Direct Research Journal of Education and Vocational Studies

Vol. 6(1), Pp. 38-50, January 2024,

https://journals.directresearchpublisher.org/index.php/drjevs

Research Article
ISSN: 2734-2174

Teacher-Student Interaction and Its Effect on Attitude to learning Outcomes in Basic Technology among Secondary School Students in Cross River State, Nigeria

Henrietta Osayi Uchegbue[1]*, Matilda Ernest Eteng[2] and Mary Imo Inyang[3]

[1]Department of Educational Foundations, University of Calabar, Cross River State, Nigeria.
[2]Department of Educational Foundations, University of Calabar, Cross River State, Nigeria.
[3]Institute of Education, University of Calabar, Cross River State, Nigeria.
*Corresponding author email: henriettauchegbue@gmail.com

ABTRACT

This study investigates the impact of teacher-student interaction on attitude to learning outcomes in basic technology among secondary school students in Cross River State, Nigeria. The research adopts a descriptive research design, utilizing both quantitative and qualitative data collection methods to evaluate the relationship between interactive teaching practices and student performance. A sample size of 400 students from various secondary schools in the state was selected through stratified random sampling to ensure a diverse representation of the student population. Structured questionnaires were administered to gather quantitative data on students' perceptions of teacher-student interactions and their corresponding attitude to learning outcomes in basic technology. Meanwhile, in-depth interviews and focus group discussions with teachers and students provided data on the dynamics of classroom interactions and their effects on learning. The study's findings indicate a significant positive correlation between the frequency and quality of teacher-student interactions and improved attitude to learning outcomes in basic technology. Furthermore, the research highlights the importance of interactive teaching methods, timely feedback, and supportive communication in enhancing students' understanding and retention of basic technology concepts. Based on the study findings, it was recommended that the policy makers and educators should to invest in training programs that enhance interactive teaching skills and promote effective teacher-student communication.

Keywords: Teacher-Student interaction; attitude to learning outcomes; basic technology, secondary

Article information
Received 28 October 2023;
Accepted 26 December 2023
Published 30 January 2024
DOI: https://doi.org/10.26765/DRJEVS63579603750

Citation: Uchegbue, H. O., Eteng, M. E., and Ibyang, M. I. (2024). Teacher-Student Interaction and Its Effect on Attitude to learning Outcomes in Basic Technology Among Secondary School Students in Cross River State, Nigeria Direct *Research Journal of Education and Vocational Studies*. Vol. 6(1), Pp. 38-50.

INTRODUCTION

Technology is recognized as a major factor in the development of any nation. Its importance in education stems from the need to enhance the developmental stage of the economy and to advance the objectives of teaching and learning. Experts in Nigeria have maintained that technology can be used for wealth creation, poverty eradication, job creation, global competitiveness, and improved learning (Zakari, Ibeme, & Lugurd, 2023).

Education, encompassing the totality of life experiences people acquire, enables them to cope with and derive satisfaction from living in the world. It facilitates social competence and individual development, making the quality of a nation's education proportional to its prosperity (Elem, 2023). From the beginning of time, man has strived to improve his quality of life through the use and application of knowledge, skills, tools, and materials, which we today describe as technology.

Basic technology is a phase of general education designed to introduce learners to the basic processes, materials, and products of various industries (Olabiyi, 2024). The first National Policy on Education in 1977 divided the secondary school system into six years, comprising three years of junior secondary school (JSS) and three years of senior secondary school. In JSS, technical subjects are integrated and called Basic Technology, aimed at developing positive attitudes towards technical subjects. Basic Technology, the only core subject among pre-vocational subjects at the JSS level, involves the practical study of materials and energy sources with the intention of applying this knowledge to create a comfortable environment for humans (Obeng, 2024). The objectives of Basic Technology, include providing pre-vocational orientation for further training in technology, offering basic technological literacy for everyday living, and stimulating creativity (Iyoha, 2023). The quality of education extends beyond curriculum content to include the learning environment and school factors. Nunes, Oliveira, Castelli, & Cruz-Jesus, (2023), notes that classroom learning environments and school factors exert dominant influences on learner achievement. School proprietors strive to provide an enabling environment for effective teaching and learning, aiming for high-quality assurance in schools, which entails providing factors that enhance effective teaching and learning, ultimately affecting students' academic achievement. These factors include teacher variables, environment/family variables, and school variables, with teacher variables being the most influential on learning outcomes.

For a nation to develop properly, its populace must have basic technological knowledge and skills to enhance individual employability. As technology becomes more prevalent, educational institutions expect students to use technology both at school and at home (Keane, Linden, Hernandez-Martinez, Molnar, & Blicblau, 2023). Despite its importance, students' performance in Basic Technology in Nigeria remains relatively poor (Oladejo, Nwaboku, Okebukola, & Ademola, 2023). Necessitating further research to improve knowledge and retention in this crucial subject. The challenges associated with teacher-student interaction significantly impact attitude to learning outcomes in Basic Technology among secondary school students in Cross River State, Nigeria (Johnson, 2024). These challenges include inadequate teacher training, resulting in a lack of proficiency in delivering technical content effectively and engaging students (Abedi, 2023). Additionally, large class sizes hinder meaningful interactions, making it difficult for teachers to address individual student needs and provide personalized feedback. Insufficient classroom resources and outdated teaching methods further exacerbate the problem, limiting students' opportunities to actively participate and develop their verbal communication skills. Furthermore, cultural and socio-economic factors may contribute to students' reluctance to engage in verbal interactions, impacting their overall learning experience. This study is apt as it seeks to identify and address these challenges, aiming to enhance teacher-student interaction and improve attitude to learning outcomes in Basic Technology. By doing so, it contributes to the broader goal of advancing the quality of education and equipping students with essential skills for future technological and vocational pursuits. This study aimed at determining the extent to which the following classroom variables (class size, Classroom settings, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students' interaction) predict students' low and high verbal reasoning group to learning.

Literature review

Teacher-student interaction is a critical component of the educational experience, significantly influencing students' learning outcomes. According to Hanaysha, Shriedeh, & In'airat, (2023). the quality of classroom interaction has been demonstrated to have a substantial impact on students' academic achievements. Positive perceptions of classroom environments are linked to better learning outcomes, as students who feel supported and engaged by their teachers are more likely to succeed academically. This is particularly relevant in subjects like Basic Technology, where the integration of verbal instructions and practical skills is essential for comprehensive learning.

Class size and the nature of teacher-student interactions play a pivotal role in shaping learning outcomes. Elliot (2000) and Attah (2002) emphasize that smaller class sizes facilitate more effective participation and individualized attention, enhancing the teaching and learning process (Alshuraiaan, 2023). In the context of Basic Technology, where verbal reasoning and practical application are intertwined, the ability to interact closely with students allows teachers to address individual learning needs and clarify complex concepts more effectively. This interaction not only aids in the development of verbal skills but also fosters a deeper understanding of technological principles. Research has shown that various classroom variables, including teacher-student interaction, significantly influence learning outcomes. Studies by Edet (2010) and Igiri (2013) highlight that effective classroom management, conducive learning environments, and positive teacher-student interactions are crucial for student success (Hunter, Jasper, Barnes, Davis, Davis, Singleton, & Scott, 2023). In Basic Technology, where students must grasp both theoretical knowledge and practical skills, the quality of teacher-student interactions can determine the extent to which students engage with and retain the material

(Kaahwa, Nansamba, & Muweesi, 2023). Teachers who create supportive and interactive classroom environments can significantly enhance students' verbal reasoning and technological proficiency. Moreover, the social and emotional aspects of teacher-student interactions cannot be overlooked. Dai, Xiong, Zhao, & He, (2024), found that healthy interpersonal relationships between teachers and students promote higher academic achievement and better verbal reasoning skills.

This is particularly important in Basic Technology, where students often work on collaborative projects and rely on clear communication for successful outcomes. Positive interactions with teachers can boost students' confidence, encouraging them to participate more actively and take intellectual risks necessary for mastering complex technological concepts.

Graham, Ridder, Thiemann, & Zamarro, (2023), define class size as the number of students in one classroom under the control of a teacher at a time. Effective student participation in the classroom is vital for effective learning.

Smaller class sizes allow more students to contribute to the teaching/learning process and enable teachers to distribute questions and interact with students on a one-on-one basis Graham, (2023). This dynamic is crucial for understanding the interrelationships between verbal-reasoning attainment and vocational interest, especially in technology among secondary school students in Calabar, Nigeria. The National Policy on Education (Jacob, & Ndubuisi, 2023), stipulates a teacher-student ratio of 1:40 in secondary schools. Effective classroom management involves techniques for making the classroom conducive to learning.

To achieve specific educational objectives as stated in the National Policy on Education, a conducive classroom learning environment should be nurtured and utilized by knowledgeable teachers. Such an environment invigorates the cognitive, affective, and psychomotor domains. Teachers with extensive subject knowledge and a good learning environment are expected to enhance students' intellectual achievements. Variables like class size, teaching-learning settings, classroom management skills, lighting, thermal conditions, and teacher-student interactions significantly influence learning outcomes (Farhat, 2021).

The secondary school classroom has a powerful influence on shaping students both cognitively and socially. Individuals develop a consciousness of self through interaction with their environment, making the classroom an important milieu for total growth. The classroom environment is crucial for educators, teachers, and students to effectively achieve educational goals. According to Ferreira, Martinsone, & Talić, (2020), the total achievement surrounding an individual is composed of a complex network of forces related to human characteristics (Munna, & Kalam, 2021).

sA conducive school environment enhances learning. Cooperation among various groups in the school setting can positively affect student performance, while tension and friction can have negative effects (Vidić, 2021). Kuhlenengel, Konstantzos, & Waters, (2021), found that aspects of the indoor environment, such as daylight, significantly impact students' learning, as measured by improvements in standardized Math and reading tests. Classroom interaction patterns also influence learning outcomes, promoting student achievement, verbal reasoning, and healthy interpersonal relationships (Banks, & Smyth, 2021). Given the positive relationship between verbal reasoning ability and vocational learning outcomes in Basic Technology among secondary school students, this research is necessary and timely (Bochkareva, Akhmetshin, Zekiy, Moiseev, Belomestnova, Savelyeva, & Aleynikova, 2020).

The importance of understanding the specific context of Nigerian secondary schools, particularly in regions like Cross River State, adds another layer of complexity to the study of teacher-student interactions in Basic Technology. Previous studies, such as those by Oladejo, Okebukola, Olateju, Akinola, Ebisin, & Dansu, (2022), indicate that culturally and regionally specific factors can influence the effectiveness of educational strategies. Investigating how teacher-student interactions affect attitude to learning outcomes in Basic Technology within this context is crucial for developing tailored educational approaches that address local needs and challenges. Given the increasing emphasis on technological education for economic and social development, this research is both timely and relevant. Eteng, and Uchegbue, (2024) state that the long hours the youth spend on the internet playing game, or watching pornographic films among other forms of entertainments which are available on the internet make the youth Have negative learning attitude.

Classroom variables and students' attitude to learning

Classroom environment evolves from the attitude of the students and teachers within the classroom. Since personality attributes like attitudes are relevant in explaining human behaviour, it is necessary to examine, the possible relationship between learners' attitude and classroom variables (Erekosimia, 1997 as cited in Effiong, 2000) Fraser, Giddings, & Mckobbie (2005) investigated associations between student attitudinal outcomes and the nature of the classroom environment measures using SLEI with 5 scales and attitudinal measures using adapted test-of-science related attitudes. Tosra and Fraser, (2008) found out that both tests had high reliability indices ranging from 0.70 to 0.90.

Linn (2000) assert that learning science community agrees that deep and effective learning is best promoted by situating learning in purposeful and engaging activity cognition and technology group (Vanderilt, 1993). Several longitudinal investigations into the use of technology in students' science, technology, engineering, and mathematics (STEM) Learning are ongoing, but very little attention has been given to discovering the outcomes of such endeavours (Boyle, Boyle, 2005). Technology can help in the scientific learning process because of its potential to support activities such as data collection, visualization, meaningful thinking, problem solving, and reflection.

Various strategies to promote better science and technology, learning have been explored. For example, web-based inquiry science and technology environment (WISE) is one of the curriculum projects than Linn and her colleagues created to help students develop more cohesive, coherent, and thoughtful accounts of scientific and technological phenomena (Linn, Clark, & Slotta, 2003).

They further researched into how the effects of using technology-mediated tools could facilitate science and technology practices. They examined such practices as applying various real data to empower students to understand the technological enterprise itself, (Papanatasiou & Zembylas, 2004). Several studies have found that students' attitudes are important in technology achievement and participation in advanced science and technology courses (e.g. Lee & Burkam, 1996; Simpson & Oliver, 1990).

It is also well known that student attitudes toward a subject as well as their learning environment impact school achievement. High quality teachers are essential to improving the teaching and learning (Parling-Hammond, 2007). Teaching practice and instructional decisions influence the quality of students' academic performance and their motivation, effort, and attitudes toward school and academic pursuits (Hidi & Harackiewiez, 2000). They also promote or reduce students' learning and achievement (Hardre & Chen, 2005).

Research involving both secondary and older students appears to indicate a relationship, between teachers' behaviours and students' attitudes towards science (Haladyna, Olsen, & Shaughnessy, 2002; Myers & Fouts, 2002). Children with positive attitudes to technology and science are more likely to be found in classrooms that have high levels of involvement, teacher support, and use of innovative teaching strategies (Myers & Fonts, 2002). One study showed that teachers' teaching style and instructional decisions are the most noticeable factors in students' attitudes toward technology and science (Jarvis & Pell, 2005).

Papanastasiou (2001) reported that those who have positive attitude toward science tend to perform better in the subject. The affective behaviours on the classroom are strongly related to achievement, and science attitudes are learned (George and Kaplan, 2008). The teachers play a significant role during the learning process and they can directly or indirectly influence the student's attitudes toward science which in consequence can influence students' achievement. Teachers are, invariably, role models whose behaviours are easily mimicked by students. What teachers like or dislike, appreciate and how they feel about their learning or studies could have a significant effect on their students. By extension, how teachers teach, how they behave and how they interact with students can be more paramount than what they teach. Student's attitude toward the learning of chemistry is a factor that has long attracted attention of researchers among other factors that may have causal relationships with students' academic performance.

Taylor & Vlastos (2009) found the relationship between environment and design within the classroom from a theoretical perspective. They found that physical environment of the classroom acts as "Silent curriculum". It means that classroom environmental design can facilitate and improve the learning process like the overt curriculum. There are several factors of classroom physical environment i.e. visual factor, acoustic factor, thermal factor, spatial factor and time factor. Visual factor refers to the quality of lighting in different parts of the classroom.

It is determined by the level of natural and artificial light available in the classroom. It also refers to the way by which the classroom environment is arranged i.e. visually interesting, creating a favourable atmosphere and any unwanted disruptions e.g. windows overlooking playgrounds etc. Acoustic factor is an important factor as we mostly depend upon verbal communication in our classroom. Noise level mainly depends upon school design, classroom organization and teaching methodologies applied during a lesson (Basit, 2005).

Poor classroom acoustics can adversely affect learning outcome for many students. Constant noise exposure can damage cognitive performance and functioning (Higgins, *et al*, 2004). Thermal factor refers to the heating and ventilation of the classroom and are generally out of the teachers' control as they are climate variables. It plays a fundamental role in making classroom atmosphere favourable and comfortable and hence affects the behaviour and performance. Spatial factor relates to the space management and has a great impact on behaviour particularly on communication. Time factor refers to the amount of time a student is participating in learning process i.e., the number of minutes the student is actively participating in teacher directed lessons and activities (Basit, 2005). Therefore, it is concluded that physical environment of classroom comprises of classroom size and structure, furniture, seating arrangement, instructional technologies, room heater, ceiling fans, curtains, cupboard, equipment, lighting, ventilation etc.

Proper arrangement of classroom plays a remarkable role in making instructional process more effective and establishes an atmosphere favourable and encouraging to learning. The quality of the physical classroom setting significantly affects academic achievement of the students. Physical facilities in classrooms ensure effective and successful teaching learning process. Without these facilities, effective and fruitful teaching learning process is not possible. Students get more information from their teachers in well facilitated classrooms and consequently they show good performance.

On the other hand, if students feel uncomfortable in classroom, then they will fail to get more information from their teachers. Lyons (2001) stated that poor school facilities adversely impact teachers' effectiveness and also their performance. Consequently, it negatively affects student achievement.

MacAulay (2009) and Walker, *et al*. (2005) found that a well-structured classroom could enhance students' academic and behavioral outcomes. Haertel, *et al*, (2008) concluded that students' perceptions of classroom environment as an important factor that show some aspects of students' outcomes i.e., achievement, motivation and satisfaction. They further concluded that achievement in cognitive and affective learning outcomes were repeatedly associated with classrooms environment, which were perceived as having greater cohesiveness, satisfaction, goal direction, organization and less friction.

Temperature and ventilation systems inside classroom are crucial factors that affect classroom learning environment. Classrooms too cold or too hot negatively affect students' performance and concentration as they feel uncomfortable in such conditions. According to Halstead (2004), it is generally accepted that high temperature and humidity creates physiological and psychological problems which expedite fatigue, causes people to work more slowly, apply much efforts and causes to make more mistakes and errors. The classroom climate should be cautiously managed not only to provide physical comfort but also to serve as a positive factor in the learning process by stimulating attentiveness and concentration. To maintain such a climate, the atmosphere must be treated to simultaneously controlled temperature, humidity, cleanliness, and circulation.

Raucher & Shertinski (2008) added that teachers do not always adapt their teaching to take advantage of small classes; they still retied a good deal on whole class teaching with very brief interactions with individuals and did not take advantage of the possibilities of increased individualization. Another implication of this study is the need to be aware of how pupils in large classes can drift off task through too much teaching to whole class talk, and how it is the low achievers who seem most affected. This suggests the value of more varied pedagogical approaches. We need to be careful not to overlook the benefits that can stem from other contexts of learning for example, pupils learning together with a deliberate attempt to minimize the rate that smaller classes will automatically lead to more productive work in groups.

Narmadha & Chamundeswari (2013) investigated attitude towards learning of science and academic achievement in science among students at the secondary level. Using random sampling technique 422 students, from the secondary level in different systems of education, namely, state, matriculation and central board schools were chosen. The Attitude toward Learning of Science Scale was used to assess the attitude towards learning Science and the marks scored in science were taken from their half yearly performance. The data collected was subjected to statistical analysis, namely, mean, standard deviation't'- test, 'F'- ratio, Karl Pearson's Product Moment Correlation Co-efficient 'r'. Results showed that the students belonging to the central board schools have a higher level of attitude towards learning of science compared to students in state board but did not differ with students in matriculation board schools at the secondary level.

Similarly, students belonging to central board schools performed better in science subject compared to the students in state and matriculation board schools at the secondary level. The girls are significantly better in their attitude toward learning of science when compared to the boys in all categories of schools.

In matriculation and central board schools the girls are better than boys in their academic achievement in science whereas in state board schools there is no significant difference in their gender. A positive correlation was found to exist between attitude towards learning Science and academic achievement in science among the students.

It is therefore in the interests of society, and the responsibility of educators, to improve students' attitude towards science, and to prepare students to live in a highly scientific and technological society. The future of our society will be determined by citizens who are able to understand and help shape the complex influences of science and technology on our world (Ungar, 2010).

According to Oludipe & Oludipe (2010), Integrated Science plays vital role in Nigerian Science Education Programme, because it prepares pupils at the Junior Secondary School level for the study of core Science subjects at the Senior Secondary School level which in turn brings about students' interest in science-oriented courses at the tertiary institutions. Research reports indicate that this negative attitude was caused, majorly, by teachers' conventional (lecture) method of teaching integrated Science. Research reports on the effectiveness of constructivist-based teaching strategy revealed that the strategy enhanced students' academic performance. Quasi-experimental research design was used to achieve the purpose of this study. Participants were 120 Junior Secondary School Students randomly selected from four out of the 25 co-educational Junior Secondary Schools in Ijebu-ode local Government area of Ogun State, South-west Nigeria. Findings revealed that the constructivist instructed students had higher scores on the posttest and the delayed posttest, compared to those exposed to conventional (lecture) method of teaching.

A study was conducted by Ali & Awan (2013) to examine the relationship of attitude of secondary school students towards Science with the achievement in the subjects of Physics, Chemistry, Biology and Mathematics. TOSRA was used to measure students' attitude towards Science and data was collected from 1,885 students of 10th grade. Simple correlation (r), Multiple regression analyses (R) and standardized regression coefficients (β) were used to investigate the relationships between attitude towards Science and achievement in Science. The results of the study indicated that attitude towards science had significantly positive relationship with the achievement of science students at secondary level.

Zhwan, Azidah, Rahimi & (Khalid, (2015). present quantitative study aims to find out the underlying factors of attitudes towards information technology and the relationship with academic achievement among students, through a self-developed questionnaire. The attitudes of the respondents were assessed in terms of three dimensions; namely affection, behavior, and belief. The results revealed a statistically significant difference between Arts and Science students in terms of their attitude towards IT in favor of science students, and also proved that there was no statistically significant correlation between students' academic achievement and their attitudes towards IT. While students at the medium level of academic achievement tended to score higher on the affection toward IT comparing with students at the satisfactory level of the academic achievement. The results of this study provide information for policy makers, and the researchers who are interested in understanding the factors that affect technology use by students in their learning.

Al-Bataineh & Anderson (2015) stated that schools in poor countries such as Jordan and Egypt lack an appropriate level of technology (e.g., not enough computers), based on this statement there are several other Arab countries facing the same problem of lacking technology in schools and universities. However, there is a need for educators to understand students' attitudes toward the use of different types of technology as well as how these attitudes are related to their learning style (Jarrah & Ashour, 2009; Yusuf & Balogun, 2011). Liu, Lee, and Chen (2013) stated that attitudes are learned, and as such, are closely related to one's experiences in the process of learning. They concluded that, attitude can be defined as the outward manifestation of an individual's evaluation of an entity, based on previous knowledge and beliefs.

Furthermore, students' achievement is one of the key contributing factors determining the student's success in various subjects and areas (Shukakidze, 2013). As such, the academic achievement is the major aim of the field of education and the higher education systems. Educators are looking for ways of enhancing education and achieving desirable student outcomes (Eret, Gokmenoglu, & Demir, 2013). Lei (2010) stated that the generous investments were supported by the strongly held premise that technology can help students learn more efficiently and effectively, and as a result increase student academic achievement. The belief of connection between technology and student achievement is a theme commonly emphasized in mission statements of educational technology projects and arguments to support educational technology investment. In fact, technology becoming a more prevalent part of the education culture with each passing year (Lukow, 2005), the integration of technology into education systems is forcing colleges and universities to make dramatic changes, by increasing the quality, diversity and availability of information, and altering the teacher-student relationship (Inoue, 2007).

Li (2012) investigated the relationship between social science students' attitude towards research methods and statistics, self-efficacy, effort and academic achievement. Self-administered questionnaire was chosen as the primary data collection method and a sample of 153 students from Department of Applied Social Studies in the City University of Hong Kong were invited to complete the survey.

After analyzing the data collected, Pearson's correlation coefficient reflected that there was a positive correlation between all the four variables – attitude towards research methods and statistics, self-efficacy, effort and academic achievement. Also, a multiple regression analysis was conducted to estimate the prediction power of attitude and self-efficacy on effort. The result showed that both attitude and self-efficacy could significantly predict effort. However, when another multiple regression analysis was conducted to estimate the prediction power of attitude, self-efficacy and effort on academic achievement, it was found that effort failed to predict academic achievement.

Even though most of the studies suggested that there was a positive relationship between attitude and academic achievement, there were other researchers arguing that students' attitude might not be a significant predictor of their academic achievement. In a study conducted by Mickelson (2009), he stated that whether attitude could significantly predict one's academic achievement depended on a number of variables, particularly the ethnic background and social class (p. 44). Correspondingly, Ma & Kishor (2007) also argued that the statement “attitude was a significant predictor of academic achievement” was indeed a paradox. Attitude might not necessarily predict one's academic achievement as it also depended on different factors, like race, sample selection and sample size (p. 26).

Sunday & Gbore (2012) carried out a study on the measures and predicts the effect of attitude and interest of students on academic performance in science. It investigates which of the variables, as essential attribute to study integrated science, will predict students' performance. Its aim was also to find out which one of the variables is influenced first under a particular teaching method. Three instruments were used for the study. They are, Science Oriented Attitude Scale (SOAS), Science Vocational Interest Inventory (SVII) and Achievement Test in Integrated Science (ATIS). The study is a quasi-experimental type. The sample of the study consisted of 30 Junior Secondary School one Students in Nigeria. Multiple regression was used to analyze the hypothesis raised for the study and the outcome shows that Science Interest possessed the strongest strength for predicting performance than attitude among the students in their different ability level group.

The significance of students‟ attitudinal variables as performance predictors have been emphasized by many researchers who indicated that student attitudes and interests could play a substantial role among students studying Integrated science. Ormerod & Duckworth (2005) supported this view by their suggestion that the attitudes of students are likely to play a significant part in any satisfactory explanation of variable levels of performance shown by students in their school science subjects.

Purpose of the study

The purpose of this study was to identify using discriminant analysis, the relationship between classroom variables and learning outcomes in basic technology among secondary school students.

Specifically, the study was aimed at determining: To determine which classroom variables (class size, Classroom settings, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students' interaction) adequately help to distinguish between students' positive and negative attitude groups to learning.

Research questions

In conducting the research, the following research questions were formulated to guide this study:

To what extent is there any relationship between the classroom variables (class size, Classroom settings, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students' interaction) and students' positive and negative attitude groups to learning?

Statement of hypothesis

The following hypothesis was formulated to guide the researcher in the study:

Hypothesis 1

The classroom variables (class size, Classroom setting, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students interaction) do not significantly predict students' positive and negative attitude groups to learning.

MATERIALS AND METHODS

Cross River State, located in the south-south geo-political zone of Nigeria and it is known for its rich tourism and educational institutions such as the famous Hope Waddel Training Institute (HOWAD), West African People's Institute (WAPI) among others. With Calabar as its capital, the state comprises eighteen local government areas and experiences a tropical climate with heavy rainfall due to its proximity to the Atlantic Ocean. Cross River boasts several tourist attractions like Agbokim waterfalls, the Obudu Ranch Resort, and Tinapa business resort.

The state has a strong educational presence with institutions such as the University of Calabar and Cross River University of Technology. The primary ethnic groups include the Efiks, Yakurr, Bekwarras, and Ejahgams, with most residents engaged in farming, fishing, and petty trading. The study adopted the ex-post facto research design. The study's population includes all Junior Secondary School 3 (JSS3) students taking Basic Technology in Cross River State's three educational zones: Calabar Zone (Akamkpa, Akpabuyo, Biase, Calabar Municipality, Calabar South, Odukpani), Ikom Zone (Abi, Boki, Ikom, Obubra, Yakurr), and Ogoja Zone (Bekwarra, Obanliku, Obudu, Ogoja, Yala). The total population is 58,816 students. JSS3 is chosen for its suitability in measuring learning outcomes due to students' accumulated knowledge and skills in Basic Technology by this stage.

This study employed multiple stages of sampling techniques to ensure a representative sample.

Table 1: Distribution of sample by Education Zone

Zone	LGA	No. of JSS Students	School Offering Basic Technology	Sample 2%
Calabar	Akamkpa	2649	8	53
	Akpabuyo	1218	2	24
	Biase	2288	2	46
	Calabar Mun.	9761	7	195
	Calabar South	5807	6	116
	Odukpani	2222	1	45
Ikom	Abi	1833	2	37
	Boki	3999	2	80
	Ikom	5750	1	115
	Obubra	3615	1	72
	Yakurr	3846	3	77
Ogoja	Bekwarra	2360	2	47
	Obaniku	1820	3	36
	Obudu	3806	2	76
	Ogoja	3415	1	68
	Yala	4427	2	89
Total		58816	45	1176

Initially, stratified sampling divides Cross River State into its three educational zones: Calabar, Ikom, and Ogoja. Random sampling then selects sixteen out of eighteen Local Government Areas. Proportionate stratified sampling follows, choosing 2% of the student population from these sixteen areas to generalize findings. Purposive sampling selects schools offering Basic Technology, and simple random sampling selects Junior Secondary School 3 students from these schools based on the targeted sample percentage. The study sampled 1176 Junior Secondary School students, representing 2% of those enrolled in schools offering Basic Technology across 45 institutions in Cross River State. This percentage was chosen to manage the study's scope effectively, ensuring a feasible number for comprehensive analysis without overwhelming the research capacity. This sample size proportionately reflects the total student population of 58,816 across the selected schools as seen in (Table 1). Structured questionnaire was the instrument for data collection.

Population of the study

The population of the study comprises of all junior secondary school three (3) students in those schools where Basic technology is offered from the three educational zones of Cross River State. These are Calabar Zone comprising of Akamkpa, Akpabuyo, Biase, Calabar Municipality, Calabar South, Odukpani Local Government Areas. Ikom Zone comprising Abi, Boki, Ikom, Obubra, Yakurr Local Government Areas and Ogoja Zone comprising Bekwarra, Obanliku, Obudu, Ogoja and Yala Local Government Areas of Cross River State. The population for the study is 58816. Reason being that Basic Technology is offered from JSS1 to JSS3 and when they get to Junior secondary class three it will be easy and appropriate to measure the outcome, having some definite results.

Sampling technique

This study involves multi-stages of sampling techniques in order to achieve a representative sample. First, stratified sampling technique was used to stratify the study area – Cross River State into three (3) educational senatorial zones – Calabar, Ikom and Ogoja. Second, random sampling technique was used to select sixteen (16) Local Government Areas out of eighteen (18) as shown in Table 2. Third, proportionate stratified sampling technique was used to select 2% of the population of students in the sixteen (16) Local Government Areas as shown in Table 1. The 2% was chosen in order to generalize the findings. Fourth, purposive sampling technique was also employed to select schools offering Basic Technology in each of the Local Government Area involved in this study. Then, simple random sampling technique was used to select number of students among the JSS 3 students. By this technique, the researcher randomly picked students based on the targeted percent of the sample.

Sample

The sample for the study was 1176 which is 2% of the junior secondary school students in each of the schools where they offer Basic technology at junior secondary school in Cross River State. The reason for this is that, the numbers of schools to be involved are many (45), if not streamlined; it will be too large to handle (Table 1). 1176 represent 2% of the population which is 58816.

Table 2 specification

Content	%	Knowledge (30%)	Comprehension (20%)	Application (50%)	Total (100%)
Component of BT Workshop safety	13.3%	(1)		1	2
Engineering materials	33.3%	(2)	1	(2)	5
Product of technology	20%	(1)	(1)	(1)	3
Energy	13.3%	(1)		1	2
Electricity	6.7%			(1)	1
Fraction	6.7%			(1)	1
Fluid flow and appliances	6.7%			(1)	1
Total	100%	5	2	8	15

Table 3: Demographic indices of respondents.

Variables		Responses	Percentage
GENDER			
	Male	503	46.2
	Female	585	53.2
	Total	1088	100.0
AGE			
	10-12	311	28.6
	13-16	671	61.7
	Above 16	106	9.7
	Total	1088	100.0
CLASS SIZE			
	20-30	85	7.8
	31-40	52	4.8
	41-50	430	39.5
	Above 50	521	47.9
	Total	1088	100.0

Source: Field survey, 2015

Procedure for data collection/scoring

The researcher prepared the instrument (questionnaires) and it was distributed with the assistance of trained personnel to the various Local Government and secondary schools offering Basic Technology which were targeted for study. The instrument was collected the same day after completion by the respondents. This was applicable to both the control and experimental group involved in the study. And these constituted the data used for this study. After collecting the questionnaire, codes/scores were assigned to each item. For ease of data preparation, a coding schedule was prepared by developing a key for each of the constructs of the instruments in a tabular form (Table 3).

RESULTS

Hypothesis 1

The classroom variable (class size, classroom setting, classroom management skills, classroom lighting, proper thermal conditions, student-student interaction, teacher-student interaction) do not significantly predict students' attitude to learning (Tables 3, 4, 5). The dependent variable is Students' positive and negative attitude group to learning, while the independent variable is Classroom variable (consisting of Class size, classroom setting, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-student interaction). This hypothesis was analyzed using discriminant technique. The results are presented in (Tables 10).

Fisher's linear method using stepwise discriminant analysis was used. This enabled the variables entered at each step to be minimized by Wilk's Lambda. From (Tables 4 and 7), the means and standard deviations of classroom variables indicate that

Classroom setting $(\bar{x} = 12.05, SD = 2.791)$,

Student-student interaction $(\bar{x} = 12.47, SD = 2.943)$,

Teacher-student interaction $(\bar{x} = 12.20, SD = 2.838)$,

Classroom lightings $(\bar{x} = 13.06, SD = 2.968)$,

Classroom management $(\bar{x} = 12.76, SD = 2.779)$,

Thermal condition $(\bar{x} = 12.07, SD = 3.141)$,

Attitude to learning $(\bar{x} = 11.85, SD = 2.766)$,

Skill acquisition $(\bar{x} = 15.90, SD = 4.065)$,

Verbal score $(\bar{x} = 13.43, SD = 6.050)$,

Academic achievement score $(\bar{x} = 11.67, SD = 4.45)$.

The mean difference between the classroom's variables suggest that these may be good discriminators as the

Table 4: Descriptive statistics of variables

Variables	N	Mean	Standard Deviation
Classroom setting	1088	12.05	2.791
Student-student interaction	1088	12.47	2.943
Teacher-student interaction	1088	12.20	2.838
Classroom lightings	1088	13.06	2.968
Classroom management	1088	12.76	2.779
Thermal condition	1088	12.07	3.141
Attitude to learning	1088	11.85	2.766
Skill acquisition	1088	15.90	4.065
Verbal score	1088	13.43	6.050
=Academic achievement score	1088	11.67	4.457

Table 5: Tests of equality of group means of classroom variables

	Wilk's Lambda	F	p-level
Classroom setting	0.994	6.592	0.010
Student-student interaction	0.997	2.999	0.84
Teacher-student interaction	0.993	7.779	0.005
Classroom lightings	0.999	0.732	0.393
Classroom management	0.998	2.514	0.113
Thermal condition	0.984	18.101	0.000
df = 1,1086			

Table 6: Group statistics for attitude to learning

	Low		High		Total	
	Mean	Std.	Mean	Std.	Mean	Std.
Classroom setting	11.59	2.770	12.68	2.698	12.05	2.791
Student-student interaction	12.11	2.928	12.95	2.897	12.47	2.943
Teacher student interaction	11.62	2.773	12.98	2.738	12.20	2.838
Classroom lightings	12.11	3.066	13.53	2.612	13.06	2.968
Classroom management	12.33	2.820	13.36	2.612	12.76	2.779
Thermal condition	11.48	3.109	12.87	3.009	12.07	3.141

separations are high. The result in (Table 5) revealed that Class Room Setting (Wilk's Lambda = .994 F = 41.762, df1 = 1, df2 = 1086 and sig, = .000); Student-student Interaction (Wilk's Lambda = .997, F = 22.319, df1 = 1, df2 = 1086 and sig. = .000); Teacher Student Interaction (Wilk's Lambda = .993, F = 64.844, df1 = 1, df2 = 1086 and sig. = .000); Classroom Lightings (Wilk's Lambda = .999, F = 20.718, df1 = 1, df2 = 1086 and sig. = .000); Classroom Management (Wilk's Lambda = .998, F = 37.811, df1 = 1, df2 = 1086 and sig. = .000) and Thermal Condition (Wilk's Lambda = .984, F = 54.374, df1 = 1, df2 = 1086 and sig. = .000). This result on the test of equality of group means (tables 5, 6, 7, 8 , 9 and 10) show a strong statistical evidence of significant differences between means of classroom setting, teacher student interaction and thermal condition at 0.05 level of significance, since P < 0.05, while student-student interaction, classroom lighting and classroom management were not significant at 0.05 level of significance, since P > 0.05. Therefore, in finding the efficiency of discriminant analysis in predicting students' learning outcome in secondary schools, discriminant analysis was used to predict classroom variables. The predictor variables were Classroom setting, Student-student interaction, Teacher-student interaction, Classroom lightings, Classroom management and Thermal condition. Significant mean differences were observed for all the predictors on dependent variables. While the log determinants were quite similar, Box's M indicated that the assumption of equality of covariance matrix was violated. However, given the large sample size, this problem was not considered serious. The function had an Eigen value of 0.021 representing 100% of the variances in the classroom variables. The contribution of the function in predicting students' learning outcome revealed that the function significantly predicts the students' learning outcome. Also, 62.7% of the original classes of classroom variables were accurately predicted. This indicates a high efficiency. The result also showed that the variables were correctly classified. Table 7 gives the result of the variables: the mean score of classroom setting was 12.05 with a standard deviation of 2.791, student-student interaction had a mean score of 12.47 and standard deviation of 2.943, teacher-student

Table 7 :Group statistics for verbal reasoning.

	Low		High		Total	
	Mean	Std.	Mean	Std.	Mean	Std.
Classroom setting	12.23	2.681	11.78	2.941	12.05	2.791
Student-student interaction	12.59	2.813	12.28	3.135	12.47	2.943
Teacher student interaction	12.39	2.684	11.89	3.047	12.20	2.838
Classroom lightings	13.12	2.849	12.96	3.151	13.06	2.968
Classroom management	12.87	2.665	12.60	2.948	12.76	2.779
Thermal condition	12.39	3.005	11.56	3.287	12.07	3.141

Table 8: Tests of equality of group means of classroom variables

	Wilk's Lambda	**F**	**p-level**
Classroom setting	0.994	41.762	0.000
Student-student interaction	0.997	22.319	0.000
Teacher-student interaction	0.993	64.844	0.000
Classroom lightings	0.999	20.718	0.000
Classroom management	0.998	37.811	0.000
Thermal condition	0.984	54.374	.000
df =1, df2= 1086			

Table 9: Log determinants-attitude to learning.

Attitude to learning	**Rank**	**Log determinants**
Negative attitude to learning group	6	11.770
Positive attitude to learning group	6	11.264
Pooled within-group	6	11.616

Table 10: Box's M test result of the variance in the different classes of classroom variables.

Box's M	**66.527**
F Approx.	**3.149**
df1	**21**
df2	**3651168.485**
Sig.	**0.000**

Tests null hypothesis of equal population covariance matrices

interaction had a mean score of 12.20 and standard deviation of 2.838, classroom lightings had a mean score of 13.06 and standard deviation of 2.968, classroom management had a mean score of 12.76 and standard deviation of 2.779, thermal condition had a mean score of 12.07 and standard deviation 3.141, attitude to learning had a mean score of 11.85 and standard deviation of 2.766, skill acquisition had a mean score of 15.90 and standard deviation of 4.065, verbal score had a mean score of 13.43 and standard deviation of 6.050 and academic achievement score had a mean score of 11.67 and standard deviation of 4.457.

Classroom variables and students' attitude to learning

The classroom variables (class size, classroom setting, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students interaction) separately and collectively significantly predict students' attitude to learning. Considering the results of tests of equality of group means for attitude to learning, on Tables 8 and 9. The Wilk's Lamda and associated Chi-square indicated that there was a significant variation between low and high students' attitude to learning, such that, one discrimination function was generated, which accounted for 100% of the relative variance. Linn (2000) assert that learning science community agrees that deep and effective learning is best promoted by situating learning in purposeful and engaging activity. Several longitudinal investigations into the use of technology in students' science, technology, engineering, and mathematics (STEM) Learning are ongoing, but very little attention has been given to discovering the outcomes of such endeavours (Boyle, Lamprianou, & Boyle, 2005).Technology can help in the scientific learning process because of its potential to support activities such as data collection, visualization, meaningful thinking, problem solving, and reflection. It is also well known that students' attitudes toward a subject as well as their learning environment impact school achievement. High quality teachers are essential to improving the teaching and learning (Parling Hammond, 1997). Teaching practice and instructional decisions influence the quality of students' academic performance and their motivation, effort, and attitudes toward school and academic pursuits (Hidi & Harackiewiez, 2000). They also promote or reduce students' learning and achievement (Hardre & Chen, 2005). Research moving both secondary and older students appears to indicate a relationship, between teachers' behaviours and students' attitudes towards science (Haladyna, Olsen, & Shaughnessy, 1982; Myers & Fouts, 1992). Children with positive attitudes technological science are more likely to be found in classrooms that have high levels of involvement, teacher support, and use of innovative teaching strategies (Myers & Fonts, 1992). One study showed that teachers' teaching style and instructional decisions are the most noticeable factors in students' attitudes toward technological science (Jarvis & Pell, 2005).

Conclusion

The main thrust of this study was to use discriminant analysis as a tool to determine the relationship between classroom variables and learning outcomes in Basic Technology among secondary school students in Cross River State. To achieve the stated objectives, the following hypothesis were formulated and tested: The classroom variables (class size, teaching-learning setting, classroom management skills, classroom lightings, proper thermal condition, student-student interaction, teacher-students interaction) do not significantly classify students into positive and negative attitude to learning groups. The population of the study was 58816. The sample for the study was 1176.This was selected using proportionate stratified sampling, stratified random sampling, purposive sampling techniques. The instrument used for data collection were 5 structured questionnaire titled classroom variables and learning outcomes in Basic Technology (CREVALOBTQ) and achievement test on Basic Technology. The face and content validity of the instrument was established after the scrutiny of some experts in the study area. The reliability was ascertained with the use of trial test and cronbach alpha method of reliability. Multivariate discriminant analysis was used to analyze the hypothesis.

Recommendations

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

1.The government and other stake holders should provide a conducive and ideal classroom environment for students, particularly in Basic Technology class in order to achieve desirable learning outcomes.
2.Curriculum builders should deliberately include evaluation techniques for accessing desirable learning outcomes in graduating students (JSS3&SS3).
3.Government should invest more on educational system, especially on provision of classroom infrastructures to boost students' interest in order to promote an ideal classroom for better learning outcomes.
4.The curriculum planners should review the current curriculum that merged four subjects together thereby reducing the teacher's time for interacting with students which has invariably affected learning outcomes.
5.Parents should be properly sensitized on the essence of stimulating their children/wards academically to enhance learning outcomes.
6.Government /administrators should maintain a maximum class enrolment for effective participation and organization of class activities.
7.Students should be convinced to imbibe a good study habit and attitude to promote learning outcome.

Suggestions for further research

1. Further researchers can consider other environmental variables such as home environment variables in predicting learning outcomes.
2. Studies of this type should be repeated considering other learning outcomes retention, etc.
3. The same work can be carried out considering a larger sample size.
4. Other variables like instructional materials and the workshop tools / appliances should be used to predict learning outcomes in Basic Technology.
5. More studies should be carried out in order to establish the general conclusion regarding the predictive power and relative variance of discriminant analysis in predicting categorized variables.

REFERENCES

Abedi, E. A. (2023). "We [teachers] first require basic technical [skills] training": Investigating formal professional development pathways and knowledge needs of teachers for technology integration. *Education and Information Technologies*, 1-22.

Alshuraiaan, A. (2023). Exploring the relationship between teacher-student interaction patterns and language learning outcomes in TESOL classrooms. *Journal of English Language Teaching and Applied Linguistics*, *5*(3), 25-34.

Banks, J., & Smyth, E. (2021). "We respect them, and they respect us": The value of interpersonal relationships in enhancing student engagement. *Education Sciences*, *11*(10), 634.

Bochkareva, T. N., Akhmetshin, E. M., Zekiy, A. O., Moiseev, A. V., Belomestnova, M. E., Savelyeva, I. A., & Aleynikova, O. S. (2020). The Analysis of Using Active Learning Technology in Institutions of Secondary Vocational Education. *International Journal of Instruction*, *13*(3), 371-386.

Dai, Z., Xiong, J., Zhao, L., & He, X. (2024). The effectiveness of ICT-enhanced teaching mode using activity theory on raising class interaction and satisfaction in an engineering course. *Interactive Learning Environments*, *32*(1), 286-305.

Eteng, M. E. and Uchegbue, H. O. (2024). Internet Usage and the Development of Social Skills among Nigerian Youths. Direct Res. Soc. Sci. Edu. Studies. Vol.12 (1): Pp. 107 -111.

Elem, S. N. (2023). *Transformation towards sustainable living under global education approach: international students' experience* (Doctoral dissertation, Anglia Ruskin Research Online (ARRO).

Farhat, T. (2021). *The impact of the class environment on high school students' learning in public schools in keserwan, Lebanon* (Doctoral dissertation, Notre Dame University-Louaize).

Ferreira, M., Martinsone, B., & Talić, S. (2020). Promoting sustainable social emotional learning at school through relationship-centered learning environment, teaching methods and formative assessment. *Journal of Teacher Education for Sustainability*, *22*(1), 21-36.

Graham, B. S., Ridder, G., Thiemann, P., & Zamarro, G. (2023). Teacher-to-classroom assignment and student achievement. *Journal of Business & Economic Statistics*, *41*(4), 1328-1340.

Hanaysha, J. R., Shriedeh, F. B., & In'airat, M. (2023). Impact of classroom environment, teacher competency, information and communication technology resources, and university facilities on student engagement and academic performance. *International Journal of Information Management Data Insights*, *3*(2), 100188.

Hunter, W. C., Jasper, A. D., Barnes, K., Davis, L. L., Davis, K., Singleton, J., ... & Scott, T. (2023). Promoting positive teacher-student relationships through creating a plan for Classroom Management On-boarding. *Multicultural Learning and Teaching*, *18*(1), 79-97.

Iyoha, M. E. (2023). Challenges Encountered by Teachers Teaching Basic Technology in Ovia North East Local Government Area of Edo State, Nigeria. *The Journal of Industrial Education and Training (JIET)*, *5*(1), 89-99.

Jacob, O. N., & Ndubuisi, A. G. (2023). Challenges Facing the Implementation of Teacher-Students Ratio Policy in Nigerian Educational System and the Ways Forward. *International Journal on Integrated Education*, *3*(9), 189-197.

Johnson, K. (2024). Teachers' Characteristics and Academic Performance of Students in Secondary Schools in Calabar South Local Government Area of Cross River State, Nigeria. *Nigeria (January 11, 2024)*.

Kaahwa, Y. T., Nansamba, F., & Muweesi, C. (2023). The Role of Technology-Enabled Teaching and Learning in Enhancing Student-Student Interaction in Secondary Schools in Kampala District. *East African Journal of Education Studies*, *6*(3), 322-334.

Keane, T., Linden, T., Hernandez-Martinez, P., Molnar, A., & Blicblau, A. (2023). Digital technologies: students' expectations and experiences during their transition from high school to university. *Education and Information Technologies*, *28*(1), 857-877.

Kuhlenengel, M., Konstantzos, I., & Waters, C. E. (2021). The effects of the visual environment on K-12 student achievement. *Buildings*, *11*(11), 498.

Munna, A. S., & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: a literature review. *International Journal of Humanities and Innovation (IJHI)*, *4*(1), 1-4.

Nunes, C., Oliveira, T., Castelli, M., & Cruz-Jesus, F. (2023). Determinants of academic achievement: How parents and teachers influence high school students' performance. *Heliyon*, *9*(2).

Obeng, F. (2024). *Ghanaian Senior High School students' Perception and Attitude Towards Visual Arts and It's Related Careers* (Master's thesis, Itä-Suomen yliopisto).

Olabiyi, O. S. (2024). Improving basic technology students' achievement using differentiated instruction learning strategy among junior secondary school. *Jurnal Pendidikan Teknologi dan Kejuruan*, *30*(1).

Oladejo, A. I., Nwaboku, N. C., Okebukola, P. A., & Ademola, I. A. (2023). Gender difference in students' performance in chemistry–can computer simulation bridge the gap? *Research in Science & Technological Education*, *41*(3), 1031-1050.

Oladejo, A. I., Okebukola, P. A., Olateju, T. T., Akinola, V. O., Ebisin, A., & Dansu, T. V. (2022). In search of culturally responsive tools for meaningful learning of chemistry in Africa: We stumbled on the culturo-techno-contextual approach. *Journal of Chemical Education*, *99*(8), 2919-2931.

Vidić, T. (2021). Students' school satisfaction: the role of classroom climate, self-efficacy, and engagement. *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, *9*(3), 347-357.

Zakari, M., Ibeme, N. P., & Lugurd, M. (2023). Leveraging On Technology Incubation Programme for Skills Acquisition and Job Creation among Women and Youths in Nigeria. *Public Administration and Regional Studies*, *16*(2), 159-186.