MIKAILALSYS
Journal of Multidisciplinary Sciences

e-ISSN : 2987-2286
p-ISSN : 2987-3924

Index : Dimensions, Scilit, Crossref, Garuda, Semantic, Lens,Google Scholar,Base, etc

https://doi.org/10.58578/mikailalsys.v3i2.5808

Effect of Collaborative Instructional Approach on Personality Traits in Geometry Achievement Among Secondary School Students in Zing Education Zone, Taraba State

Shiaki O. Bulus & Bernard A. Yukwa
Taraba State University, Jalingo, Taraba State, Nigeria
bernardalphayuks@gmail.com

Article Info:

Submitted:	Revised:	Accepted:	Published:
Apr 15, 2025	May 12, 2025	May 24, 2025	May 29, 2025

Abstract

This study investigates the effect of a collaborative instructional approach (CIA) on geometry achievement among secondary school students in Taraba State, Nigeria, with particular attention to the moderating role of personality traits. The study focused on three personality dimensions, agreeableness, conscientiousness, and openness to experience, examining how each interacts with instructional methods (CIA vs. traditional lecture) to influence academic performance. Guided by four research objectives, questions, and hypotheses, the study employed a quasi-experimental pre-test/post-test design. A total of 295 students from the Zing Education Zone participated, with grouping based on their dominant personality traits as measured by a validated inventory (Cronbach's $\alpha = 0.95$). Students received instruction in geometry using either the collaborative instructional approach or the lecture method. Descriptive statistics (mean and standard deviation) were used to address the research questions, while analysis of covariance (ANCOVA) tested the hypotheses at the 0.005 level of significance. The findings revealed that students with

Mikailalsys is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

openness to experience achieved significantly lower scores when taught with the collaborative instructional approach compared to those taught using the lecture method, contrary to prevailing assumptions about learner-centered instruction. The study underscores the need for differentiated instructional strategies aligned with students' personality profiles. It recommends targeted professional development programs, including seminars and workshops, for mathematics educators in the Zing Education Zone to enhance pedagogical responsiveness and subject mastery in meeting diverse learner needs.

Keywords: Personality Traits; Geometry Achievement; Collaborative Instructional Approach; Lecture Method; Secondary Education

INTRODUCTION

Mathematics possesses distinct characteristics, such as its unique language and symbols, which set it apart from other disciplines. It is utilized by individuals in their everyday lives. Shiaki et al. (2024) confirmed that mathematics is a branch of study capable of cultivating constructive and idealistic learners across the globe. Due to its abstract and unique nature, many students encounter challenges in grasping mathematical concepts, which can be attributed to individual characteristics, ineffective teaching methods, and the learning environment among other factors. Indeed, mathematics holds significant importance, as Iyekekpolor (2016) argues that for a student to excel in mathematics, they must also excel in the various concepts and topics that comprise it, including geometry.

Nevertheless, Fabiyi (2017) asserts that students still struggle with learning topics such as geometry. The researcher identifies nine issues related to students' difficulties in geometry: first, the absence of proofs from students; second, insufficient background knowledge; third, inadequate reasoning skills in geometry; fourth, comprehension of geometric language; fifth, a lack of visualization skills; sixth, the teaching methods employed by educators; seventh, the unavailability of instructional materials; eighth, a failure to provide proofs by students; and ninth, gender differences and the traits of students, among other factors contributing to poor geometry performance.

Geometry is crucial for establishing a solid mathematical foundation for students. It is present in the ecosystem through various patterns and displays. Moreover, it forms an essential aspect of the synthetic world, including art, architecture, vehicles, machinery, and nearly everything created by humans. It is a mathematics branch focused on object shapes,

spatial relationships, and the composition of surrounding spaces. Geometry enables a comprehensive appreciation of our world. However, given its significance in human life, geometry has attracted considerable research interest in contemporary times. Clearly, Alenka et al. (2020) indicated that there is a growing global awareness regarding the importance of mathematical knowledge, and concerns have been voiced for many years across various educational levels regarding persistent underachievement in mathematics, including geometry, from primary education to higher education, which remains an important issue. It is essential to recognize that for organizations to operate effectively, it is expected that the staff possess mathematical skills, with geometry being no exception.

The methods employed by mathematics educators for teaching geometry continue to be a significant concern, as many educators have not progressed beyond traditional teaching techniques, such as the conventional method. Consequently, the persistent low performance of students in geometry and mathematics in general is evident in the country's public examinations, including those conducted by the West African Examination Council and the National Examination Council. Heather (2019) indicates that teachers have struggled to implement suitable teaching methods that could enhance students' performance in Mathematics and related subjects. Isa *et al.* (2020) note that the teaching strategies employed by educators greatly influence the degree to which students excel academically; therefore, many teachers' instructional approaches significantly affect their students' academic success. The study recommended that interactive teacher-student methods should be promoted. Innovative teaching strategies could be crucial in facilitating student learning and improving academic performance. Currently, educators tend to adopt teaching methods that do not align with their students' individual personality traits, which poses obstacles to their academic success. This study introduces a collaborative instructional approach to assess its impact on students' personality traits and their geometry achievements in secondary schools in Taraba. Okeke and Ordu (2018) characterized collaborative instructional approach (CIA) as a method that transforms the traditional lecture or teacher-led classroom into a student-centered environment focused on peer-to-peer learning. Ford (2013) views collaborative instruction as a learning process that necessitates teamwork to accomplish a common goal. Therefore, the collaborative instructional approach promotes collective learning where teachers cultivate skills within their students in mathematics classrooms.

With respect to this method, teachers' utilization of various instructional strategies, such as the collaborative instructional approach, has the potential to positively influence students' personality traits in secondary schools in Taraba State. Mathematics educators should currently adopt teaching methods that cater to students' unique personality traits since these traits are fundamental aspects on which students vary, leading to different responses to various learning situations. According to the Merriam-Webster Dictionary, personality is defined as the collection of emotional qualities and behavioral patterns that distinguish one individual from others. Notably, personality encompasses qualities that an individual possesses within a social context, making them distinctive in how they react to their surroundings. Conversely, Cherry (2020) argues that traits consist of the diverse characteristics that form an individual's personality.

In a similar vein, Samuel et al. (2020) assert that individuals display variations in their behaviors, emotions, and reactions to situations (learning abilities). The researchers further explain that this can also be observed in how students answer questions and respond to circumstances, which may reflect their personality traits. As Baykal and Yildirum (2021) argue, personality traits can influence how emotions, thoughts, and events are perceived from one individual to another. Samuel et al. (2020) suggest that nurturing these traits among students could lead to improvements and positively impact students' academic performance and the overall quality of education, particularly among secondary school learners. In academic contexts, a learner's personality traits are vital and can significantly influence their engagement with school work. Therefore, students may experience either high or low academic achievement as a result.

Personality traits, as noted by Abusic and Schimmack (2016), encompass characteristics that remain consistent over time, vary among individuals, and are stable across different situations. According to Olowookere et al. (2017), these traits may play a significant role in influencing the enduring emotional, cognitive, attitudinal, and behavioral patterns of students, which ultimately impacts their academic performance. Cherry (2020) added that personality traits are complex and suggested that they are influenced by both genetic and environmental factors, with these elements interacting to shape our unique personality.

Thus, every individual comprises multiple personality traits. For the purposes of this research, the investigator chose three traits from the Big Five personality model, originally

developed by D.W. Fiske in 1949, to fulfil the study's objectives. The specific traits selected for this research are openness, conscientiousness, and agreeableness, with each factor representing a different aspect of psychological functioning. Researchers such as Baumert et al. (2017) and Zeigler-Hill et al. (2019) indicated that personality traits and behaviors should be viewed as distinct from one another. Bunga et al. (2017) and Obeka (2010) expressed that there is a positive significant relationship between personality traits and students' academic success, particularly in relation to teaching methods. Furthermore, we have yet to reach a conclusive argument regarding how personality traits correlate with academic achievement in geometry when employing a collaborative instructional approach. Shiksha and Nabin (2021) noted in their findings that there are various dimensions of these traits and their impact on academic performance. Meghan et al. (2021) suggested that individuals with high levels of agreeableness are likely to excel in collaborative social interaction environments. Rashedi & Ajilchi (2014) found that conscientiousness and openness to experience traits are indicators of academic success. Taiwo & Amad (2021) indicated a significant negative correlation between openness to experience, conscientiousness, and agreeableness traits. These reports are not enough.

This is why the focus of the study is on three traits from the Big Five personality traits among secondary school students in Taraba State, aiming to evaluate how these traits—openness to experience, conscientiousness, and agreeableness—influence geometry achievement in the Zing Education Zone, Taraba State. Conscientiousness is characterized as a stable pattern within an individual (Behav, 2013). Additionally, agreeableness, as described by Michael and Deniz (2022), relates to the degree of cooperativeness, reliability, and compassion exhibited by a person, while openness to experience is equated with intelligence. Jarrett (2021) noted that individuals with high openness may find those with low scores to be dull or unrefined, whereas individuals with low openness might perceive high scorers as fanciful, overly intellectual, and perhaps pretentious, keen to showcase their uniqueness.

Considering the information outlined, it is evident that the traits discussed may influence how students with such characteristics respond to geometry instruction when taught using a collaborative instructional approach. This study aimed to explore the effect of collaborative instructional methods on students' personality traits in geometry topics.

In a study conducted by Onderi *et al.* (2015), it was indicated that the performance in mathematics in Masaba Sub-County, Kenya has been consistently poor for several years, and it is likely that students in Nigeria, including those in Taraba State, are similarly affected. This situation necessitates the current research to examine the impact of Collaborative Instructional Approaches (CIA) on personality traits in geometry achievement among secondary school students in Taraba State, Nigeria. There remains an ongoing debate regarding whether teaching methods influence students' emotional, cognitive, and behavioral changes during the learning process. This controversy serves as a catalyst for the need for research in these specific areas. Heather (2019) highlights that educators have encountered difficulties in implementing effective teaching strategies to enhance students' performance in Mathematics and related subjects such as geometry. Additionally, this issue may stem from the individual characteristics of students and the instructional approaches employed by teachers. According to Isa et al. (2020), the teaching methods implemented by educators are pivotal in determining students' performance levels. They further revealed that most teaching strategies significantly impact students' academic achievements and recommended that methods emphasizing student engagement and interactive teacher-student dynamics should be promoted. Following their perspective, this research combines students' personality traits with the use of a collaborative instructional approach to assess whether it influences geometry achievement among students in Taraba State.

Nevertheless, various factors affecting geometry achievement can be observed in both students and teachers within secondary schools. Notably, research conducted by Alenka et al. (2020) pointed out that the global recognition of the significance of mathematical knowledge and the long-standing concerns about underachievement in Mathematics across all educational levels continue to be pressing issues. Based on this context, there is a scarcity of research that explores the integration of personality traits with collaborative instructional methods in geometry for students, particularly focusing on conscientiousness, openness to experience, and agreeableness in Taraba State. Indeed, John (2017) noted that the relationship between personality traits and achievement in mathematics has not been thoroughly and comprehensively examined. It is important to acknowledge that geometry, as a crucial branch of mathematics, is essential for students to learn with an understanding of its concepts, enabling the development of their mathematical skills. The distinctiveness of this study lies in its aim to investigate how

selected personality traits of students influence their geometry achievement when taught using a collaborative instructional approach.

Statement of the Problem

There is a noticeable gap between the characteristics of students and the teaching methods employed by mathematics educators in secondary schools across Nigeria. The issue of students' academic performance in geometry is a significant concern, complicating the overall study of mathematics. The challenges faced by teachers in delivering mathematics, particularly geometry, have led to widespread failures in examinations, such as those conducted by the West African Examinations Council and the National Examinations Council, creating a serious issue. According to the chief examiners' report from the West African Examinations Council (2019), students demonstrate poor performance in geometry topics, likely due to ineffective innovative instructional methods in mathematics classrooms. It is anticipated that contemporary basic education should foster social interaction among students. While researchers have attempted to link academic success with individual traits such as personality, findings remain limited.

In Nigeria, it has become commonplace for secondary school teachers to rely heavily on the chalkboard rather than involving students during mathematics instruction. Educators often prefer to convey lessons, particularly those that are intricate, through verbal explanations without engaging student participation. Given this unfortunate situation, this study recommends the implementation of innovative learning strategies like Collaborate, Inquire, and Apply (CIA), which can enable students to collaborate with one another while actively participating in the learning process. Nevertheless, the lack of attention to students' personality traits by teachers when delivering instructions in geometry classrooms has created a gap that this study aims to address using a collaborative instructional approach among secondary school students in Taraba State.

Purpose of the Study

The broad purpose of the study is to determine the Effects of Collaborative Instructional Approach on Students' Personality Traits in Geometry among Secondary Schools in Taraba State, Nigeria. The specific objectives of the study are as follows:

i. To determine the level of academic achievement of students with agreeableness traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone.

ii. To determine the level of academic achievement of students with conscientiousness traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone.

iii. To determine the level of academic achievement of students with openness to experience traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone.

Research Questions

The following Research questions are formulated to guide the study:

i. What is the level of academic achievement of students with agreeableness traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone?

ii. What is the level of academic achievement of students with conscientiousness traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone?

iii. What is the level of academic achievement of students with openness to experience traits taught geometry using collaborative instructional approach and lecture method in Zing Education Zone?

METHODS

The study utilized a quasi-experimental research design, specifically a non-equivalent pretest-posttest design with treatment and control groups. This study chose a quasi-experimental design due to the presence of intact classes to meet the objectives of the study. The research was conducted in the Zing Education Zone within Taraba State, Nigeria, which includes the local government areas of Zing and Yorro. The total number of SS 2 students in the Zone is 3,336, comprising 1,671 boys and 1,665 girls (Zing Education Zonal office, 2023). Two intact classes were chosen using a multi-stage sampling method. This approach was selected to allow the researcher to cluster students based on the two local government areas within the Zing education Zone. This resulted in a total sample size of two hundred and ninety-five (295) students. The Big Five Inventory (BFI) and the Geometry Achievement Test (GAT) were utilized for data gathering. The Geometry Achievement Test (GAT) and the Big Five Inventory (BFI) underwent a validation process. Three specialists from the Department of Science Education at the

Faculty of Education, Taraba State University Jalingo were tasked with this validation. The Cronbach's Alpha was used to evaluate the internal consistency and reliability of the multiple choice questions to ensure the dependability of the data gathered from that scale. The reliability coefficients for the GAT and BFI were 0.99 and 0.95, respectively, which are regarded as reliable.

The collected data were organized, coded, and analyzed using both descriptive and inferential statistics. The descriptive statistics encompassed means and standard deviations, while the inferential statistics involved the use of analysis of covariance (ANCOVA). ANCOVA was employed to assess the null hypotheses at a significance level of 0.05, utilizing the statistical package for social sciences (SPSS) version 25.0 for data analysis in this research project.

RESULTS

Research Question one

What is the academic achievement level of students possessing agreeableness traits when taught geometry through a collaborative instructional approach and a lecture method in Zing Education Zone?

Table 1: Level of Academic Achievement of Students with Agreeableness Trait taught Geometry using CIA and LM

ITEMS	N	Pre-test		Post-test		Mean Diff.
		Mean	Std. dev	Mean	Std. dev	
Control Group of students with Agreeableness trait	32	30.94	9.30	29.75	9.31	**1.19**
Experimental Group of students with Agreeableness trait	69	39.48	11.46	49.13	20.97	**9.65**
N	**101**					**10.84**

The data shown in table 1 above shows students with agreeableness traits who were taught geometry using the lecture method recorded a pretest mean academic achievement of 30.94

with a standard deviation of 09.30. In contrast, those with agreeableness traits taught geometry using the Collaborative Instructional Approach (CIA) had a pretest mean of 39.48 and a standard deviation of 11.46. The mean academic achievement difference between the experimental and control groups is 08.54. Following the treatment for both groups, the posttest mean academic achievement for students with agreeableness traits taught geometry using CIA was 49.13, while those taught using the lecture method scored 29.75, resulting in a difference of 19.38. This indicates that the mean academic achievement of students with agreeableness traits taught geometry using CIA was superior to those taught via the lecture method.

Research Question Two

Table 2: Level of Academic Achievement of Students with Conscientiousness Trait taught Geometry using CIA and LM

What is the academic achievement level of students with conscientiousness traits who learned geometry through a collaborative instructional approach and a lecture method in Zing Education Zone?

ITEMS	N	Pre-test		Post-test		Mean Diff.
		Mean	Std. dev	Mean	Std. dev	
Control Group of students with Conscientiousness trait	31	24.97	07.87	31.48	08.61	**06.51**
Experimental Group of students with Conscientiousness trait	68	41.56	19.67	48.06	25.25	**06.50**
N	**99**					**13.01**

The findings presented in Table 2 above, indicate that the mean scores for the pretest and post-test groups for students taught geometry using CIA were 41.56 and 48.06, respectively. In comparison, those taught using the lecture method had scores of 24.97 and 31.48. The results reveal that students taught geometry using the lecture method outperformed those taught using CIA with a mean difference of 0.01.

Research Question Three

What is the academic achievement level of students with openness to experience traits taught geometry through a collaborative instructional approach and a lecture method in Zing Education Zone?

Table 3: Level of Academic Achievement of Students with Openness to Experience Trait taught Geometry using CIA and LM

ITEMS	N	Pre-test		Post-test		Mean Diff.
		Mean	Std. dev	Mean	Std. dev	
Control Group of students with openness to experience trait	32	40.94	09.30	30.94	10.00	**10.00**
Experimental Group of students with Openness to experience trait	63	37.02	15.40	43.27	25.25	06.25
N	**95**					**16.25**

According to the results shown in table 3 on page 72, students with openness to experience traits who learned geometry via the lecture method achieved a pretest mean academic performance of 40.94 with a standard deviation of 09.30, whereas those with openness to experience traits instructed with CIA had a pretest mean of 37.02 and a standard deviation of 15.40. The pretest mean academic achievement difference between the experimental and control groups was 03.92. Post-treatment, the mean academic achievement for students with openness to experience traits taught geometry using CIA was 43.27, while those taught via the lecture method scored 30.94, resulting in a difference of 12.33. This suggests that the mean academic achievement of students with openness to experience traits taught geometry through the lecture method was superior to those taught using CIA in Zing Education Zone, Taraba State.

Research Hypothesis One

HO1: There is no Significant Difference in the Academic Achievement of Students with the Agreeableness Trait taught Geometry Using Collaborative Instructional Approach and Lecture Method in Zing Education Zone, Taraba State.

Table 4: Tests of Between -Subjects Effects of Academic Achievement of Students with Agreeableness Trait Taught Geometry using CIA and LM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	19830.467[a]	2	9915.234	46.310	.000	.486
Intercept	149.942	1	149.942	.700	.405	.007
PRETEST	11619.303	1	11619.303	54.269	.000	.356
GROUP	2256.179	1	2256.179	10.538	.002	.097
Error	20982.523	98	214.107			
Total	227476.000	101				
Corrected Total	40812.990	100				

a. R Squared = .486 (Adjusted R Squared = .475)

The findings presented in Table 4 above indicate that F = 10.538 and the p-value = 0.002. Since the computed p-value is lower than $\alpha = 0.050$ (the critical value), we accept the primary hypothesis, affirming that there is a Significant difference in the academic achievement of students with the agreeableness trait taught geometry using the collaborative instructional approach and the Lecture Method in Zing Education Zone, Taraba State.

Research Hypothesis Two

HO1: There is no Significant Difference in the Academic Achievement of Students with the Conscientiousness Trait taught Geometry Using Collaborative Instructional Approach and Lecture Method in Zing Education Zone, Taraba State.

Table 5: Tests of Between -Subjects Effects of Academic Achievement of Students with Conscientiousness Trait Taught Geometry using CIA and LM

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5868.210[a]	2	2934.105	6.271	.003	.116
Intercept	29354.845	1	29354.845	62.739	.000	.395

PRETEST1	18.424	1	18.424	.039	.843	.000
GROUP1	4584.360	1	4584.360	9.798	.002	.093
Error	44917.083	96	467.886			
Total	232720.000	99				
Corrected Total	50785.293	98				

a. R Squared = .116 (Adjusted R Squared = .097)

The results shown in Table 5 above reveal that F = 09.798 and the p-value = 0.002. Given that the computed p-value is less than α = 0.050 (the critical value), we accept the primary hypothesis, concluding that there is a Significant difference in the academic achievement of students with the conscientiousness trait taught geometry using the collaborative instructional approach and the Lecture Method in Zing Education Zone, Taraba State.

Research Hypothesis Three

HO1: There is no Significant Difference in the Academic Achievement of Students with Openness to Experience Traits taught Geometry Using Collaborative Instructional Approach and Lecture Method in Zing Education Zone, Taraba State.

Table 6: Tests of Between -Subjects Effects of Academic Achievement of Students with openness to experience trait taught Geometry using CIA and LM

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	28268.298[a]	2	14134.149	121.104	.000	.725
Intercept	945.993	1	945.993	8.105	.005	.081
PRETEST2	25040.860	1	25040.860	214.554	.000	.700
GROUP2	6048.367	1	6048.367	51.823	.000	.360
Error	10737.428	92	116.711			
Total	184360.000	95				
Corrected Total	39005.726	94				

a. R Squared = .725 (Adjusted R Squared = .719)

Referring to the results in Table 7 on page 74, it is noted that F = 51.823 and the p-value = 0.000. However, since the computed p-value exceeds $\alpha = 0.050$ (the critical value), we accept the primary hypothesis, indicating that there is a Significant difference in the Academic Achievement of Students with openness to experience traits taught Geometry using the Collaborative Instructional Approach and Lecture Method in Zing Education Zone, Taraba State.

DISCUSSION

The discussion of major findings was based on the answered research questions.

Level of Academic Achievement of Students with Agreeableness Trait taught Geometry using CIA and LM

The results indicated that students characterized by the trait of agreeableness who were taught geometry through the Collaborative Instructional Approach (CIA) performed better academically compared to those who learned through the lecture method. The main hypothesis was confirmed, demonstrating a noteworthy difference in the academic performance of students with the agreeableness trait who were taught geometry via the collaborative instructional approach versus the lecture method in the Zing Education Zone, Taraba State. This finding aligns with Meghan et al. (2021), who proposed that individuals with high agreeableness tend to excel in collaborative social interaction environments.

Level of Academic Achievement of Students with Conscientiousness Trait taught Geometry using CIA and LM

The results indicated that students with the trait of conscientiousness who were instructed in geometry through the collaborative instructional approach achieved lower academic results than their peers taught using the lecture method. The hypothesis testing showed a significant disparity in the academic performance of conscientious students taught geometry using a collaborative instructional method compared to those taught via lectures in the Zing education zone of Taraba State. This finding aligns with Olowookere et al. (2017), who stated that the trait of conscientiousness has a notable positive effect on students' academic success. Similarly, Tomsik (2018) discovered a positive correlation between conscientiousness and academic achievement. Additionally, Shiksha & Nabin

(2021) noted that personality traits such as conscientiousness are crucial in educational settings and beyond, as individuals with high conscientiousness tend to be diligent, complete their tasks promptly, and remain focused, avoiding distractions that detract from their studies. In this instance, it may be the case that their traits allow them to be influenced by various teaching methods, as academic development is a gradual process.

Level of Academic Achievement of Students with Openness to Experience Trait taught Geometry using CIA and LM

It was further noted that the average academic performance of students characterized by the openness to experience trait who were taught geometry via the lecture method was superior to that of those taught using the collaborative instructional approach in the Zing education zone of Taraba State. The hypothesis testing indicated a significant difference in the academic performance of students with openness to experience traits when taught geometry through collaborative instructional approach compared to the lecture method in the Zing education zone. This finding contradicts the research by Taiwo & Amad (2021), which indicated a significant negative correlation between openness to experience, conscientiousness, and agreeableness traits. Rashedi & Ajilchi (2014) found that conscientiousness and openness to experience traits are indicators of academic success.

The findings suggest that students with openness to experience traits are likely to develop a quicker ability to openly discuss their challenges during learning, contributing to their academic success in geometry when instructed through the lecture method in the Zing education zone. This brings clarity to the findings of the current study, explaining why students with openness to experience traits achieved better academic performance in geometry compared to those taught with the collaborative instructional approach in the Zing education zone of Taraba State.

CONCLUSION

This study explored the influence of a Collaborative Instructional Approach (CIA) on geometry achievement among secondary school students in Taraba State, Nigeria, with specific attention to the moderating role of personality traits—agreeableness, conscientiousness, and openness to experience. Employing a quasi-experimental design and robust statistical analysis, the findings offer significant insights into how instructional strategies interact with learner characteristics to affect academic outcomes.

The results revealed a nuanced relationship between instructional methods and personality traits. Students high in agreeableness performed significantly better when taught using the CIA, reinforcing the idea that collaborative and socially engaging learning environments are particularly effective for learners who value harmony and cooperation. In contrast, students with conscientiousness and openness to experience traits demonstrated higher achievement under the traditional lecture method than through CIA. These outcomes challenge conventional assumptions favoring learner-centered approaches for all student profiles, indicating instead that instructional effectiveness is moderated by individual personality differences.

The study makes an important contribution to educational psychology and instructional design by empirically validating the differential impact of teaching methods across personality dimensions. It underscores the need for differentiated instruction that aligns with students' individual traits, rather than applying uniform teaching strategies. This is particularly relevant in the context of mathematics education, where learner engagement and comprehension are deeply influenced by both cognitive and non-cognitive factors.

In light of these findings, the study recommends targeted teacher training and professional development that emphasizes personality-aware pedagogy. Educators should be equipped to recognize and respond to diverse learner profiles by adopting flexible instructional strategies. Furthermore, curriculum planners and school administrators should support the integration of personality-sensitive teaching models, including the provision of workshops and resources that enable educators to refine their pedagogical approaches. Future research should consider longitudinal designs and explore additional personality dimensions to deepen understanding of the dynamic interplay between learner traits and instructional practices.

Recommendations

The study made the following recommendations as follows: -

i. Mathematics instructors ought to be consistent and utilize collaborative instructional methods in teaching mathematics within the Zing education zone.
ii. Mathematics teacher trainees should receive training on how to recognize various personality traits among students that could enhance secondary school students' performance in mathematics.

iii. Innovative teaching methods should be adopted in the Zing Education Zone to enhance students' understanding of geometry in relation to their individual differences.

iv. There is a need to organize seminars and workshops for teachers in Zing Education to improve their subject mastery and advance their ability to address the individual needs of their students based on their personality traits.

REFERENCES

Abolmaali, K., Rashedi, M., & Ajilchi, B. (2014). Explanation of academic achievement based on personality characteristics, psycho-social climate of the classroom, and students' academic engagement in mathematics. *Open Journal of Applied Sciences*, *4*, 225–233. https://doi.org/10.4236/ojapps.2014.45022

Alenka, B., Janja, J., Gregor, R., & Anja, Z. (2020). Factors influencing mathematics achievement of university students of social sciences. *Education Sciences*, *8*(12). https://doi.org/10.3390/educsci8120170

Baykal, D., & Yildirim, D. (2021). Investigating the effect of personality traits and academic self-efficacies on malpractice tendencies in health college students. *Nigerian Journal of Clinical Practice*, *23*(12), 17–21. https://doi.org/10.4103/njcp.njcp_538_19

Behav, A. (2013). The conscientiousness: Evidence and implications for a personality trait marker of health and longevity. *Annals of Behavioral Medicine*, *45*(3), 278–288. https://doi.org/10.1007/s12160-012-9454-6

Bunga, V. S., Anni, H. P., & Wy, D. (2017). The effect of teaching method and students' personalities on students' achievement in descriptive writing. *Journal of Education and Practice*, *8*(28), 158–163. http://www.iiste.org

Cherry, K. (2020). The Big Five personality traits. *Verywell Mind.* https://www.verywellmind.com/what-is-personality-2795416

Fabiyi, T. R. (2017). Geometry concepts in mathematics perceived difficult to learn by senior secondary school students in Ekiti State, Nigeria. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *7*(1), 83–90. https://doi.org/10.9790/7388-0701018390

Ford, H. (2013). *Collaborative learning.* Retrieved September 22, 2013, from http://www.kennesaw.edu/siegelinstitute/pdf/collaborative-learning-Funk.pdf [Broken Link]

Heather, C. (2019). *Teachers' perceptions of inclusive education in Nova Scotia, Canada* [Doctoral dissertation, University of Glasgow]. http://theses.gla.ac.uk/82212/

Jarrett, C. (2021). *Be who you want: Unlocking the science of personality change*. Robinson.

John, N., Ekaterina, O., & Ekaterina, K. (2013). Big five personality traits and academic performance in Russian universities. *Working Paper BRP 10/PSY/2013*, Higher School of Economics. https://www.hse.ru/data/2013/10/16/1282680467/10PSY2013.pdf

Michael, P. W., & Deniz, S. O. (2022). Agreeableness and its consequences: A quantitative review of meta-analytic findings. *[Missing Journal Title]*, *26*(3). [Missing Pages] [Missing DOI/URL]

Okeke, M. N., & Okey, K. O. (2018). Impact of collaborative learning strategy on the academic achievement of senior secondary school chemistry students in Obio-Akpor Local Government Area. *International Journal of Education and Evaluation*, *4*(2). http://www.iiardpub.org/get/IJEE/VOL.%204%20NO.%202%202018/Impact%20of%20Collaborative.pdf

Olowookere, E. I., Alao, A. A., Adekeye, O. A., & Ayorinde, E. (2017). Influence of gender and personality characteristics on students' academic performance: Evidence from Covenant University. In *Proceedings of the 10th International Conference of Education, Research and Innovation (ICERI)*. https://doi.org/10.21125/iceri.2017.2314

Samuel, J. G., Adeogun, R. O., & Asokere, S. I. (2020). Influence of personality traits on English language performance of secondary school students in Oyo. *International Journal of Research and Innovation in Social Science (IJRISS)*, *4*(7), 450–456. https://www.rsisinternational.org/journals/ijriss/Digital-Library/volume-4-issue-7/450-456.pdf

Shiaki, O. B., & Bernard, A. Y. (2024). Mathematics education in restructuring the current impediment affecting growth: Issues and way forward. *Mikailasys Journal of Multidisciplinary Sciences*, *3*(1). https://doi.org/10.58578/mikailalsys.v3i1.4364

Taiwo, D. E., & Amadi, G. N. (2021). Personality traits and academic underachievement of secondary school students in Bayelsa State. *Asian Journal of Advanced Research and Reports*, *5*(2), 22–29. https://doi.org/10.9734/ajarr/2021/v15i230371