and their achievement in Biology.

Table 4: Summary of Pearson correlation analysis of the relationship between students' attitude and their achievement in Biology.

Variable	N	X	$\overline{Sd}$	r-value	Sig	decision
Attitude	186	42.45	3.781	-0.272	0.000	Significant
Achievement	186	52.12	10.772			

Table 4 shows the mean and standard deviation of attitude to be 42.45 and 3.78, respectively, while those of achievement were 52.12 and 10.77, respectively. On further statistical testing with the Pearson Moment Correlation technique, the computed r-value was -0.27 with a significant value of 0.00, which is far below the chosen level of significance (0.05) for the study. Consequently, the null hypothesis is therefore not accepted. The result is that there is a significant relationship between students' attitudes towards mathematics and their achievement in Biology, even though the relationship is negative and low.

Discussion

The study's findings have illuminated a significant divergence in the attitudes of Biology Education students towards mathematics. A substantial portion of these students exhibited positive attitudes, while a smaller fraction displayed negative attitudes. This observation implies that the majority of these students do not perceive mathematics as an insurmountable challenge, and as a result, they do not harbour the common fear of mathematics reported among their peers. It is conceivable that these students may excel in their mathematics courses. This discovery is in harmony with the findings of Mata et al. (2012) and Mazana et al. (2019), who also identified that students generally exhibited positive attitudes, albeit with a minority holding negative attitudes. These discrepancies in attitudes may be attributed to variations in teaching methodologies and the learning environments experienced by these students during their earlier educational experiences.

However, in contrast, the current study's results diverge from previous research, such as those conducted by Adesoji (2008) as cited in Abulude (2016) and Dan'inna (2017), which reported a prevailing negative attitude among students. This disparity could be linked to differences in self-efficacy levels among the students in the present study compared to those in previous research. It is conceivable that students in the prior studies may have felt more insecure and less capable in terms of their mathematical abilities, contributing to their negative attitudes.

Moreover, the study also unveiled a notable relationship between students' attitudes and their academic achievements, albeit this relationship was both negative and of modest magnitude. This implies that although a connection between attitude and achievement exists, it is not a robust or positive one. In contrast to this finding, earlier studies by Adesoji (2008) as cited in Abulude (2016), Abu and Leong (2014) as cited in Ayob and Yasin (2017), and Mensah and Kurancie (2013) as cited in Mazana et al. (2019) had reported positive relationships between attitude and mathematics achievement. The negative and weak relationship uncovered in this study suggests that students' academic performance in mathematics may not be solely dependent on their attitudes. Other influential factors may have played a more substantial role, as evidenced by instances where high attitude scores corresponded with low achievement scores and vice versa.

This research underscores the diversity of attitudes among Biology Education students toward mathematics and highlights the intricate nature of the relationship between attitude and academic achievement. It suggests that while a majority of students maintain positive attitudes and may perform well in mathematics, other factors beyond attitude are pivotal in determining their actual achievement levels. These findings offer valuable insights into the multifaceted aspects of students' perceptions and performance in mathematics, emphasizing the need for a holistic approach to understanding and enhancing their mathematical experiences.

Conclusion

Based on the findings of the study, it is concluded that the majority of the students have a positive attitude towards mathematics and there is a significant though negative and low relationship between attitude towards mathematics and achievement in Biology which is that attitude towards mathematics is not a determinant of their achievement in Biology

Recommendations

Based on the findings of the study the following recommendations are made:

1) Secondary school teachers should adopt strategies that will arouse the students' interest during the teaching and learning process to reduce their fear of the subject.
2) Lecturers teaching Biology Education students' mathematics courses should help the students to see the relevance of mathematics to Biology and their everyday life to make them develop an interest in mathematics and to allay the fears of those with poor perception.
3) The mathematics lecturers should go at a slower pace and also use lots of instructional resources to facilitate understanding.
4) Biology Education students should help themselves in their subject area by putting more effort into their study.

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