International Journal of Advanced Education
www.allpaperjournal.com
Online ISSN:3107-9601
Received: 15-11-2025, Accepted: 14-12-2025, Published: 29-12-2025
Volume 1, Issue 2, 2025, Page No. 88-94

Assessment of critical thinking skill of secondary school students for sustainable development and capacity building of science education in Anambra State

Ngozi Elizabeth Ezenwosu, Goodluck Erutujiro
Department of Educational Foundations, Faculty of Education, Nnamdi Azikiwe University, Awaka, Nigeria

Abstract
As education shifts from content memorization to skill development, critical thinking skill has become a core competency for student success in science subjects. Critical thinking skill is very important skill for science and technical advancement of any society. The study focused on assessment of critical thinking skill of secondary school students for sustainable development and capacity building of science education in Anambra State. The study was guided by three research questions and three hypotheses. The study is both a descriptive and predictive correlation research design. The study was conducted in Anambra State, Nigeria. The population of the study consist of 23,247 secondary school two (SS 2) students. A sample of 670 students was drawn through simple random sampling techniques. The data were collected using Critical Thinking Questionnaire developed by Alihali *et al* (2023). The Cronach Alpha of the instrument is. 89. The instrument has 64 items with a seven-point likert scale ranging from 0 = Never; 1 = Rarely; 2 = Occasionally; 3 = Usually; 4 = Often; 5 = Frequently; 6 = Always. The instrument was subjected to confirmatory factor analysis. The results of the confirmatory factor analysis shows that the instrument is valid and reliable. The data were collected with questionnaires and academic proforma with the help of six research assistants. The collected data were analyzed using mean, standard deviation, t-test and multiple regression. The researchers found out that secondary school students in Anambra State have high critical thinking skill. The researchers also found out that the mean scores of critical thinking skills of male students is higher than female secondary school students in Anambra State. The study shows that the mean scores of critical thinking skill of urban students is higher than mean scores of rural secondary school students in Anambra State. Finally, the study shows that critical thinking skill has significance influence on academic achievement of secondary school students in science subjects (Physics, Chemistry, Biology and Mathematics) in Anambra State. In term of critical thinking skill dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in science subjects in Anambra State. However, self-regulation and interpretation dimensions of critical thinking skill have no significance influence on academic achievement of secondary school students in science subjects in Anambra State. Based on the above, it was recommended that teachers should help students to improve critical thinking skill for the advancement and capacity building of science education in Anambra State.

Keywords: Assessment, critical thinking, capacity building, sustainable development, science education

Introduction

Science education is crucial in Nigeria for several reasons, including fostering scientific literacy, developing critical thinking, and driving economic growth. It equips students with the knowledge and skills to understand the natural world, engage with technology, and contribute to advancements in various sectors like healthcare, agriculture, and renewable energy (Olofin *et al*, 2023) [13]. A strong science education is also essential for preparing students for future careers and enabling them to solve real-world problems (Owan, Nwannunu & Madukwe, 2018) [15].

In spite of the roles of science education in national development, evidence in literature and that of available Chief Examiners' Report of WASSCE May / June 2020-2024 revealed that candidates performed woefully in science subjects (Physics, Chemistry, Biology and Mathematics) in Anambra State. Several factors have been identified (Nauman, 2017) [8]. Among are shortage of science teachers, shortage of instructional materials, outdated curriculum, poor funding, overcrowded classroom and poor lesson delivery by inexperience teachers (Ojetunde & Ayodabo, 2024) [11].

To overcome the problem of poor academic performance of secondary school students in science subjects (Physics, Chemistry, Biology and Mathematics), capacity and sustainable development of science education is imperative. Capacity building and sustainability are deeply intertwined, forming a synergistic relationship where one enhances the other. Capacity building, involves strengthening individuals, organizations, and systems, is crucial for achieving sustainable development goals, as it enables long-term problem-solving and adaptation. Conversely, sustainable development efforts rely on the capacity of individuals and communities to implement and maintain sustainable practices. Capacity and sustainable development of science education can be improved through critical thinking.

Critical thinking is the ability to evaluate, analyze, and synthesize information to form reasoned judgments, critical thinking is essential for navigating academic tasks and problem-solving in real-world contexts. According to Glaser (2019) [4], critical thinking involves both cognitive skills and dispositional factors, such as open-mindedness and intellectual curiosity that contribute to higher levels of academic performance. Critical thinking enables learners to go beyond rote learning by applying knowledge to novel situations, evaluating sources of information, and constructing coherent arguments (Dronkers, 2020; Okasha, 2021) [3, 12]. This depth of engagement improves both comprehension and long-term retention. Moreover, students with developed critical thinking skills are more adept at

identifying biases, resolving conflicts, and generating creative solutions—all essential abilities in academic success across disciplines.

The assessment of critical thinking is very important for important for the advancement and capacity building of science education. Critical thinking is crucial for hypothesis development, experimental design, and data interpretation. Critical thinking facilitates argument analysis, theory comparison, and ethical reasoning. According to Burgin and Sadler (2016) [2], integrating critical thinking instruction into science education improves students' conceptual understanding and ability to reason through complex issues such as climate change and biotechnology.

Literature Review

Research consistently shows that students with strong critical thinking skills perform better academically. For instance, Semerci and Elaldı (2017) found a significant positive relationship between university students' critical thinking disposition and their academic performance, particularly in fields requiring analytical and evaluative thinking. Similarly, Bensley and Murtagh (2016) demonstrated that instruction designed to enhance critical thinking leads to measurable gains in course achievement, especially in psychology and humanities courses. Ralston and Bays (2018) found out the impact of Paul-Elder Critical Thinking Framework to improve undergraduate students' critical thinking skills. The results of the study indicated that there was a significant increase in critical thinking scores of the students.

Critical thinking ability can also enhance by exposing the students to interact with the learning materials. Akbarilakeh, Naderi and Azizollah (2018) [1] study reported that secondary school students with high critical thinking was found to have high academic achievement in science than the secondary. This research is consistent with the research study carried out by Akbarilakeh, *et al* (2018) [1] who found that the students with higher level of critical thinking performed better than the students who had low level of critical thinking. The above finding is also in line with Selvarani and Saroja (2021) [18] study that reported that there was a significant relationship between the critical thinking and academic achievement in science of secondary school students. Thalib, Corebima and Ghofur (2017) [19] conducted a study on students with a high and low level of academic success and showed a negative relationship between critical thinking and academic achievements.

Onuorah (2023) [14] reported that the mean critical thinking scores of urban students is higher than those students from rural areas. Critical thinking between urban and rural has a significant difference. The difference in the critical thinking skills of secondary school students can be influenced by many factors (Liang, W., & Fung, 2021) [5]. One of them is with the facilities and quality of learning. The above finding is in line with Periasamy (2021) [16] study that reported that the urban secondary school students have higher critical thinking mean scores than the rural school students. There is no significant difference between rural school and urban school secondary school students in their critical thinking. The finding also corroborated with Uddin, Shimizu and Sharmin (2023) [20] study that reported that the mean score of urban students indicates better critical thinking skill than rural students. The result shows a statistical significance difference between rural and urban students while calculating the overall critical thinking skills. Yu, Lin, Ho and Wang (2016) assessed the impact of various teaching methodologies on academic achievement and critical thinking dispositions of the undergraduate nursing major students. The results indicated no significant differences among the groups in critical thinking dispositions for truth-seeking, openmindedness, analyticity, systematicity, confidence, inquisitiveness, and maturity at both the pretest and post test.

Gender has a significant effect on critical thinking of secondary school students. Previous research as show that male students have better critical thinking skill than female secondary school students. This may be due to the ability of male students to solve the problems encountered in daily life particularly in academic areas (Muhammad, *et al*, 2021) [6]. The high critical thinking skill in science of male secondary school students can be the result of understanding the concepts well in science by taking part in the teaching and learning activities effectively (Selvarani and Saroja, 2021) [18].

Research Questions

1. what is the mean scores of critical thinking skill of secondary school students in Anambra State?
2. what is the mean scores of critical thinking skill of male and female secondary school students in Anambra State?
3. what is the mean scores of critical thinking skill of urban and rural secondary school students in Anambra State?

Hypotheses

1. There is no significance difference between the mean scores of critical thinking skill of male and female secondary school students in Anambra State
2. There is no significance difference between the mean scores of critical thinking skill of urban and rural secondary school students in Anambra State
3. Critical thinking skill and its dimensions have no significance influence on academic achievement of secondary school students in science subjects (Physics, Chemistry, Biology and Mathematics) in Anambra State.

Methods

The study is both a descriptive and predictive correlation research design. The study was conducted in Anambra State, Nigeria. The population of the study consist of 23,247 secondary school two students. A sample of 650 students (Male =320, 280=Female) was drawn from through simple random sampling techniques. The data were collected using Critical Thinking Questionnaire developed by. The instrument is a seven-point likert scale ranging from 0 = Never; 1 = Rarely; 2 = Occasionally; 3 = Usually; 4 = Often; 5 = Frequently; 6 = Always. The instrument was subjected to confirmatory factor analysis. The results of the confirmatory factor analysis show that the instrument is valid and reliable. The collected data were analyzed using mean, standard deviation, t-test and multiple regression.

The data were first screened for missing values. 6 respondents had missing values representing 4%. Hence listwise deletion approach was adopted. After deleting the 6 incomplete scores, the sample size was reduced to 644. Thereafter, test of assumptions of multiple regression model were conducted.

Univariate outliers of the data were checked by examination of the boxplot value of each variable in the mathematical model. An examination of the boxplot of the scores suggests no outliers was found. Other variables have no outliers. The skewness statistics of the variables in this study are within the range of −.196 to. 504 and kurtosis are within the range of -.244 to -1.207, all within the range of an absolute value below 2.0 suggesting evidence of normality. Multivariate normality was examined using Mardia test for Standardized Kurtosis. A Standardized Multivariate Kurtosis (Std-MK) -1.5179 was found. The value was below 5 recommended (Bryne, 2016). Therefore, the univariate and multivariate normality was met.

To test if the assumption of absence of multicollinearity among the variables was violated, Variance Inflated Factor (VIF) and Tolerance (T) statistics were used; values obtained were less than 10 for VIF and greater than. 20 for T respectively as recommended (Schumacker, 2015). Hence, there is no presence of multicollinearity among the variables in the path model.

Durbin Watson statistics was used to test if the assumption of independent errors was violated; the results showed that the value of Durbin Watson statistics is 1.948 less than 4 but greater than zero as recommended (Denis, 2020). Hence the assumption of independent error of observation was met.

Results

Research question 1 what is the mean scores of critical thinking skill of secondary school students in Anambra State

Table 1: Mean scores of critical thinking skills of secondary school students in anambra state

Critical Thinking skill	Mean	SD	Kurtosis	Skweness	Remark
General Construct	71.01	4.67	.10	.50	High

Table 1 shows the mean and standard deviation scores of critical thinking skill of secondary school students in Anambra State**.** Table 1 shows that secondary school students in Anambra State has high critical thinking skill.

Research question 2 what is the mean scores of critical thinking skill of male and female secondary school students in Anambra State

Table 2: Mean and standard deviation scores of critical thinking skill of male and female secondary school students in Anambra State

Gender	Mean	N	Std. Deviation	Kurtosis	Skewness
Male	71.3931	318	4.75052	-.156	.467
Female	70.6534	326	4.58218	-.024	.534

Table 1 shows that the mean scores of critical thinking skills of male students (M=71.3931, SD=4.75) is higher than female (M=70.6534, SD=4.58) secondary school students in Anambra State. In other words, male students have better critical thinking skill than female secondary school students in Anambra State.

Research question 3 what is the mean scores of critical thinking skills of urban and rural secondary school students in Anambra State

Table 3: Mean and standard deviation scores of critical thinking skill of urban and rural secondary school students in Anambra State

Location	Mean	N	Std. Deviation	Kurtosis	Skewness
Rural	60.7450	302	11.45399	-1.276	.131
Urban	64.3392	342	11.25871	-1.239	-.395

Table 1 shows that the mean scores of critical thinking skills of urban students (M=64.33, SD=11.25) is higher than mean scores rural secondary school students (M=60.74, SD=11.45) in Anambra State. In other words, urban students have better critical thinking skill than rural secondary school students in Anambra State.

Hypothesis 1: there is no significance difference between the mean scores of critical thinking skill of male and female secondary school students in Anambra State

Table 4: test of significance difference between mean scores of critical thinking skill of male and female secondary school students in Anambra State

Gender	N	Mean	SD	T	Df	p-value	Remark
Male	318	71.39	4.75				
				2.011	642	.045	Sign
Female	326	70.65	4.58				

Table shows the t-test of significance between the mean scores of critical thinking skill of male and female secondary school students in Anambra State. Table shows that there is a significance between the mean scores of critical thinking skill of male and female secondary school students in Anambra State.

Hypothesis 2: There is no significance difference between the mean scores of critical thinking skill of urban and rural secondary school students in Anambra State

Table 5: test of significance difference between mean scores of critical thinking skill of male and female secondary school students in Anambra State

Location	N	Mean	SD	T	Df	p-value	Remark
Urban	342	64.33	11.25				
				4.010	642	.000	Sign
Rural	302	60.74	11.45				

Table shows the t-test of significance between the mean scores of critical thinking skill of male and female secondary school students in Anambra State. Table shows that there is a significance between the mean scores of critical thinking skill of male and female secondary school students in Anambra State

Hypothesis 3: Critical thinking skill and its dimensions have no significance influence on academic achievement of secondary school students in science subjects (Physics, Chemistry, Biology and Mathematics) in Anambra State.

Table 6: Predictive Influence of Critical Thinking Skills and Its Dimensions on Academic Achievement of Secondary School Students in Physics in Anambra State

Dimensions of critical thinking skill		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	24.394	2.533		9.632	.000
	Analysis	-.194	.037	-.146	-5.251	.000
	Evaluation	.253	.036	.204	7.008	.000
	Inference	.306	.083	.101	3.707	.000
	Explanation	.285	.071	.110	4.009	.000
	self_regulation	-.135	.092	-.038	-1.473	.141
	Interpretation	-.108	.059	-.048	-1.819	.069
	Overall construct	.247	.021	.351	11.948	.000

a. Dependent Variable: Physics

b. R^2 =. 339, Adjusted R square=. 335, F-ratio = 76.0641, p <. 05, SEE = 7.73, n = 644

Table shows the predictive influence of critical thinking skill and its dimensions on academic achievement of secondary school students in physics in Anambra state. Table shows that critical thinking skill has significance influence on academic achievement of secondary school students in physics in Anambra state, p<.05. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in physics in Anambra state, p<.05. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in physics, in Anambra state, p>. 05.

Table 7: Predictive Influence of Critical Thinking Skills and Its Dimensions on Academic Achievement of Secondary School Students in Chemistry in Anambra State

Dimensions of critical thinking skills		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.752	2.723		9.457	.000
	Analysis	-.211	.039	-.160	-5.374	.000
	Evaluation	.244	.039	.196	6.306	.000
	Inference	.313	.089	.104	3.532	.000
	Explanation	.265	.076	.102	3.493	.001
	self_regulation	-.123	.100	-.035	-1.226	.220
	Interpretation	-.113	.064	-.050	-1.761	.079
	Overall construct	.236	.022	.336	10.660	.000

a. Dependent Variable: Chemistry

b. R^2 =. 327, Adjusted R square=.322, F-ratio = 63.450, p <. 05, SEE = 7.77, n = 644

Table shows the predictive influence of critical thinking skill and its dimensions on academic achievement of secondary school students in Chemistry in Anambra state. Table shows that critical thinking skill has significance influence on academic achievement of secondary school students in Chemistry in Anambra state, p<.05. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in Chemistry in Anambra State, p<.05. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Chemistry in Anambra state, p>. 05..

Table 8: Predictive Influence of Critical Thinking Skills and Its Dimensions on Academic Achievement of Secondary School Students in Biology in Anambra State

Dimensions of critical thinking skills		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	28.138	2.892		9.730	.000
	Analysis	.241	.042	.180	5.735	.000
	Evaluation	.223	.041	.177	5.392	.000
	Inference	.277	.093	.092	2.991	.003
	Explanation	.226	.079	.087	2.844	.005
	self_regulation	.126	.106	.036	1.190	.235
	Interpretation	.132	.067	.058	1.963	.050
	Overall construct	.235	.023	.337	10.145	.000

a. Dependent Variable: Biology

b. R^2 =. 326, Adjusted R square=.320, F-ratio = 57.481, p <. 05, SEE = 7.02, n = 644

Table shows the predictive influence of critical thinking skill and its dimensions on academic achievement of secondary school students in Biology in Anambra state. Table shows that critical thinking skill has significance influence on academic achievement of secondary school students in Biology in Anambra state, p<.05. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of

secondary school students in Biology in Anambra state, p<.05. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Biology in Anambra state, p>. 05.

Table 9: Predictive Influence of Critical Thinking Skills and Its Dimensions on Academic Achievement of Secondary School Students in Biology in Anambra State

Dimensions of critical thinking skills		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	28.118	2.923		9.618	.000
	Analysis	-.241	.043	-.179	-5.657	.000
	Evaluation	.219	.042	.174	5.193	.000
	Inference	.276	.094	.091	2.947	.003
	Explanation	.210	.081	.080	2.610	.009
	self regulation	-.120	.107	-.034	-1.122	.262
	Interpretation	-.132	.068	-.058	-1.928	.054
	Overall construct	.239	.024	.342	10.127	.000

a. Dependent Variable: Mathematics

b. R^2 =. 328, Adjusted R square=. 322, F-ratio = 5.631, p <. 05, SEE = 6.98, n = 644

Table shows the predictive influence of critical thinking skill and its dimensions on academic achievement of secondary school students in Mathematics in Anambra state. Table shows that critical thinking skill has significance influence on academic achievement of secondary school students in Mathematics in Anambra state, p<.05. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in Mathematics in Anambra state, p<.05. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Mathematics, in Anambra state, p>. 05.

Discussions

The researcher found out that that secondary school students in Anambra State has high critical thinking skill. The study shows that the mean scores of critical thinking skills of male students is higher than female secondary school students in Anambra State. In other words, male students have better critical thinking skill than female secondary school students in Anambra State. This may be due to the ability of male students to solve the problems encountered in daily life particularly in academic areas (Muhammad Zafar Iqbal, *et al*, 2021) [6]. The high critical thinking skill in science of male secondary school students can be the result of understanding the concepts well in science by taking part in the teaching and learning activities effectively (Selvarani and Saroja, 2021) [18].

The researchers found out that the mean scores of critical thinking skill of urban students is higher than the mean scores of rural secondary school students in Anambra State. In other words, urban students have better critical thinking skill than rural secondary school students in Anambra State. Testing the corresponding hypothesis shows that there is a significance between the mean scores of critical thinking skill of male and female secondary school students in Anambra State. The above finding is in line with Onuorah (2023) [14] study that revealed that the mean critical thinking scores of urban students is higher than those students from rural areas. Critical thinking between urban and rural has a significant difference. The difference in the critical thinking skills of secondary school students can be influenced by many factors. One of them is with the facilities and quality of learning. The above finding is in line with Periasamy (2021) [16] study that reported that the urban secondary school students have higher critical thinking mean scores than the rural school students. There is no significant difference between rural school and urban school secondary school students in their critical thinking. The finding also corroborated with Uddin, Shimizu and Sharmin (2023) [20] study that reported that the mean score of urban students indicates better critical thinking skill than rural students. The result shows a statistical significance difference between rural and urban students while calculating the overall critical thinking skills.

The study shows that critical thinking skill has significance influence on academic achievement of secondary school students in physics in Anambra state. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in physics in Anambra state. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Physics, in Anambra state. Critical thinking skill has significance influence on academic achievement of secondary school students in Chemistry in Anambra state. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in Chemistry in Anambra State. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Chemistry in Anambra state.

The study shows that the predictive influence of critical thinking skill and its dimensions on academic achievement of secondary school students in Biology in Anambra state. Critical thinking skill has significance influence on academic achievement of secondary school students in Biology in Anambra state. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in Biology in Anambra state. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Biology in Anambra state. Furthermore, the study shows that critical thinking skill has significance influence on academic achievement of secondary school students in Mathematics in Anambra state. In term of its dimensions, analysis, evaluation, inference, explanation have significance influence on academic achievement of secondary school students in Mathematics in Anambra state. However, self-regulation and interpretation dimension of critical thinking skill have no significance influence on academic achievement of secondary school students in Mathematics, in Anambra state.

The above finding is in line with Akbarilakeh, Naderi and Azizollah (2018) [1] study that reported that secondary school students with high critical thinking was found to have high academic achievement in science than the secondary. This research is consistent with the research

study carried out by Akbarilakeh, *et al* (2018) [1] who found that the students with higher level of critical thinking performed better than the students who had low level of critical thinking. The above finding is also in line with Selvarani and Saroja (2021) [18] study that reported that there was a significant relationship between the critical thinking and academic achievement in science of secondary school students.

Conclusion

Critical thinking skill has significance influence on academic achievement of secondary school students in science subject in Anambra state. The mean scores of critical thinking skills of male students is higher than female secondary school students in Anambra State. Also, mean scores of critical thinking skills of urban students is higher than the mean scores of rural secondary school students in Anambra State.

Recommendations

1. It is recommended for the school to create more opportunities for participation in thinking skills related programmes, debates, discussions, multidisciplinary projects etc., to widen students' critical thinking.
2. In addition, the teachers can frame more questions which are relevant to science subject and give more situations to solve the problems independently by thinking critically.
3. Assessment of students' academic achievement needs to be revisited whether the element of critical thinking is visibly reflected or lacking.
4. It is recommended that critical thinking needs to be developed among the students and particular focus needs to be paid to female and rural group students.
5. The sub-constructs of critical thinkingsuch as analysis, interpretation, inference, deduction, and argumentation need to be developed among the students so that they would apply them to maximize their academic achievements
6. Efforts to align critical thinking and academic achievement in the teaching and learning process can provide desired results

Reference

1. Akbarilakeh M, Naderi A, Azizollah A. Critical thinking and emotional intelligence skills and relationship with students' academic achievement. Journal of Science Education,2018:8(1):26–31.
2. Burgin SR, Sadler TD. Learning nature of science concepts through a research apprenticeship program: A comparative study of three approaches. Journal of Research in Science Teaching,2016:53(1):31–59.
3. Dronkers IT. Relationship between home environmental factors and academic performance of secondary school student. Unpublished Ph. D Thesis, University of Nigeria, Nsukka, 2020.
4. Glaser BG. Grounded description: No no. In Bryant A, Charmaz K, Editors. The Sage handbook of current developments in grounded theory. London, England, Sage, 2019, 441–445.
5. Liang W, Fung D. Fostering critical thinking in English as a second lanauge classrooms: challenges and opportunities. Thinking Journal,2021:39(7):67–73.
6. Muhammad Zafar Iqbal, Muhammad Jamal Khan, Tariq Javed, Uzma Rao, Jahan Ara Shams. Relationship between Secondary Students' Critical Thinking and Academic Achievement: A case of public Schools. International Journal of Research in Education,2021:6(3):68–78.
7. Muhammed ZI, Muhammed JL, Tariq J, Uzma R, Jahan AM. Relationship between secondary students' critical thinking and academic achievement: a case of public schools. Humanities and Social Sciences Reviews,2021:9(3):56–70.
8. Nauman S. Lack of critical thinking skills leading to research crisis in developing countries: A case of Pakistan. Learned Publishing,2017:30(3):233–236.
9. Obialor COM, Mbaegbu SC, Okonkwo GI, Okonkwo HC. Science education for national development and scientific creativity among secondary school students in Nigeria. Unizik Journal of STM Education,2022:8(2):98–106.
10. Oguejiofor CN, Anyakaorah DC, Ekechukwu LE, Ogbuanya DC. Factors accountable for poor academic achievement in junior secondary schools in Enugu North Local government area. Academic Journal of Current Research,2021:8(7):28–38.
11. Ojetunde SH, Ayodabo O. Causes and remedies of poor performance and character decline in public secondary schools in Nigeria. International Journal of Research in Education,2024:3(1):68–78.
12. Okasha MAH. The effect of critical thinking techniques for improving reading skills. Journal of Research in Curriculum, Instruction and Educational Technology,2021:7(1):141–157.
13. Olofin SO, Ogunjobi AO, Falemu FA, Akinwumi IO. Science Education as a Tool for Achieving Socio - Economic Development of Nigeria. International Journal of Development and Economic Sustainability,2023:11(4):33–44.
14. Onuorah KL. Relationship between critical thinking and academic achievement of secondary school students. Journal of Education Psychology,2023:5(2):81–90.
15. Owan VJ, Nwannunu BI, Madukwe EC. Problems of school management and students' academic performance in secondary schools in Calabar education zone, Cross River State, Nigeria. International Journal of Research and Innovation in Social Science,2018:2(10):120–127.
16. Periasamy R. Critical thinking among secondary school students in relation to their academic achievement. International Research Journal of Modernization in Engineering Technology and Science,2021:6(31):18–20.
17. Ralson PA, Bays CL. Critical thinking development in undergraduate engineering students from freshman through senior year: A 3-cohort longitudinal study. American Journal of Engineering Education,2015:6(2):85–98.
18. Selvarani SC, Saroja MM. Critical thinking and academic achievement of secondary school students. Journal of Positive School Psychology,2021:6(4):8168–8173.
19. Thalib M, Corebima AD, Ghofur A. Comparison on critical thinking skill and cognitive learning outcome among students of x grade with high and low academic

ability through reading questioning answering strategy. Journal of Science Education,2017:5(1):26–31.
20. Uddin MR, Shimizu K, Sharmin HWA. Comparing critical thinking skills between rural and urban students in secondary level education of Bangladesh: A focus on environmental education. AIP Conference Proceedings,2023:2614:010001.