



## Undergraduate Science Education Students' Attitude Towards Practical Work in Anambra State, Nigeria

Stephen Chinedu Nwafor <sup>1</sup>, Destiny Onyebuchi Ekoyo <sup>2</sup>, Chidimma Adaeze Ezenwobodo <sup>3</sup>

<sup>1,2</sup>Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

<sup>3</sup>Department of Biology, Nwafor Orizu College of Education, Nsugbe, Anambra State, Nigeria

E.mail: [sc.nwafor@unizik.edu.ng](mailto:sc.nwafor@unizik.edu.ng)

### Article Info.

#### Article history:

Received 9 April 2024

Revised 2 June 2024

Published 20 June 2024

#### Keywords:

Science, Attitude, Undergraduate students, and Practical work

#### How to cite:

Stephen Chinedu Nwafor, Destiny Onyebuchi Ekoyo, Chidimma Adaeze Ezenwobodo, 2024.

Undergraduate Science Education Students' Attitude Towards Practical Work in Anambra State, Nigeria. Aca. Int. J. Soc. Sci. H.2(1):19-28.

<https://doi.org/10.59675/S212>

#### Copyright:

This article is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0)

### Abstract

The study investigated undergraduate science students' attitudes towards practical work in Nnamdi Azikiwe University, Awka, Anambra State. Two hypotheses and three research questions were posed to guide the investigation. The population was 285 final-year students in the Department of Science Education. Using a standard random sampling method, 180 undergraduate science education students were chosen for the descriptive survey design study. The study problems were addressed using frequency, percentages, mean, and standard deviation and the hypotheses were tested using one-way ANOVA and t-test statistics. The research findings indicate that a more significant percentage of undergraduate science education students exhibit a positive attitude towards science practical work. The attitudes of male and female students regarding practical science work also differed significantly, with female students' attitudes being more favourable. Furthermore, a moderate degree of influence from the area of specialization on undergraduate science education students' attitudes toward practical work can be seen, as demonstrated by the significantly higher attitudes toward practical work demonstrated by integrated Science, Biology, and Chemistry Education students

compared to those in Computer Science, Mathematics, and Physics units. It was suggested that the government give more science-related practical equipment considering the findings, more laboratories should be built in federal universities, and science practical should continue to ensure a nonbiased gender-based practical and also more practical classes should be held than always lecturing method.

### Introduction

Nations all over the world depend on science for technological advancement. In Nigeria, the government has special interest in science due to its significance and relevant to the society and human life. Science, according to Ezeudu (2011), is a body of knowledge gathered via systematic experimentation and observation. It is a collection of knowledge concerning the nature of the universe

and how organisms interact with their surroundings. Science can be seen as a method of thinking that aims to comprehend nature. Science refers to an organized body of knowledge acquired through investigation and experimentation. Justiny (2016) asserted that science is a dynamic human endeavor that aims to understand the world. Justiny maintained that science is more focused on different investigative processes and activities concerning the growth, acquisition, and management of information, aptitudes, and attitudes concerning the inherent elements of the environment. These investigative processes can be achieved through science practical work obtainable in different area of specialization in science teaching such as “Physics, Computer Science, Biology, Integrated Science, Chemistry and Mathematics”. The various areas of specialization found in science education, according to Nwafor, Chinweuba-Eze, and Chukwuka (2021), help expose students to scientific principles and processes, giving them the proper scientific attitude as well as professional and practical skills.

Educators believe that practical practice is a crucial component of science learning and a requirement for becoming a science teacher. According to Bangoy (2022), the term "practical work" describes a method where students watch or handle actual things or materials and participate in a teacher demonstration. Its primary objective is to help students become more proficient in applying, interpreting, and generalizing certain scientific concepts and resources. The laboratory is a location where practical activities are conducted. Because it offers science teachers the chance to change up their teaching methods and escape boring classroom settings, the science laboratory is a special kind of learning environment. Students can learn science through hands-on experiences by actively participating in laboratory experiments through practical exercises. In schools, practical tasks ought to be compulsory rather than optional. Practical activity according to Okam and Zakari (2017), is that which boosts students' enthusiasm for successful science learning and supports their positive attitudes. In this study, "practical work" refers to any science-related instruction where students work with real materials and objects rather than just virtual ones, either individually or in small groups. In the words of Musengimana, Kampire, and Ntawiha (2021), using practical approaches can significantly improve students' attitudes toward science. Because of this, Babalola, Lambourne, and Swithenby (2020) claimed that offering students fresh educational opportunities in scientific laboratories can have a crucial advantage in fostering their scientific attitude. Consequently, scientific students' academic performance may be greatly affected by having a favourable attitude toward practical tasks.

The way that students feel about situations and events is referred to as their attitude. As stated by Iliyasu, Lee, and Yahya (2015), an attitude might refer to a strategy, state of mind, emotion, or another attribute of a person or thing. When a student exhibits a particular attitude toward anything, he is responding to his idea of the object rather than the reality of it. Students through learning experiences develop their attitudes. Consequently, positive attitudes are developed by students from positive learning experiences, while negative attitudes are developed from negative learning experiences. Because of this, sociologists, psychologists, and administrators are interested in how to shape students' attitudes, which in turn affects how they behave, and how to modify them. On the other hand, Olasheinde and Olatoye (2014) contended that attitudes vary over time and with gradual modifications.

Extant literature has been done on students' attitude focusing more on its influence towards science subjects. Nevertheless, based on the empirical studies reviewed below no expletory looked into the undergraduate science education students' attitude towards practical work, hence, the gap of the study. Students who attend secondary schools, for example, exhibit affirmative (positive) attitudes toward science, according to Sakariyau, Taiwo, and Ajagbe (2016). In a study conducted in Borno State, Nigeria, Ghuluzé and Joda (2021) looked into how senior secondary school students felt about their

practical chemistry practical works and how that attitude related to their academic performance. The research findings demonstrated that students' attitudes toward practical chemistry work reflect their academic achievement in the subject, and that gender has no bearing on these relationships. In Birnin-Kebbi Metropolis, Nigeria, biology students' attitudes were investigated in a study by Iliyasu, Lee, and Yahya (2015). It was discovered that the differences in opinions between male and female students were not statistically significant. Furthermore, the results indicated a considerable difference in attitude between science and art students as well as between public and private students. The majority of Kebbi students, according to the report, had a favourable attitude toward biology. Chikendu and Obikezie (2021) assert that science is essential to all subjects and that students typically have positive attitudes about it. Therefore, in order to improve students' attitudes toward science, the researchers recommended that teachers use instructional strategies that would spark students' interest in learning science. Adebisi and Ajayi (2015) conducted research to ascertain the relationship between gender disparities in students' attitudes and their comprehension of concepts in physics practicals.

The results demonstrated a strong correlation between students' attitudes and topic knowledge, but their gender did not significantly affect their interaction in the Physics practical. On the other hand, although Sharpe and Abrahams (2020) stated that secondary school students posed a good practical work attitude, they also claimed that this positive attitude changed over time and was not uniform. Jebson and Hena (2015) studied students' positive attitude towards science subjects and found out that boys had more interest than girls' counterpart. In teaching of science, one of the primary goals is usually to help students develop positive attitudes toward science practical work which have been on the decline. In recent years, studies have focused on finding answers to these problems. Therefore, the current study explores the attitudes of undergraduate science education students regarding practical labour.

### **Purpose of the Study**

The aim of the research was to ascertain the attitudes of Nigerian undergraduate scientific education students in Anambra State toward practical work. In particular, the research aimed to ascertain the:

1. Attitude scores of science education students towards practical work.
2. Difference between the mean attitude score of male science education students and their female counterparts towards practical work.
3. Extent in which area of specialization influences undergraduate science education students' attitude to practical work.

### **Research Questions**

The investigation was guided by the research questions that followed:

1. What are the science education students' attitude scores towards practical work?
2. What is the difference between the mean attitude score of male science education students and their female counterparts towards practical work?
3. To what extent does area of specialization influence undergraduate science education students' attitude to practical work?

### **Hypotheses**

The following null hypotheses (Ho) were developed and put to the test at significance levels of 0.05.

HO<sub>1</sub>: There is no significant difference between the mean attitude score of male science education students and their female counterparts towards practical work.

HO<sub>2</sub>: There is no significant difference between the mean attitude scores of undergraduate science education students to practical work and their area of specialization.

## Methods

The design applied was descriptive survey. Nworgu (2018) states that a descriptive survey research design is an approach wherein data is gathered and analyzed from a sample of the population using a questionnaire or interview, and the study's conclusions are extrapolated to the entire population. For this reason, the design was deemed appropriate. The 285 final-year students from the Department of Science Education at Nnamdi Azikiwe University in Awka, Anambra State, for the 2022–2023 academic year comprised the study's population. 180 science education students (66 males and 114 females) made up the study's sample. This was determined by utilizing a stratified proportionate sampling strategy to sample the students according to their gender and areas of expertise and randomizing selecting the necessary number of students. Data was collected using an instrument called "Questionnaire on Students Attitude to Science Practical Work (QSASPW)," which has 25 items and was adapted from the University of Cambridge (2010). The participants were requested to indicate how much they agree with the questionnaire's items by checking a box. Next, the values were distributed as follows: There are four points for Strongly Agree (SA), three points for agreeing (A), two for disagreeing (D), and one for strongly disagreeing (SD). Three experts from Nnamdi Azikiwe University's Department of Science Education in Awka validated the instrument. The reliability index of 0.84 was obtained by applying Cronbach Alpha to ascertain the estimated internal coherence of the instrument. To guarantee a 100% return rate, the researchers gave the students questionnaires and immediately collated the responses from them. Using the mean, standard deviation, frequency, and percentage, the research issues were addressed; the hypothesis was examined using one-way ANOVA and t-test statistics at the 0.05 level of significance. The following real limit of numbers was utilized to interpret the mean: low extent (2.49 and below); moderate extent (2.50-3.49); and high extent (3.00-4.00). Additionally, respondents who scored higher than 50% on the frequency percentage showed a positive attitude toward science practical tasks, whereas those who scored 49.9% and below on the frequency percentage showed a negative attitude toward practical work.

## Results

**Research question one:** What are the science education students' attitude scores towards practical work?

**Table 1: Science education students' attitude scores towards practical work**

Students Attitude scores	Frequency	Percent	Cumulative Percent
Positive Attitude	134	74.5	100
Negative Attitude	46	25.5	
Total	180	100	

The result in table 1 shows that 74.5% (134) of undergraduate science education students have a positive attitude towards practical work while 25.5% (46) of the students have negative attitude towards practical work. This implies that the undergraduate science education students have positive attitude towards practical work.

**Research question Two:** What is the difference between the mean attitude score of male science education students and their female counterparts towards practical work?

**Table 2: The mean attitude score of male science education students and their female counterparts towards practical work**

Gender	N	Mean	SD	Mean Difference
Male	66	61.55	15.25	7.41
Female	114	68.96	18.52	

Table 2 presents the mean attitude score of 61.55 for male undergraduate scientific education students towards practical work, whereas the mean score for female students is 68.96. It would seem from that female undergraduate student studying science education value science practical work more than their male peers. Nevertheless, to confirm if the difference is significant, hypothesis one was test as shown below.

**Hypothesis One:** There is no significant difference between the mean attitude score of male science education students and their female counterparts towards practical work.

**Table 3: t-test statistics of the significant difference between the mean attitude score of male science education students and their female counterparts towards practical work**

Gender	N	Mean	SD	Std. Error Mean	df	t	Sig.	Decision
Male	66	61.55	15.25	1.87676	178	-2.757	.006	Significant
Female	114	68.96	18.52	1.73487				

Table 3 reveals that the mean attitude score of male students ( $\bar{x} = 61.55$ ,  $SD = 15.25$ ) was significantly different to that of their female counterparts ( $\bar{x} = 68.69$ ,  $SD = 18.52$ );  $t(178) = -2.757$ ,  $p = .006$ . Consequently, hypothesis one was rejected. This indicates that the mean attitude score of male science education students significantly differs from their female counterparts towards practical work in favour of the female students.

**Research Question Three:** To what extent does area of specialization influence undergraduate science education students' attitude to practical work?

**Table 4: Extent area of specialization influences undergraduate science education students' attitudes to practical work**

Area of Specialization	N	Mean	SD	Decision
Biology	43	2.97	0.53	Moderate Extent
Chemistry	32	2.94	0.38	Moderate Extent
Computer Science	14	2.14	0.79	Low Extent
Mathematics	25	1.96	0.67	Low Extent
Physics	23	2.18	0.68	Low Extent
Integrated Science	43	2.93	0.57	Moderate Extent
<b>Total</b>	<b>180</b>	<b>2.65</b>	<b>0.71</b>	<b>Moderate Extent</b>

The result in Table 4 reveals that Undergraduate students majoring in science education who specialize in Mathematics Education had mean scores of 1.96 with standard deviation of .67; Physics Education had mean scores of 2.18 with standard deviation of .68; Integrated Science Education had mean scores of 2.93 with standard deviation of .57; Biology Education had mean scores of 2.97 with standard deviation of .53; Chemistry Education had mean scores of 2.94 with standard deviation of .38; Computer Science Education had mean scores of 2.14 with standard deviation of .79. This points out that Biology, Chemistry and Integrated Science influence science education students attitude to practical work to a moderate extent, whereas, Computer Science, Mathematics and Physics influence to a low extent science education students attitude to practical work. In addition,  $\bar{x} = 2.65$  and  $SD = .71$  were found to be the total mean and standard deviation. This suggests that undergraduate science education students' attitudes about practical work are moderately influenced by their area of specialty.

**Hypothesis Two:** There is no significant difference between the mean attitude scores of undergraduate science education students to practical work and their area of specialization.

**Table 5: Analysis of Variance of the difference between the mean attitude scores of undergraduate science education students to practical work and their area of specialization**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	31.132	5	6.226	18.437	0
Within Groups	58.762	174	0.338		
Total	89.893	179			

Significant ( $p < .05$ )

The mean attitude ratings of undergraduate science education students toward practical work and their field of specialization differ significantly, as shown by Table 5's result  $F(5, 174) = 18.437$  ( $p = .000$ ). This is due to the fact that the hypothesis is rejected because 0.00 is less than 0.05. This suggests that the field of specialty of undergraduate science education students has a big impact on how they approach practical work. Multiple comparison tests are necessary to determine how the variables differ from one another because there is a significant variance in the mean attitude scores of students toward practical work and their area of concentration. The Bonferroni posthoc multiple comparison test was employed by the study in an efficient manner.

**Table 4: Bonferroni Posthoc multiple comparison test of the difference between the mean attitude scores of undergraduate science education students to practical work and their area of specialization**

(I) Area of Specialization	(J) Area of Specialization	Mean Difference (I-J)	Std. Error	Sig.	Decision
Biology	Chemistry	0.03177	0.13567	1	NS
	Computer Science	.83017*	0.17882	0	S
	Mathematics	1.01462*	0.14616	0	S
	Physics	.79215*	0.15012	0	S
	Integrated Science	0.04558	0.12533	1	NS
Chemistry	Biology	-0.03177	0.13567	1	NS
	Computer Science	.79839*	0.18621	0	S
	Mathematics	.98285*	0.15512	0	S
	Physics	.76038*	0.15886	0	S
	Integrated Science	0.01381	0.13567	1	NS
Computer Science	Biology	-.83017*	0.17882	0	S
	Chemistry	-.79839*	0.18621	0	S
	Mathematics	0.18446	0.19399	1	NS
	Physics	-0.03801	0.19699	1	NS
	Integrated Science	-.78458*	0.17882	0	S
Mathematics	Biology	-1.01462*	0.14616	0	S

(I) Area of Specialization	(J) Area of Specialization	Mean Difference (I-J)	Std. Error	Sig.	Decision
	Chemistry	-.98285*	0.15512	0	S
	Computer Science	-0.18446	0.19399	1	NS
	Physics	-0.22247	0.1679	1	NS
	Integrated Science	-.96904*	0.14616	0	S
Physics	Biology	-.79215*	0.15012	0	S
	Chemistry	-.76038*	0.15886	0	S
	Computer Science	0.03801	0.19699	1	NS
	Mathematics	0.22247	0.1679	1	NS
	Integrated Science	-.74657*	0.15012	0	S
Integrated Science	Biology	-0.04558	0.12533	1	NS
	Chemistry	-0.01381	0.13567	1	NS
	Computer Science	.78458*	0.17882	0	S
	Mathematics	.96904*	0.14616	0	S
	Physics	.74657*	0.15012	0	S

\* The mean difference is significant at the 0.05 level.

The multiple comparison test of the undergraduate science education students' mean attitude scores toward practical work and their areas of specialization is displayed in Table 4. The findings indicate that while there was no significant difference ( $p > 0.05$ ) in the attitudes of students studying Biology, Chemistry, and Integrated Science, there was a significant difference ( $p < 0.05$ ) between these three disciplines and the attitudes of students studying Computer Science, Mathematics, and Physics Education. Additionally, no significant difference ( $p > 0.05$ ) was found between students studying computer science, mathematics, or physics education; however, a significant difference ( $p$ -value less than 0.05,  $p < 0.05$ ) was found between these three disciplines and students studying biology, chemistry, or integrated science education regarding their attitudes toward practical work. Hence, rather than on computer science, mathematics, and physics education, the thrust of the disparity in the hypothesis is between integrated science, biology, chemistry, and computer science education. This indicates that Integrated Science, Biology and Chemistry Education students had significant higher attitude to practical work than their counterparts in Computer Science, Mathematics and Physics units.

## Discussion

The investigation's findings demonstrated that undergraduate science education students have positive attitude towards practical work. This may be because due to the interesting and enjoyable way practical work are been taught in the university. Hence, the students understand it better and develop positive attitude to practical work. The finding is in line with Trivedi and Sharma (2013) which demonstrated that learners exhibit a significant high positive attitude to physics practical work at government owned secondary schools in Udaipur city, India. Also, Sakariyau, Taiwo, and Ajagbe's (2016) report, which revealed that a greater percentage of students had a good attitude toward science is similar to this study's findings. Iliyasu, Lee and Yahya (2015) study equally agreed with the present study that shows greater percentage of Biology students in Kebbi exhibit positive attitudes in the subject.

Also, this finding agreed with Jebson and Hena (2015) findings which are in line with majority of Adamawa state science students showing positive attitude towards science subjects.

The study demonstrated that, in comparison to their male counterparts, female undergraduate science education students have a significantly greater attitude toward science practical work. This outcome is in line with the conclusions of Trivedi and Sharma's (2013) report, which found that there is a substantial difference between female and male secondary school students' attitudes toward practical work and that females' attitudes are noticeably more positive than males. Additionally, the outcomes align with the findings of Lane et al. (2022), who discovered that female students' attitudes about science (and other STEM courses) were significantly more positive than those of male students. This result disagrees with Ghuluze and Joda (2021), who established that gender had no bearing on the cognitive, affective, or behavioural aspects of students' attitudes toward practical chemistry work or their achievement the subject. In a similar vein, the study refutes the findings of Hinneh (2017), who claimed an insignificant relationship between the attitude of students about practical work and gender. Also, the findings diverge with Jebson and Hena (2015), who found that male students had an upbeat attitude than their female counterparts.

The study also demonstrated that undergraduate science students' attitudes toward practical work are moderately influenced by their area of expertise. Furthermore, the student's responses indicated that Integrated Science, Biology, and Chemistry have a moderate impact on their attitude toward practical work while Computer Science, Mathematics and Physics influence students' attitude to practical work to a low extent. Subsequent investigation showed that undergraduate science education students' mean attitude scores toward practical work and their area of specialty differed significantly. Additionally, students studying Integrated Science, Biology, and Chemistry Education demonstrated a much more positive attitude toward practical work than their counterparts studying Computer Science, Mathematics, and Physics, according to the Bonferroni posthoc multiple comparison test analysis. This could be due to the increasing practical experience they students in these subject areas are subjected to within the university. This is in agreement with the report of Sharp and Abrahams (2019) which asserted that even though there were a positive attitude of secondary school students to practical work, they were not consistent although found to vary with time and by subject area across the three science subjects (Biology, Chemistry & Physics) determined; Consequently, the study came to the conclusion that students' attitudes toward practical work were influenced by the science subjects-such as biology, chemistry, or physics. This conclusion coincides with the work of Iwuanyanwu (2022), who contended that students' gender, personality and other factors play a role in influencing science students' attitudes (which may include area of specialization).

## **Conclusion**

The conclusion drawn from this study is that undergraduate science education students' attitudes toward practical work are positive. However, female students showed a significantly higher attitude toward practical work than their male counterparts. In addition, students' areas of specialization were found to influence their attitudes toward practical work significantly.

## **Recommendations**

The conclusions led to the following suggestions being made.

1. Practical work should be promoted by university administrations and lecturers; while attendance should be made compulsory so as to maintain the positive attitude towards sciences and invariably enhancing their achievement in their different area of specialization.

2. Science practical work should be taught using a non biased gender based activities towards incorporating the male students into the practical processes.
3. The government should provide more science practical apparatus, laboratories and other laboratory resources in the universities for the students towards enhancing practical work.
4. Lecturers and laboratory technologists should adopt practical based instructional strategies which will enhance students' positive attitude to practical work.
5. More of practical classes should be held to enhance and promote the positive attitude of the students in science teaching.
6. Students should be counseled on how to develop, nurture and maintain positive attitude towards practical work in order to achieve lifelong learning.
7. The curriculum developers should include additional topics that lend themselves to experimental instruction, hence, ensuring the John Dewey's philosophy of learning by doing.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

### References

1. Adebisi, T. A. & Ajayi, P.O. (2015). Correlation of students' attitude and gender differences on understanding of concept in physics practical. *Advances in Social Sciences Research Journal*, 2(4), 215-219.
2. Babalola, F.E., Lambourne, R.J., & Swithenby, S.J. (2020). The real aims that shape the teaching of practical physics in Sub-Saharan Africa. *International Journal of Science and Mathematics Education*, 18(2), 259-278.
3. Bangoy, R. M. (2022). Practical work approach: A tool to improve the creativity skills of the students in recycling. *Globus Journal of Progressive Education*, 12(1), 100-103.
4. Chikendu, R. E. & Obikezie, M. C. (2021). Students' attitudes towards science education: evidence from secondary schools in Onitsha South of Anambra State. *International Journal Of Trend In Scientific Research And Development*, 6(1), 144-150.
5. Ezeudu, F.O. (2011). *Fundamentals of science education*. Enugu: Coal city and company limited
6. Ghuluzé, M & Dr Joda, F (2021). Senior secondary school students' attitude to chemistry practical work as a predictor of their academic achievement In Borno State, Nigeria. *International Journal Of Innovative Social & Science Education Research*9(3), 128-140
7. Hinneh, J. T. (2017). Attitude towards practical work and students' achievement in Biology: A case of a private senior secondary school in Gaborone, Botswana. *IOSR Journal of Mathematics*, 13(4), 06-11. Doi: 10.9790/5728-1304010611
8. Iliyasu H., Lee, M. F. & Yahya, K. (2015). Attitudes of secondary school students towards biology as a school subject in Birninkebbi Metropolis, Nigeria. *International Journal of Research and Review*, 2(10), 596-600.
9. Iwuanyanwu, P. N. (2022). Is science really for me? Gender differences in student attitudes toward science. *School Science and Mathematics*, 122(5), 259-270. <https://doi.org/10.1111/ssm.12541>
10. Jebson, S. R., & Hena, A. Z. (2015). Students' attitude towards science subjects in senior secondary schools in Adamawa State. *International Journal of Research in Applied, Natural and Social Sciences*, 3(3), 117-124.
11. Justiny, C.R. (2016). Practical approach to effective teaching of local and majorbiotic communities (Biomes) to secondary school students, for sustainable Development. *Science Teachers' Association of Nigeria (STAN) Biology Panel Series* 2008.41-55.

12. Lane, C., Kaya-Capocci, S., Kelly, R., O'Connell, T. & Goos, M. (2022). Fascinating or dull? Female students' attitudes towards STEM subjects and careers. *Frontiers in Psychology*, 13, 1-16. <https://doi.org/10.3389/fpsyg.2022.959972>
13. Musengimana, J., Kampire, E., & Ntawiha, P. (2021). Factors affecting secondary schools students' attitudes toward learning chemistry: A review of literature. *EURASIA Journal of Mathematics, Science and Technology Education*, 17(1), 1-12.
14. Nwafor, S. C., Chinweuba-Eze, V. O. & Chukwuka, C. Uju (2021). Entrepreneurial mindset of undergraduate science education students in federal tertiary institutions: A tool for national development in Nigeria. *International Research Journal of Modernization in Engineering Technology and Science*, 03(05), 1291-1300.
15. Nworgu, B.G (2018). *Educational research: basic issues & methodology (3<sup>rd</sup> edition)*. University Trust Publishers Nsukka Enugu.
16. Okam, C. C, & Zakari, I.I (2017) Impact of laboratory-based teaching strategy on students' attitudes and mastery of chemistry in Kastina State, Nigeria. *International Journal of Innovative Research and Development*, 6(1), 112-121
17. Olasheinde, K. J. & Olatoye, R. A. (2014). Scientific attitude, attitude to science and science achievement of senior secondary school students in Katsina State, Nigeria. *Journal of Educational and Social Research*, 4(1), 445-452.
18. Sakariyau, A., Taiwo, M., & Ajagbe, O. (2016). An investigation on secondary school students' attitude towards science in Ogun State, Nigeria, *Journal of Education and Practice*, 7(28), 125-128
19. Sharpe, R & Abrahams, I. (2020). Secondary school students' attitudes to practical work in biology, chemistry and physics in England. *Research in Science & Technological Education*, 38(1), 84-104. <https://doi.org/10.1080/02635143.2019.1597696>
20. Trivedi, R. & M.P.Sharma, M. P. (2013). A study of students' attitude towards physics practical at senior secondary level. *International Journal of Scientific and Research Publications*, 3(8), 1-4.
21. University of Cambridge (2010). *Attitude questionnaire science*. Retrieved from <https://www.educ.cam.ac.uk/research/programmes/episteme/epiSTEMeScienceAttitudeQuestionnaire.pdf>