



ChatGPT in Organic Chemistry Classrooms: Analyzing the Impacts of Social Environment on Students' Interest, Critical Thinking and Academic Achievement

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Abstract: This study aims to analyze the Impacts of Social Environment on Interest, Critical Thinking and Academic Achievement of Students Taught Organic Chemistry Using Artificial Intelligence ChatGPT. Correlational research design was engaged for the study. 50-students in SS3 with an average age of 17 years, who have access to android phones and the ChatGPT application from two senior secondary schools in Gwale Local Government area of Kano State, Nigeria formed the study sample. The instruments used for data collection include; the students' social environment, interest and critical thinking questionnaire ($r=0.96$) and Organic Chemistry Achievement Test ($r=0.92$). The data were analyzed using mean, standard deviation and Spearman Rank Order Correlation. The study revealed a high positive correlation between the social environment and student's interest; Social environment and critical thinking; as well as social environment and students' achievement in the ChatGPT's Organic Chemistry Classroom. The study further found a strong positive correlation between the students' interest and critical thinking, critical thinking and students' achievement in Organic Chemistry among students in the ChatGPT condition. It was concluded that social environment has a strong positive impact on students' interest, critical thinking and academic achievement in organic chemistry among students in the ChatGPT classrooms. The study recommends that, as the artificial intelligence (AI) ChatGPT is migrating into the chemistry classrooms, government needs to re-train chemistry teachers, school librarians and lab-technologists through refreshers courses to improve their performance in the concepts

INTRODUCTION

Science, from the ages, aims at solving global problems by providing explanations for the working system of the environment through the application of scientific discoveries in technological ventures (Freedman, 2018; Bradford and Hamer, (2022)). By so doing, many scientific ideas have been helping the chemistry teaching community, including Chemistry textbook authors, curriculum developers and chemistry teachers to increase human knowledge and build capacity for technological growth. One of such innovations in the recent time is the Artificial Intelligence (AI) robot-teachers and the ChatGPT apps. According to Iona University (2023), ChatGPT is a natural language processing tool or

model trained to produce text that allows users to have human-like conversations with an AI Chatbot. Specifically, ChatGPT is optimized for dialogue by using reinforcement learning with human-like feedback that uses demonstrations to guide the learners toward desired behavior. At the global stage, ChatGPT is gradually finding its way into the education system and Chemistry teachers in Nigeria needs to be aligned with this developmental process. This has to be achieved through empirical research backing for its usability and the quality of impact produced on students' educational variables.

However, the improvement of Chemistry teaching and learning depend largely on the quality of Science Education as a research field. In that science education through research of this nature on AI ChatGPT may provide empirical finding for teacher education institution to train world class Chemistry teachers for Secondary schools, not only in Nigeria but globally. As described by Babalola, (2023a), science education is the total package of activities involving the teaching, learning and research into science subjects including Chemistry. Nevertheless, the teaching of chemistry as a science subject cannot be said to be efficient, when students' interest towards Organic Chemistry is low.

Students' interest in Organic Chemistry is a psychological term, referring to likes and dislikes as well as choices and aspirations that may enhance students' attention to get involve and be dedicated to organic concepts and chemistry in general. Harackiewicz, Smith, and Priniski, (2016), revealed that interest is a powerful reinforcement that promote learning, guides academic activities and career trajectories which are essential for academic success. Interest inspires students to learn Organic Chemistry willingly with receptive minds which may lead to academic achievement in Chemistry. As reported by Boesdorfer (2019), the students' diversity in learning styles, the abstract nature of chemistry, and the bookish way of teaching chemistry without adequate attention given to innovation (such as ChatGPT) have been causing decline in students' interest in Chemistry including Organic Chemistry concepts.

Organic Chemistry can be defined as the branch of Chemistry dealing with the study of carbon compounds with exception of CO_2 gas and $-\text{CO}_3^{2-}$ compounds. Organic compounds are found in animals and plants that form part of human foods such as carbohydrate, protein and fruits. Also, Petrol, Diesel and Kerosene used as fuel in homes, industries and automobiles are organic substances. Organic polymers are used for making vehicle parts like dashboard, and in health sector for making medical hand gloves and nylon for surgical operations. Students can only become experts in this area of chemistry enterprise by gaining admission into tertiary institutions that is well packed with inclusive skills (Babalola, 2023b) through innovative ways of learning like the ChatGPT. Hence, lack of interest, critical thinking and underachievement in Organic Chemistry could mean a reduction in number of future experts in those areas of economy. Sadly, Organic Chemistry has been contributing to students' underachievement in Chemistry.

Academic achievement in chemistry is the extent to which students realize their educational goals through examination and continuous assessment scores from tests, assignments, debates and practical engagements. The problem of academic achievement is in chemistry is evident in the WAEC Examiner's report, which shows that out of 2,125 students who sat for WAEC between years 2020 and 2022 in Gwale Secondary schools

only 920-students constituting 44.8% passed and 55.2% failed. The problem of poor achievement in chemistry generally has been militating against students from gaining admission into tertiary institutions causing inadequate personnel in science related discipline. As observed by Ali, Babalola and Ibrahim (2023), one of the most annoying problems of underachievement is that students are carrying their poor knowledge of chemistry to the tertiary institutions making them to drop-out. Likewise, the scientific skills and technological knowledge needed for self-reliance and those required for the nation to move up the ladder of development are under threat among students. Unfortunately, lack of interest and Critical-thinking among science students have been linked to poor academic achievement in the secondary school chemistry. The Bandura, through his Socio-cognitive theory using Bobo doll experiment assumed that social environment may help in this situation. Thus; this study hereby examined the impact of Social environment on these variables among Gwale Secondary school students in Organic Chemistry taught using ChatGPT.

However, It has been found that student' academic achievement improves whenever their critical thinking abilities increases (Rokhim, Widarti, & Permatasari, 2023). According to Ennis (2015), the 12-indicators of Critical thinking upon which students can be assessed includes; comprehension, analyzing, evaluating, and synthesizing among others. In another words, the cognitive level of bloom taxonomy can be used to measure critical thinking. However, if students are given adequate opportunities to solve problems using ChatGPT within the school and home environment, their critical thinking abilities may develop. Therefore, teachers' may need to guide and provide their students with skills of gathering, analyzing and utilizing information from ChatGPT to enable them solve real life problems.

In an effort to solve the problem of low students' interest, lack of critical thinking and underachievement in Organic chemistry, Bandura's theory was considered. Albert Bandura believes that apart from the teaching resources, such as diagrams, mnemonics and technology, learners' academic behaviors may be influenced by the social environment (Harinie, et al. 2017). As suggested by Nabavi (2014), the persistent change in learners' behavior as a result of interaction with social environment may improve their academic achievement. This interaction involves observation and imitation of the Social environment. Harinie, et al. (2017), found that if children are raised in an entrepreneur family, there is tendency that they may observe and imitate entrepreneurship skills.

Research scholars have viewed Students' social environment differently, for instance, Abumchukwu & Okigbo (2023) sees social environment as an online destination where people come together to create content, share knowledge and learn from one another. This perspective has been termed social media chemistry groups in this study. Similarly, Nubunga (2020), describe social environment as the combination of social learning elements like networking, tagging, files sharing and microblogging to create a safe place to work and learn collaboratively in learning where people gather to share knowledge. In this study, social environment simply means the human components of the learners' academic environment both in and outside the school. This suggests that chemistry teacher, lab-technologist, school librarian, classmates, home-lesson teachers and

chemistry groups on social media form the bulk of learners' social environment interested in this study. Consequently, this article seeks to demonstrate that the quality of chemistry teaching and learning can be improved using ChatGPT as a resource assisted instruction, which does not need to take the job from chemistry teachers, school librarians and lab-technologists.

METHOD

This study analyzed the impact of social environments on students' interest, academic achievement and critical thinking among students taught Organic Chemistry using AI ChatGPT in Gwale Secondary Schools, Kano-Nigeria. Four research questions and six hypotheses were raised to guide the study. Correlational research design was adopted for the study. The study population covered 718 science students from eight (8) secondary schools in the study area. The Cochran's formula of 1963 was used to determine the sample size to be 50-students of SS3 with an average age of 17yrs. According to Babalola (2023c), the Cochran's formula states that; $(n = n_o / (1 + (n_o - 1) / 385))$. Nevertheless, using simple random sampling technique, two intact classes were selected for the study, the instruments were administered to only 55-students who have access to the ChatGPT.

The two researcher-made instruments used and their Kuder Richardson formula 20 reliability coefficients (r) include; Social environment, Students' Interest and Critical-thinking questionnaire ($r = 0.96$), and Organic Chemistry Achievement Test ($r = 0.92$). The achievement test made up of 30-multiple choice WAEC past questions in Organic Chemistry, while the questionnaire was also made up of 30-items (10-items for each variable). The questionnaire was made of 4-point scale; Strongly Agreed (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) rated 4,3,2,1. The instruments were validated by three Professors in the field of Science Education, Test and Measurement and Linguistics.

The researchers taught the students Organic Chemistry using the artificial intelligence ChatGPT for a period of 6-weeks after which the two instruments were administered. The data was analyzed using Histogram, Mean, Standard deviation and Spearman Correlation. The range of scores and the decision taken on the hypotheses are; ± 0.80 to ± 1.00 (High correlation), ± 0.50 to ± 0.79 (Moderate correlation), ± 0.00 to ± 0.49 (Low Correlation).

RESULTS AND DISCUSSION

Based on the observations and data analysis that have been carried out in this research, data was obtained from the four research questions created for this research which were described, stated and answered using a histogram, mean and standard deviation, where each data obtained was very good. importance or urgency in the education and teaching process. The question process used is of course about the educational and teaching environment, both how the forms of behavior are used and how the learning environment is related to influencing the learning process carried out by students. The learning environment can be influenced by one of them, the social environment, namely how students interact both at school and outside the school environment. In this study the researcher asked a First Research Question, what is the average social environmental rating

(SER) of students taught Organic Chemistry in the artificial intelligence ChatGPT Classroom in Gwale? The data obtained can be seen in Figure 1.

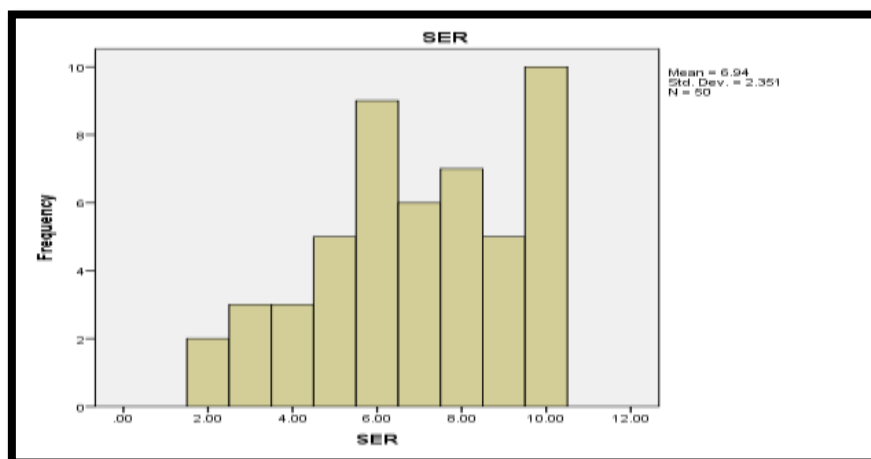


Figure 1. Histogram of Social Environment Ratings (SER) in ChatGPT Classes

As presented in Figure 1, from the research results, the number of students examined was 50 people, while the maximum social environment rating obtained was 10. This positively sloping histogram shows a conducive social environment with an average value of 6.94 and a standard deviation of 2.351. This means that students' social environment in the ChatGPT organic chemistry class is conducive. The conducive social environment that has been formed indicates that the learning process can be carried out well and effectively. Perfect and practical learning conditions or environments are needed to provide information and knowledge. Then, the researcher continued with the second question, namely, about what is the average critical thinking score of students taught organic chemistry in the ChatGPT classroom with artificial intelligence?, where the complete data that can be collected from this question can be seen in Figure 2.

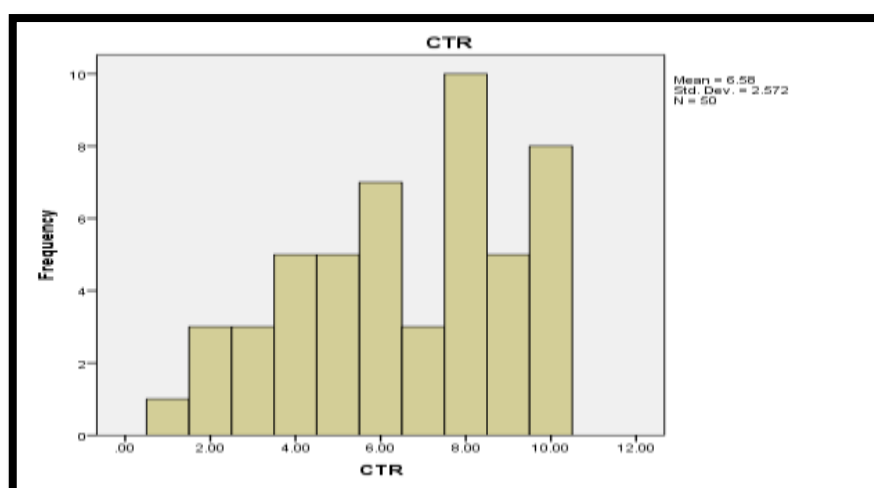


Figure 2. Histogram of Critical Thinking Ratings (CTR) in Organic Chemistry

The research data presented in Figure 2 is a histogram graph that measures students' critical thinking abilities after being taught Organic Chemistry using ChatGPT artificial

intelligence. As revealed, students' maximum critical thinking score was 10, while the average score was 6.58, and the standard deviation was 2.572. This shows that students' critical thinking scores after teaching Organic Chemistry in the ChatGPT class are high, with an average score of >50% of the maximum score that can be obtained (5/10). Then, the researchers analyzed Question Three, namely, What is meant by the Organic Chemistry Achievement Score in the artificial intelligence ChatGPT Classroom at Gwale Secondary School, Kano? The complete data produced can be seen in Figure 3.

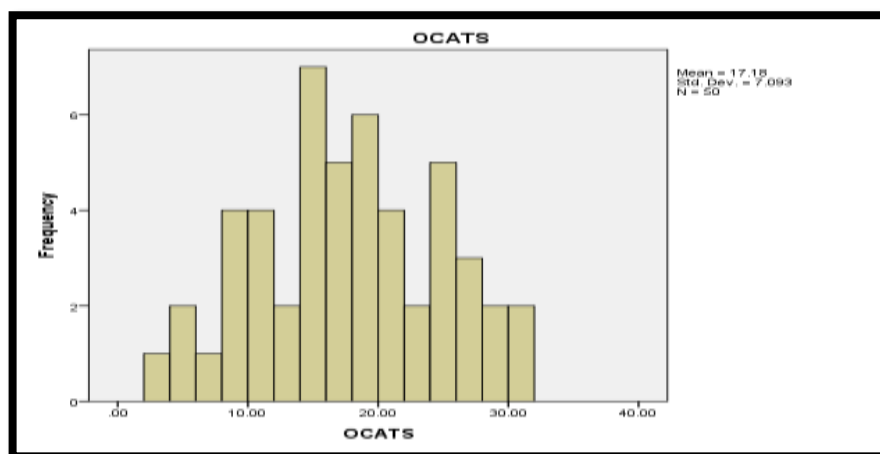


Figure 3. Histogram of Organic Chemistry Achievement Scores (OCATS).

Figure 3 is the histogram of students' achievement scores in organic chemistry after they were taught using the artificial intelligence ChatGPT. The histogram shows a bell shape indicating a normally distributed score of 50 students in a 30-question Organic Chemistry Achievement test in the ChatGPT classroom. The histogram further revealed the mean achievement score of 17.18 and the standard deviation of 7.09. Since the mean achievement scores of $17.18 > 15.00$ (50% of the maximum obtainable marks) in the achievement test, it can be concluded that ChatGPT is a practical technological Application for teaching chemistry. Question Four is: What are the mean interest ratings of students taught Organic Chemistry in the artificial intelligence ChatGPT Classrooms in Gwale Secondary Schools, Kano? This research question was also answered using Histogram, Mean, and Standard Deviation of the descriptive statistics, as shown in Figure 4.

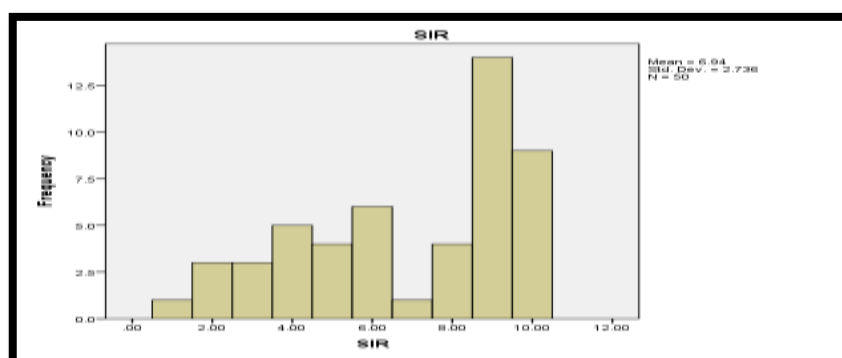


Figure 4. Histogram of Students' Interest Rating (SIR) in Organic Chemistry

The histogram in Figure 4, revealed a positively skewed interest rating of 50-students with a maximum obtainable rating of 10 in the ChatGPT classroom. The histogram further revealed the mean interest rating of 6.94 and the standard deviation of 2.736. Since the mean scores of $6.94 > 5.00$ (50% of the maximum obtainable rating), this implies that artificial intelligence ChatGPT is an effective technological Application for improving students' interest in chemistry. All the six null hypotheses (HO) formulated were tested using Spearman's Rank Order Correlation Statistics (ρ) of the SPSS version 20 as follows; Null Hypothesis One (HO₁), There is no significant relationship between social environment Rating and Students' interest in the ChatGPT's Organic Chemistry Classes. The relationship between the Social Environment ranking and the Interest ranking in the ChatGPT Organic Chemistry Class can be seen in Table 1.

Table 1: rho Test of relationship between Social Environment ratings and Interest ratings in Organic Chemistry's ChatGPT Classrooms.

Statistics	Variables		SER	SIR
Spearman's rho	Social Environment Ratings(SER)	Correlation Coefficient	1.000	.865
		Sig. (2-tailed)	.000	.000
		N	50	50
	Students' Interest Ratings(SIR)	Correlation Coefficient	.865	1.000
		Sig. (2-tailed)	.000	.
		N	50	50

Table 1, shows the Spearman's rho of 0.865. This indicates a High correlation which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the HO₁ is rejected. There is a significantly high positive correlation between Social environment ratings and students' interest in Organic chemistry taught with ChatGPT. It can be concluded that social environment impact students' interest in Organic Chemistry in the ChatGPT classroom. The null hypothesis one (HO₁), was rejected because the result shows a significant correlation between the student Social environment ratings and students' interest in organic chemistry with a Spearman Rank Order correlation ($\rho = 0.865$; $P < 0.001$) which is significant. The positive direction indicates an increase in students' Social parameters and a tremendous increase in student academic interest towards organic chemistry. Conversely, if there is a decline in quality of student interaction with Social environment parameters such as the chemistry teacher, laboratory technologist, school librarian, brilliant classmates, home-lesson teachers, chemistry groups on social media, parents and siblings, the students may witness low interest in organic chemistry. This findings agreed with that of Ezike (2018) who discovered that conducive classroom environment correlate students' academic interest and academic achievement. The study also agreed with Igboanugo (2023), who found a significant impact of teachers' experience on students' interest in chemistry. Null Hypothesis Two (HO₂), There is no significant Relationship between Social Environment Ratings and Critical Thinking ratings in the ChatGPT's Organic Chemistry Classrooms. The data obtained regarding the relationship between social environmental assessment and students' critical thinking abilities in the classroom learning process can be seen in more detail in Table 2.

Table 2. rho Test of Relationship between Social Environment Ratings and Critical Thinking ratings in Organic Chemistry's ChatGPT Classrooms.

Statistics	Variables		SER	OCATS
Spearman's rho	Social Environment Rating (SER)	Correlation Coefficient	1.000	.912
		Sig. (2-tailed)	.000	.000
		N	50	50
	Organic Chemistry Achievement Test Scores (OCATS)	Correlation Coefficient	.912	1.000
		Sig. (2-tailed)	.000	.
		N	50	50

The table 2, revealed the Spearman's rho of 0.912 indicating a high positive correlation between social environment rating and the Organic Chemistry Achievement Scores which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the null hypothesis H_{02} is rejected. That is, there is a significantly high positive correlation between Social environment ratings and students' Critical thinking rating in Organic chemistry in the artificial intelligent ChatGPT classrooms. It can be concluded that Social environment determines students' achievement in Organic Chemistry in the artificial intelligence ChatGPT classes. The result of the null hypothesis two (H_{02}) revealed a significant correlation between the students' social environment and Critical thinking in Organic Chemistry with a Spearman Rank Order Correlation ($\rho = 0.912$; $P < 0.001$) which is significant.

This implies that, there is a strong positive correlation between Social environment and student Critical thinking in Organic Chemistry. This positive direction implying that, if there is increase in students Social parameters there will be a laudable increase in student Critical thinking towards Organic Chemistry. Conversely, if there is a decline in quality of student Social environment parameters, there will be low Critical thinking ability of students towards organic chemistry. This findings correspond with that of Purwanto, Rahmawati, Rahmayanti, Mardiah and Amalia (2022), who discovered that improvement in critical thinking skills encourages students' involvement in the learning process and provided the required support for using problem-oriented approach in chemistry classrooms. Null Hypothesis Three (H_{03}): There is no Significant Relationship between the Social Environment Ratings and Organic Chemistry Achievement in the ChatGPT's Organic Chemistry Classes. The relationship between social environment ranking and Organic Chemistry Achievement in the ChatGPT Classroom can be seen in Table 3.

Table 3. rho Test of relationship between the Social environment ratings and Organic Chemistry Achievement in ChatGPT Classrooms.

Statistical tool	Variables		SER	CTR
Spearman's rho	Social Environment Ratings (SER)	Correlation Coefficient	1.000	.954
		Sig. (2-tailed)	.000	.000
		N	50	50
	Critical Thinking Rating (CTR)	Correlation Coefficient	.954	1.000
		Sig. (2-tailed)	.000	.
		N	50	50

The table 3, shows that the Spearman's rho of 0.954 indicating a high positive correlation between social environment rating and students' critical thinking rating which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the H_{O3} is rejected, there is a significant correlation between the Social environment ratings and Organic chemistry achievement scores in the ChatGPT's Organic Chemistry Classes.

Result of this Null hypothesis three (H_{O3}) shows a significant relationship between the students' social environment and Academic achievement in organic chemistry with a correlation coefficient ($\rho = 0.954$; $P < 0.000$) which is statistically significant. This implies that, there is a high positive correlation between the students' social environment and students' academic achievement in organic chemistry. This positive direction signifies that, if there is increase in students' social environment there will be a consequential increase in students' achievement in Organic Chemistry. The this findings agreed with that of Malik & Rizvi (2018) and Dangara & Madulili (2019) who found that social environment increases academic achievements in chemistry among students. Null Hypothesis Four (H_{O4}), There is no Significant Relationship between Students' Interest and Critical Thinking Ratings in the ChatGPT's Organic Chemistry Classes. The significance in terms of the relationship between student interest ratings and critical thinking ratings in the ChatGPT Organic Chemistry Classroom can be seen in Table 4.

Table 4. rho Test of significance in relationship between students' interest ratings and critical thinking ratings in Organic Chemistry's ChatGPT Classrooms.

Statistical tool	Variables		SIR	CTR
Spearman's rho	Students' interest	Correlation Coefficient	1.000	.880
	Ratings(SIR)	Sig. (2-tailed)	.000	.000
		N	50	50
	Critical Thinking	Correlation Coefficient	.880	1.000
	Ratings(CTR)	Sig. (2-tailed)	.000	.
		N	50	50

The table5 revealed the Spearman's correlation (ρ) of 0.880 indicating a high correlation between the students' interest rating and critical thinking rating which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the H_{O4} is rejected, That is, there is a statistically significant high positive correlation between the Students' interest ratings and critical thinking ratings among the students taught organic chemistry in the ChatGPT classrooms. It can be concluded that students' interest in Organic Chemistry predicts their critical thinking in the ChatGPT's Organic Chemistry Classes.

Result of this Null hypothesis four (H_{O4}) shows a significant relationship between the students' interest and critical thinking in organic chemistry with a correlation coefficient ($\rho = 0.925$; $P < 0.001$) which is very much significant. This indicates a strong positive correlation between students' interest and students' critical thinking in organic chemistry. This indicated that, whenever there is increase in students' interest, there will be a consequential increase in students' critical thinking ability. Conversely, if there is decrease in student' interest, the students may experience low critical thinking in organic chemistry. Null Hypothesis Five (H_{O5}), There is no Significant Relationship between Critical thinking and Organic Chemistry Achievement Scores in the ChatGPT's Organic

Classes. The relationship between critical thinking assessments and organic chemistry achievement scores in the ChatGPT class can be seen in Table 5.

Table 5: rho Test of significance in relationship between Critical thinking ratings and organic chemistry achievement scores in ChatGPT Classrooms.

Statistical tool	Variables		CTR	OCATS
Spearman's rho	Critical Thinking Ratings(CTR)	Correlation Coefficient	1.000	.911
		Sig. (2-tailed)	.000	.000
		N	50	50
	Organic Chem. Achievement Test Scores(OCATS)	Correlation Coefficient	.911	1.000
		Sig. (2-tailed)	.000	.
		N	50	50

The table6 shows the Spearman's rho of 0.911 indicating a high correlation between students' Critical thinking and Academic achievement test scores in organic chemistry which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the H_{O5} is rejected, That is, there is a significant correlation between the students' Critical thinking ratings and Organic chemistry achievement scores in the ChatGPT classrooms. It can be concluded that students' critical thinking is needed to impact students' academic achievement in Organic Chemistry in the artificial intelligent ChatGPT classroom.

The result of null hypothesis (H_{O5}) revealed the correlation between students' critical thinking ratings and academic achievement scores in Organic Chemistry. There is a significant correlation between the students' Critical thinking ratings and Organic chemistry achievement scores in the ChatGPT classrooms ($\rho = 0.911$; $P < 0.001$). It can be concluded that students' critical thinking is needed to impact students' academic achievement in Organic Chemistry in the artificial intelligent ChatGPT classroom. Null Hypothesis Six (H_{O6}): There is no significant relationship between students' interest and academic achievement scores in the ChatGPT's Organic Chemistry Classrooms. Significance of the Relationship between Student Interest Ratings and Academic Achievement Scores in the ChatGPT Organic Chemistry Class. can be seen in Table 6.

Table 6. rho Test of Significance in Relationship between Students' Interest Ratings and Academic Achievement Scores in Organic Chemistry's ChatGPT Classes.

Statistical tool	Variables		SIR	OCATS
Spearman's rho	Students Interest Ratings(SIR)	Correlation Coefficient	1.00	.782
		Sig. (2-tailed)	.	.000
		N	50	50
	Organic Chem. Achievement Test Scores(OCATS)	Correlation Coefficient	.782	1.000
		Sig. (2-tailed)	.000	.
		N	50	50

N= Number of students; SIR= Students' Interest Ratings; OCATS=Organic Chem. Ach. Scores

The table 6, revealed the Spearman's rho of 0.782 indicating a moderate correlation between students' interest rating and academic achievement in Organic Chemistry which is statistically significant at 0.05. ($0.001 < 0.05$). Hence, the H_{O6} is rejected. That is, there

is a significant correlation between the students' interest ratings and Organic chemistry achievement scores in the artificial intelligent ChatGPT classrooms. It can be concluded that students' interest is needed to positively impact academic achievement in Organic Chemistry in the ChatGPT classrooms.

Result of this null hypothesis (H_{06}) revealed the correlation between the students' interest ratings and academic achievement in Organic Chemistry. There is a significant correlation between the students' interest ratings and Organic chemistry achievement scores in the artificial intelligent ChatGPT classrooms ($\rho = 0.782$; $P < 0.001$). It can be concluded that students' interest is needed to positively impact academic achievement in Organic Chemistry in the artificial intelligent ChatGPT classrooms.

CONCLUSIONS

The significant challenges confronting chemistry learning opportunities in Nigeria and globally include lack of student interest, low critical thinking, and underachievement, which were investigated under this study's artificial intelligence ChatGPT Classroom condition. Showcases that artificial intelligence (AI) robot teachers and ChatGPT are migrating into chemistry classrooms. The search for the solution to these academic challenges brought Bandura's Social Learning Theory forward. The theory assumed that learners' academic behaviours could be improved due to interactions with the social environment. The impact of the social climate components such as chemistry teachers, lab technologists, classmates, home lesson teachers, chemistry groups on social media, and even the school librarians was examined on students' interest, critical thinking and academic achievement when taught Organic chemistry using the artificial intelligence ChatGPT. In each case, a strong positive correlation was found between the students' social environment and the variables above of investigation in Organic chemistry when taught with artificial intelligence ChatGPT. Artificial intelligence ChatGPT is a plus to chemistry education in improving students' interest, critical thinking, and academic achievement, especially when the social environment conditions are favourable. The study recommended that the Government re-train chemistry teachers and lab technologists on using ChatGPT through refresher courses such as workshops and Seminars.

When using ChatGPT in Organic Chemistry lessons, students should interact regularly with Social environments such as chemistry teachers, lab technologists, and school librarians to improve their interest, critical thinking and academic achievement. The school managers should employ and retain ICT-literate chemistry teachers, lab-technologists and school librarians who can support ChatGPT usage. Parents should hire intelligent Science-based home lesson teachers who can operate ChatGPT for their children to improve academic achievement in Organic chemistry. The school counsellors should encourage Group discussions and tutorial classes among classmates using ChatGPT to enhance students' interest, critical thinking, and academic achievement in Organic Chemistry. This study believes that if these recommendations are implemented, AI ChatGPT could be a practical tool for enhancing students' interest, critical thinking and academic achievement in Organic Chemistry and Chemistry in General.

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