INTERNATIONAL SOCIAL SCIENCES AND EDUCATION JOURNAL (ISSEJ)
ISSN: 3005-3463 (Online)
DOI: https://doi.org/10.61424/issej.v4i2.795
Journal Homepage: https://bluemarkpublishers.com/index.php/ISSEJ

ISSEJ
BLUEMARK PUBLISHERS

Sociocultural Dynamics and Students' Engagement in Studying Mathematics in Akwa Ibom North-East Senatorial District

Uya Asukwo Okon
Department of Curriculum Studies, Educational Management and Planning, Faculty of Education, University of Uyo, Uyo, Nigeria

Corresponding Author: Uya Asukwo Okon **E-mail:** asukwouya@uniuyo.edu.ng

ARTICLE INFO

Received: February 15th, 2026
Accepted: March 27th 2026
Published: April, 17th 2026
Volume: 4
Issue: 2
DOI: https://doi.org/10.61424/issej.v4i2.795

KEYWORDS

Parental Involvement, Language Background, Teachers' Classroom Interactions, Classroom Environment and Students' Engagement in Mathematics

ABSTRACT

This study determined the influence of sociocultural dynamics on students' engagement in studying mathematics in Akwa Ibom North-East Senatorial District of Akwa Ibom State, Nigeria. The study employed a survey research design. A sample size of 525 respondents representing senior secondary II students were selected using multi-stage and random sampling technique during 2024/2025 academic session were used. The instruments used in gathering data for the study was a researcher-made instrument namely: "Perceptions on Sociocultural Dynamics and Students' Engagement in Studying Mathematics Questionnaire (PSDSESMQ)". The instruments had a face validation and Cronbach Alpha formula was used to determine the internal consistency reliability where the average reliability coefficient stood at 0.81. The data collected was analysed using mean and standard deviation to answer the research questions and the independent t-value to test the null hypotheses at the 0.05 level of significance. The study revealed that parental involvement, language background, teachers' classroom interactions, and the classroom environment positively influences students' engagement in studying mathematics. Based on the findings of this study, it was concluded that concluded that sociocultural dynamics significantly influence students' engagement in studying mathematics among secondary school students in Akwa Ibom North-East Senatorial District. And that when teachers adopt facilitative, supportive environment, active parenting, clear language, interactive, and student-centered teaching methods, students are more likely to develop interest, confidence, and persistence in mathematics. It was recommended that schools and teachers should promote parental involvement by encouraging parents to take an active role in their children's mathematics education through home support, monitoring, and participation in school activities amongst others.

1. Introduction

Mathematics is a fundamental discipline that plays a crucial role in academic achievement, career opportunities, and the development of logical reasoning and problem-solving skills. The study of mathematics education is always faced with persistent challenge in fostering sustained student engagement and motivation. Traditional pedagogical

approaches often struggle to captivate students, leading to disinterest, lack of participation, and diminished learning outcomes. Mathematics as a compulsory subject for major career paths becomes a barrier, discouraging students from continuing their education. Students from privileged backgrounds with access to private tutoring and better learning resources perform better than those from rural and underprivileged communities. Recognizing this issue, there is a critical need to explore sociocultural dynamics and students' engagement in studying mathematics.

Engagement in mathematics refers to the level of students' active participation**,** motivation, and emotional investment in learning mathematical concepts. It is a multidimensional construct which are affected by the broader social and cultural environment in which students learn (Fredricks et al., 2016). This constructs encompasses behavioural engagement (participation in classroom activities, completing assignments, asking questions, and involvement in problem-solving); cognitive engagement **(**investment in deep learning, applying critical thinking, and perseverance in solving challenging mathematics problems); and **e**motional engagement **(e**njoyment of mathematics, interest in learning new concepts, and a positive attitude toward mathematics).

High engagement in mathematics is associated with better academic performance, increased problem-solving skills, and reduced mathematics anxiety (Ryan & Deci, 2020). Conversely, low engagement often leads to poor academic outcomes and a lack of interest in STEM-related careers (OECD, 2022). Therefore, understanding the sociocultural factors that influence engagement is vital for improving students' learning experiences in mathematics. Sociocultural dynamics significantly influence students' engagement in studying mathematics by shaping their perceptions of the value of mathematics, their confidence in their abilities, and their willingness to participate in mathematics activities, largely due to the cultural messages and expectations around mathematics within their community and family, which can either promote or hinder their engagement in the subject.

Sociocultural dynamics encompass the interplay of cultural practices, societal values, economic trends, and political influences that impact educational structures. In Nigeria, with over 250 ethnic groups and diverse cultural heritages, these dynamics are deeply embedded in the educational experience. Factors such as language, traditional norms, gender roles, and community priorities significantly influence students' attitudes towards mathematics and their performance in the subject.

However, disparities in mathematics engagement levels and confidence persist in the subject significantly across different sociocultural contexts. Understanding the sociocultural dynamics that influence students' engagement is essential for developing effective teaching strategies, inclusive learning environments, and educational policies that promote mathematics achievement for all learners. Sociocultural factors such as parental involvement, language background, teachers' interactions, and classroom environment significantly impact students' engagement in mathematics. These factors shape students' motivation, learning experiences, confidence, and attitudes, ultimately influencing their performance and long-term interest in the subject (Boaler, 2019). Given the global emphasis on STEM education and mathematical proficiency, it is essential to further investigate how sociocultural dynamics contribute to engagement disparities in mathematics learning**.**

This study is based on Sociocultural Theory by Vygotsky (1978) which emphasizes the role of social interaction, language, and cultural tools in cognitive development. The Zone of Proximal Development (ZPD) is a key concept, where learners can achieve higher understanding with the help of a more knowledgeable other. The theory proposed that students learn best within their Zone of Proximal Development (ZPD)—the range of tasks they cannot yet complete independently but can accomplish with scaffolding from teachers or peers. A supportive classroom environment fosters engagement by encouraging collaboration, dialogue, and problem-solving activities. And that learning is inherently social and that cognitive development which is influenced by cultural and environmental factors. This theory is suitable for understanding how collaborative learning and cultural context influence mathematical engagement. By applying Vygotsky's principles, educators can create learning environments that promote collaboration, dialogue, and culturally relevant pedagogy, ensuring that all students, regardless of background, are actively engaged in mathematics learning.

1.1 Parental Involvement and Students' Engagement in Studying Mathematics

Parental involvement significantly influences students' motivation and engagement in mathematics. Parental involvement refers to the active participation of parents in their children's education and learning process. It includes various forms of engagement that support a child's academic, social, and emotional development. Parental involvement can occur at home, in school, or through community activities that contribute to a child's educational success. In the context of mathematics education, parental involvement may include encouraging a positive attitude toward mathematics; providing resources such as books, apps, or tutors; helping with homework or problem-solving exercises; and engaging children in everyday mathematics activities, like budgeting or cooking.

Studies suggest that students whose parents provide academic encouragement, monitor progress, and engage in math-related activities at home show higher levels of confidence and engagement (Fan & Williams, 2018). Parental attitudes toward mathematics also shape children's perceptions of the subject. If parents view mathematics as difficult or unnecessary, their children may develop negative attitudes and low engagement (Gonida & Cortina, 2021). A meta-analysis by Liu et al. (2023) examined the relationship between parental homework involvement and students' mathematics achievement. The study found that supportive parental involvement had a positive correlation with students' mathematics performance, while intrusive involvement was negatively associated with achievement. The effects varied across educational levels, with the strongest negative impact of intrusive involvement observed in high school students.

Another study highlighted that the influence of parental involvement on students' math performance is moderated by various factors, such as the type of involvement and parental expectations. Positive involvement, emphasizing autonomy support, enhances intrinsic motivation and learning engagement, leading to better academic performance (Uya, 2026). Conversely, excessive control can undermine students' learning autonomy, resulting in negative academic outcomes. Research by Silinskas and Kikas (2019) explored parents' daily involvement in children's math homework and its association with children's academic performance. The study found that parents' involvement in homework was more affectively negative, particularly among parents with low self-efficacy, suggesting that the quality of parental involvement is crucial for positive student outcomes.

Furthermore, a study by Zhang, et al. (2023) analyzed the influence of parental participation in school activities, parental support at home, and family socioeconomic status on student learning. The findings indicated that parental support at home positively affects students' mathematics performance, highlighting the importance of a supportive home learning environment. Parental involvement is a significant determinant of students' engagement and success in mathematics. Supportive and autonomy-enhancing involvement strategies are associated with positive outcomes, while intrusive or controlling behaviours can have detrimental effects. Tailoring parental involvement to be supportive and responsive to students' needs is essential for fostering effective engagement in mathematics learning.

1.2 Language Background and Students' Engagement in Studying Mathematics

Language plays a crucial role in mathematics education, especially when mathematical concepts are taught in a language that is not the student's first language (Barwell, 2020). Language background refers to an individual's linguistic experience, including their first language (L1), additional languages learned (L2, L3, etc.), and the level of proficiency in each language. It also encompasses the linguistic environment in which a person grows up, such as whether they come from a monolingual, bilingual, or multilingual household. Students from multilingual backgrounds often face difficulties in comprehending word problems, mathematical vocabulary, and teacher instructions, leading to lower engagement levels (Setati, 2018).

Language background is very important because it affects academic performance, especially in subjects requiring high levels of linguistic comprehension, like mathematics and science (Planas & Civil, 2024); it influences cognitive development, including problem-solving and critical thinking skills (Cummins, 2000); and shapes cultural identity and communication within different social and educational settings. Research highlights those linguistic barriers in mathematics classrooms can widen performance gaps, making it essential for teachers to adopt culturally and linguistically responsive teaching strategies (Moschkovich, 2015, 2018). Also, students from non-English-speaking backgrounds may face difficulties in understanding mathematical terminology and concepts presented in English, which can hinder their engagement and performance. For instance, a study by Planas and Civil (2024) highlights that

language barriers can lead to misunderstandings in mathematical problem-solving and reduce participation in classroom discussions.

Considering the impact of language on mathematical understanding, a comprehensive examination by the Association of Teacher Educators' Commission (2024) on the effects of language on children's conceptual understanding of mathematics identified several key areas where language affects mathematics learning as follows:

i. Meaning making (language proficiency influences how students interpret and make sense of mathematical concepts);
ii. Understanding mathematical symbols and expressions is closely tied to language comprehension;
iii. Engaging in mathematical discussions requires language skills that enable students to articulate reasoning and understand others;
iv. Developing a robust mathematical vocabulary is essential for grasping complex concepts;
v. Promoting the ability to read and comprehend problem statements is crucial for problem-solving; and
vi. Expressing mathematical ideas in writing reinforces understanding and reveals misconceptions.

To support students from diverse linguistic backgrounds, teachers can implement language-responsive instructional strategies. Prediger and Wessel (2020) proposed six design principles aimed at enhancing language for mathematics learning: Connect oral and written forms to reinforce understanding; employ diagrams and visual aids to bridge language gaps; foster a classroom environment where students feel comfortable expressing mathematical ideas verbally; introduce and reinforce key mathematical terms systematically; provide structured support that gradually decreases as students become more proficient; and incorporate examples and contexts familiar to students' cultural backgrounds to make learning more relatable. Implementing these principles has been shown to improve engagement and understanding among linguistically diverse students.

By adopting language-responsive instructional strategies and fostering an inclusive learning environment, teachers can enhance mathematical understanding and participation among linguistically diverse students.

1.3 Teachers' Classroom Interactions and Students' Engagement in Studying Mathematics

Teachers' pedagogical approaches and classroom interactions play a pivotal role in shaping students' engagement and success in mathematics. Supportive and interactive teaching methods—such as problem-based learning, collaborative discussions, and real-world applications—tend to increase students' engagement and interest in mathematics (Jansen et al., 2021). Conversely, traditional rote memorization, high-pressure testing environments, and negative teacher feedback can lead to disengagement and math anxiety (Boaler, 2019). Teachers who provide positive reinforcement, encourage questions, and create a participatory learning environment can foster higher levels of engagement and confidence in students (Schukajlow et al., 2018).

Teachers' classroom interactions refer to the communication and relationships that occur between teachers and students during the teaching and learning process. These interactions are integral to shaping the classroom environment, influencing student engagement, motivation, and academic achievement, particularly in subjects like mathematics. Classroom interactions are not limited to verbal exchanges but also encompass non-verbal cues, teacher actions, and the way students respond and engage with each other and the content.

This encompasses building mathematical confidence where teachers offer praise and constructive feedback, students are more likely to feel confident in their ability to solve math problems; engaging students through questioning, discussion, and problem-solving activities increases participation. When students are actively involved in the learning process, they are more likely to stay engaged and retain information. This often provides students with opportunities to verbalize their understanding, which reinforces learning; encouraging a growth mindset by emphasizing effort and persistence rather than innate ability, teachers can help students view challenges as opportunities to learn. This can be done be encouraging mistakes as part of the learning process is also a key aspect of fostering a positive and

productive classroom environment; and encourage open dialogue, active participation, and mutual respect can create an environment where students feel comfortable engaging with the material. In mathematics, where students often face anxiety and fear of failure, a supportive classroom environment can encourage risk-taking and persistence in problem-solving.

A study by Sari et al. (2023) examined the effects of teaching effectiveness, teacher-student relations, and student engagement on mathematical achievement. The findings suggest that positive teacher-student relationships and high levels of student engagement have a significant impact on students' mathematical performance. This underscores the importance of fostering strong relational connections in the classroom. Pianta et al. (2012) found that teacher-student relationships significantly impact student engagement and achievement. When teachers form strong, supportive relationships with students, those students are more likely to be engaged in class and perform better academically.

Ing et al. (2015) highlighted that teacher actions such as encouraging student explanations, providing feedback, and facilitating peer interactions were positively associated with higher levels of student engagement in mathematics classrooms. These actions help students become more active participants in the learning process. Attard (2011) showed that teacher-student interactions that promote self-confidence and a positive classroom climate increase student motivation, particularly in mathematics, which is often seen as a challenging subject. Teachers' classroom interactions are foundational to creating an environment where students are engaged, motivated, and successful in learning mathematics. Effective teacher-student communication, a supportive classroom climate, scaffolding techniques, and differentiated instruction contribute to a rich learning experience. When teachers build positive relationships with their students, encourage active participation, and provide meaningful feedback, they foster an atmosphere where students can thrive academically, particularly in subjects like mathematics (Uya, 2026).

1.4 Classroom Environment and Students' Engagement in Studying Mathematics

A supportive and inclusive classroom environment plays a crucial role in shaping students' engagement levels in mathematics. Studies have found that students are more likely to engage in mathematics when they feel safe, valued, and encouraged in the learning environment (Ryan & Deci, 2020). Collaborative learning environments, where students work in groups and discuss mathematical ideas, lead to increased engagement and deeper conceptual understanding (Webb, 2019). However, classrooms with competitive grading, rigid instruction, or peer judgment may cause fear of failure and disengagement in mathematics (Lerkkanen et al., 2018).

Classroom environment refers to the physical, emotional, social, and cultural aspects of the classroom that influence how students interact with each other, the teacher, and the content being taught. It includes both tangible elements, such as the arrangement of desks and access to resources, as well as intangible factors, like the overall atmosphere, teacher-student relationships, and the behavioral climate. A positive classroom environment plays a significant role in fostering student engagement, motivation, and academic achievement, particularly in subjects like mathematics, where students often experience anxiety or difficulty.

A positive classroom environment actively engages students by providing opportunities for them to interact with the material, the teacher, and their peers. Engagement is closely linked to academic achievement, especially in subjects like mathematics, where students often need encouragement to participate keenly. Uya (2024) asserted that social classroom environment that promotes collaboration and peer interaction helps students learn from one another and share different perspectives. Collaborative learning enhances problem-solving skills, which are essential in mathematics.

Jansen, Kunter, and Brunner (2023) conducted a study on how classroom management and the classroom environment affect student engagement in secondary mathematics education. They found that classrooms with a structured yet flexible environment, where students have opportunities for interaction and collaboration, show higher levels of student engagement. They highlighted that teacher behavior, including how teachers structure lessons and manage classroom interactions, plays a crucial role in maintaining a conducive learning environment. The physical and emotional atmosphere of the classroom influences how students learn. A well-organized and comfortable space, coupled with positive relationships, can enhance focus and productivity. When students feel supported and respected, they are more likely to invest effort in their learning.

Cohen et al. (2021) explored the impact of emotional and behavioral classroom climates on students' mathematics learning. Their findings indicated that a positive emotional classroom climate reduces mathematics anxiety and increases students' willingness to engage in mathematical tasks. Teachers who cultivate a calm, inclusive, and respectful classroom environment encourage greater student effort and participation. In mathematics, where many students experience anxiety, a supportive classroom environment can help reduce stress and foster a positive attitude toward learning. Teachers can create a safe space where students feel confident in asking questions, making mistakes, and seeking help.

Wang and Degol (2021) highlighted the role of the classroom climate in fostering a growth mindset among students. In their study of mathematics classrooms, they found that students who perceived the classroom environment as supportive and motivating were more likely to embrace challenges, demonstrate persistence in problem-solving, and engage actively with the content. A culturally responsive and inclusive classroom environment ensures that all students, regardless of their background or ability, can participate meaningfully in the learning process. This is especially important in mathematics, where diverse strategies and approaches can lead to greater understanding.

A well-organized, emotionally supportive, and culturally inclusive classroom environment encourages active participation, reduces anxiety, and fosters a sense of belonging. Teachers' use of active learning strategies, collaborative activities, clear expectations, and timely feedback all contribute to creating an environment that promotes sustained engagement and deeper understanding of mathematical concepts (Uya, 2026). Creating such an environment requires deliberate planning, thoughtful instructional practices, and continuous efforts to ensure that all students feel valued and motivated to succeed in mathematics.

1.5 Problem of the Study

Mathematics is a core subject in the Nigerian education system, serving as a foundation for science, technology, and innovation. However, in Akwa Ibom North-East Senatorial District, there is growing concern over students' low engagement and poor performance in mathematics, despite various government interventions and curriculum reforms. Several factors contribute to this challenge, particularly sociocultural dynamics such as parental involvement, language background, classroom environment, and teacher-student interactions.

The region is characterized by diverse linguistic and socio-economic backgrounds, where many students speak Ibibio, Annang, or Oron as their first language before learning English—the language of instruction. This language barrier affects comprehension and engagement in mathematics. Additionally, many parents have limited formal education, reducing their ability to support their children's mathematical learning at home. Furthermore, large class sizes, inadequate teacher training, and a lack of culturally relevant teaching methods further exacerbate the disengagement of students in mathematics.

Consequently, the language barrier makes it difficult for students to grasp abstract mathematical concepts, leading to poor understanding and low test scores; students from low-income families with limited parental support struggle more in mathematics due to a lack of reinforcement at home; teacher-centered instruction in overcrowded classrooms leads to disengagement and passive learning; students perceive mathematics as difficult, leading to anxiety and a lack of motivation to participate in learning activities; the lack of real-life, culturally relevant examples in mathematics instruction makes the subject feel disconnected from students' everyday experiences; and poor mathematical engagement reduces the number of students pursuing STEM careers, affecting local and national development.

Thus, the problem of the study is to investigate how sociocultural dynamics influence students' engagement in studying mathematics in Akwa Ibom North-East Senatorial District and to explore potential strategies to improve their participation and academic outcomes.

1.6 Purpose of the Study

The purpose of this study is to investigate the influence of sociocultural dynamics on students' engagement in studying mathematics in Akwa Ibom North-East Senatorial District. The study is designed to achieve the following objectives:

i. To determine the influence of parental involvement on students' engagement in studying mathematics.
ii. To determine the influence of language background on students' engagement- confidence in studying mathematics.
iii. To determine the influence of teachers' classroom interactions on students' engagement- confidence in studying mathematics.
iv. To determine the influence of classroom environment on students' engagement- confidence in studying mathematics.

1.7 Research Questions

To guide the researcher to achieve the earlier stated research objectives, the following research questions were posed.

i. What is the influence of parental involvement on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?
ii. What is the influence of language background on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?
iii. What is the influence of teachers' classroom interactions on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?
iv. What is the influence of classroom environment on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?

1.8 Research Hypotheses

The following hypotheses were formulated to guide the study

i. There is no significant influence of parental involvement on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.
ii. There is no significant influence of language background on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.
iii. There is no significant influence of teachers' classroom interactions on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.
iv. There is no significant influence of classroom environment on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.

1.9 Significance of the Study

The findings from the study of sociocultural dynamics and student engagement in mathematics are highly significant for multiple stakeholders. Parents, students, and teachers can use these insights to foster a more positive and engaging learning environment, while policymakers and curriculum experts can develop informed strategies to enhance mathematics education. Additionally, researchers can build upon these findings to address emerging challenges in educational equity and engagement. Ultimately, understanding these sociocultural influences will contribute to a more inclusive, effective, and student-centered mathematics education system**.**

2. Research Methods

The study employed a survey research design, utilizing a questionnaire for data collection. The population for the study consisted of the entire 22,276 senior secondary two students in the 89 public secondary schools in Akwa Ibom North East Senatorial District during 2023/2024 academic session (Akwa Ibom State Secondary School Board, 2023). The choice of the students was considered appropriate for the study because of their experience and daily interaction with teachers in the schools, and was delimited to senior secondary two students.

A sample size of 525 respondents representing the study population was selected for the study using multi-stage sampling technique. A researcher-developed instrument namely Perceptions on Sociocultural Dynamics and Students' Engagement in Studying Mathematics Questionnaire (PSDSESMQ) was used. The PSDSESMQ was

subjected to face validity by three validators, and the internal consistency reliability was determine using Cronbach Alpha formula to arrive at the average reliability coefficient of 0.81. The data collected was analysed using mean and standard deviation to answer the research questions and the independent t-value to test the null hypotheses at the 0.05 level of significance.

3. Interpretation of Data and Discussion of Findings

Research Question 1

What is the influence of parental involvement on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?

Table 1: Mean and Standard Deviation of the influence of parental involvement on students' engagement in studying mathematics.

Variables	**Parental Involvement**	N	X	SD
Students' Engagement	Active	224	54.36	9.89
	Passive	301	50.64	10.27

Analysis on Table 1 reveals that students with active parental involvement had a higher mean engagement score ($\bar{X}$ = 54.36) compared to those with passive parental involvement ($\bar{X}$ = 50.64). The difference of 3.72 points suggests that students whose parents are actively involved in their education tend to engage more in studying mathematics. The results indicate a positive influence of active parental involvement on students' engagement in studying mathematics. This means that students with active parental support may receive more encouragement, academic supervision, and resources, leading to higher engagement; and students with passive parental involvement may lack motivation or structured support, reducing their level of engagement. This indicates that parental involvement plays a role in shaping students' academic behaviours.

Research Question 2

What is the influence of language background on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?

Table 2: Mean and Standard Deviation of the influence of language background on students' engagement in studying mathematics.

Variables	**Language Background**	N	X	SD
Students' Engagement	Monolingual	293	55.41	9.73
	Multilingual	232	49.59	10.38

Analysis on Table 2 reveals that students with Monolingual students had a higher mean engagement score ($\bar{X}$ = 55.41) compared to those with multilingual students ($\bar{X}$ = 49.59). The difference of 5.82 points suggests that students who primarily speak one language tend to engage more in studying mathematics compared to those who speak multiple languages. The data indicates that monolingual students engage more in studying mathematics than multilingual students. This means that Multilingual students may face difficulties understanding mathematical instructions if the language of instruction differs from their primary language. And managing multiple languages may increase cognitive demands, affecting focus on mathematical concepts. This indicates a noticeable influence of language background on engagement.

Research Question 3

What is the influence of teachers' classroom interactions on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?

Table 3: Mean and Standard Deviation of the influence of teachers' classroom interactions on students' engagement in studying mathematics.

Variables	**Classroom Interactions**	N	X	SD
Students' Engagement	Controlling Interactions	251	48.76	10.40
	Facilitative Interactions	274	56.17	9.36

Analysis on Table 3 reveals that students taught using facilitative interactions had a higher mean engagement score ($\bar{X}$ = 56.17) compared to those exposed to controlling interactions ($\bar{X}$ = 48.76). The difference of 7.41 points suggests that students engage more actively in mathematics when teachers adopt a facilitative approach rather than a controlling one. This means that in a facilitative approach, teachers encourage student participation, discussions, and problem-solving; learning is collaborative, giving students more control over their learning process, which resulted in higher and more consistent engagement levels. This implies that facilitative interactions significantly improve students' engagement in studying mathematics.

Research Question 4

What is the influence of classroom environment on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District?

Table 4: Mean and Standard Deviation of the influence of classroom environment on students' engagement in studying mathematics.

Variables	Classroom Environment	N	X	SD
Students' Engagement	Supportive	239	53.80	8.77
	Unsupportive	286	51.09	11.01

Analysis on Table 4 reveals that students taught using supportive environment had a higher mean engagement score ($\bar{X}$ = 53.80) compared to those exposed to controlling interactions ($\bar{X}$ = 51.09). The difference of 2.71 points suggests that students tend to engage more in mathematics when learning in a supportive classroom environment. This indicates that a supportive classroom environment contributes to higher engagement in studying mathematics compared to an unsupportive environment. This enhances better teacher-student relationships where encouragement and positive reinforcement can increase student participation. The results suggest that a supportive classroom environment leads to higher student engagement in studying mathematics than an unsupportive one.

3.1 Testing of Hypotheses

Hypothesis 1

There is no significant influence of parental involvement on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.

Table 5: Result of independent t-test analysis of the influence of **parental involvement** on students' engagement in studying mathematics.

Variables	**Parental Involvement**	**N**	**X**	**SD**	**df**	**t-cal**	**t-crit**	**Decision**
Students' Engagement	Active	224	54.36	9.89	523	5.19*	1.96	Rejected
	Passive	301	50.64	10.27				

* = Significant at 0.05 alpha level; N = 525.

Results in Table 5 shows that the calculated t-value of 5.19 is higher than the critical t-value of 1.96 at 0.05 alpha levels with 523 degrees of freedom. This revealed that the null hypothesis which speculated that there is no significant influence of parental involvement on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District is rejected and alternative retained. This shows that there is a significant influence of parental involvement on students' engagement in studying mathematics. This suggest that the differences in engagement between students with active and passive parental involvement is statistically significant, and not due to random chance. This implies that students with more engaged parents tend to show greater commitment and interest

in mathematics, likely due to increased motivation and support at home as well as better learning resources and guidance.

Hypothesis 2
There is no significant influence of language background on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.

Table 6: Result of independent t-test analysis of the influence of **language background** on students' engagement in studying mathematics.

Variables	**Language Background**	**N**	**X**	**SD**	**df**	**t-cal**	**t-crit**	**Decision**
Students' Engagement	Monolingual	293	55.41	9.73	523	7.03*	1.96	Rejected
	Multilingual	232	49.59	10.38				

* = Significant at 0.05 alpha level; N = 525.

Results in Table 6 shows that the calculated t-value of 7.03 is higher than the critical t-value of 1.96 at 0.05 alpha levels with 523 degrees of freedom. This revealed that the null hypothesis which speculated that there is no significant influence of language background on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District is rejected and alternative retained. This shows that there is a significant influence of language background on students' engagement in studying mathematics. This suggest that the differences in engagement between monolingual and multilingual students is statistically significant, and not due to random chance. This implies that students who speak only one language (monolinguals) tend to engage more with mathematics than their multilingual counterparts.

Hypothesis 3
There is no significant influence of teachers' classroom interactions on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.

Table 7: Result of independent t-test analysis of the influence of teachers' classroom interactions on students' engagement in studying mathematics.

Variables	**Classroom Interactions**	**N**	**X**	**SD**	**df**	**t-cal**	**t-crit**	**Decision**
Students' Engagement	Controlling	251	48.76	10.40	523	7.92*	1.96	Rejected
	Facilitative	274	56.17	9.36				

* = Significant at 0.05 alpha level; N = 525.

Results in Table 7 shows that the calculated t-value of 7.92 is higher than the critical t-value of 1.96 at 0.05 alpha levels with 523 degrees of freedom. This revealed that the null hypothesis which speculated that there is no significant influence of teachers' classroom interactions on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District is rejected and alternative retained. The rejection of the null hypothesis indicates that teachers' classroom interactions significantly influence students' engagement in studying mathematics. Specifically, facilitative interactions enhance engagement more than controlling interactions. This finding underscores the importance of adopting student-centered teaching approaches to improve learning outcomes in mathematics.

Hypothesis 4
There is no significant influence of classroom environment on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District.

Table 8: Result of independent t-test analysis of the influence of classroom environment on students' engagement in studying mathematics.

Variables	**Classroom** Environment	**N**	**X**	**SD**	**df**	**t-cal**	**t-crit**	**Decision**
Students' Engagement	Supportive	239	53.80	8.77	523	3.05*	1.96	Rejected
	Unsupportive	286	51.09	11.01				

* = Significant at 0.05 alpha level; N = 525.

Results in Table 8 shows that the calculated t-value of 3.05 is higher than the critical t-value of 1.96 at 0.05 alpha levels with 523 degrees of freedom. This revealed that the null hypothesis which speculated that there is no significant influence of classroom environment on students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District is rejected and alternative retained. This shows that there is a significant influence of classroom environment on students' engagement in studying mathematics. This suggest that the differences in engagement between supportive and unsupportive classrooms is statistically significant and not due to random variation. This implies that students in a supportive environment are more engaged compared to those in an unsupportive setting, showing that a welcoming and encouraging atmosphere can enhance participation.

4. Discussion of Findings

4.1 Parental Involvement and Students' Engagement in Studying Mathematics

The result of the investigation of research question and hypothesis one showed that parental involvement positively and significantly influence students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District. This finding suggests that students whose parents actively participate in their education tend to demonstrate higher levels of motivation, interest, and commitment to learning mathematics. Parental involvement in education can take various forms, including monitoring homework, providing learning materials, encouraging academic efforts, attending school meetings, and fostering a positive attitude toward mathematics. When parents take an active role in their children's education, students feel more supported and are more likely to engage in mathematical learning activities. This aligns with previous research indicating that supportive and autonomy-enhancing involvement strategies are associated with positive outcomes (Zhang, et al., 2023). The significant impact of parental involvement on mathematics engagement also highlights the cultural and socio-economic dimensions of education in Akwa Ibom North-East Senatorial District. In communities where parents actively engage in their children's academics, students tend to view mathematics as a valuable subject, leading to higher participation and engagement. Conversely, in cases where parental involvement is minimal, students may lack the necessary motivation and support, leading to reduced engagement.

4.2 Language Background and Students' Engagement in Studying Mathematics

The result of the investigation of research question and hypothesis two showed that language background positively and significantly influence students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District. This finding suggests that students with a strong language background, particularly in the language of instruction, are more engaged in learning mathematics compared to those who struggle with linguistic challenges. Mathematics is a subject that heavily relies on language for comprehension, problem-solving, and conceptual understanding. If students have a strong grasp of the language used in teaching mathematics, they are more likely to actively participate in discussions, understand mathematical terminology, follow problem-solving processes, and engage with mathematical tasks effectively. This finding aligns with prior research indicating that language background is very important because it affects academic performance, especially in subjects requiring high levels of linguistic comprehension, like mathematics and science; and it influences cognitive development, including problem-solving and critical thinking skills (Planas & Civil, 2024; Cummins, 2000). This implies since mathematics is often taught through verbal explanations, reading materials, and written expressions, students with a strong language background are better positioned to grasp abstract concepts, communicate mathematical reasoning, and engage in problem-solving discussions. On the other hand, students with weak language skills may struggle to understand instructions, misinterpret word problems, or experience difficulties in expressing their mathematical thinking, leading to lower engagement.

4.3 Teachers' Classroom Interactions and Students' Engagement in Studying Mathematics

The result of the analysis of research question and hypothesis three showed that teachers' classroom interactions positively and significantly influence students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District. This finding suggests that the way teachers interact with students in the classroom plays a crucial role in shaping their engagement, motivation, and participation in mathematics learning. Classroom interactions encompass verbal and non-verbal communication, teacher-student relationships, questioning techniques, feedback, encouragement, and the overall classroom climate. When teachers create an interactive and supportive learning environment, students are more likely to actively participate, ask questions, engage in problem-solving, and develop a positive attitude toward mathematics. This aligns with previous research indicating that teacher actions such as encouraging student explanations, providing feedback, and facilitating peer interactions were positively associated with higher levels of student engagement in mathematics classrooms. These actions help students become more active participants in the learning process (Ing et al. 2015). The positive impact of teacher-student interactions highlights that students are more engaged when their psychological needs for autonomy, competence, and relatedness are met (Uya, 2026). A teacher who provides encouragement, fosters a sense of belonging, and offers constructive feedback can significantly boost students' motivation to engage in mathematics. Conversely, a controlling or authoritarian classroom environment may lead to reduced engagement, anxiety, and disinterest in the subject.

4.4 Classroom Environment and Students' Engagement in Studying Mathematics

The result of the analysis of research question and hypothesis four showed that classroom environment positively and significantly influence students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District. This finding suggests that a well-structured, supportive, and stimulating learning environment enhances students' willingness to participate, engage, and excel in mathematics. A classroom environment encompasses physical, psychological, and social aspects, including classroom layout, availability of learning resources, teacher-student relationships, peer interactions, and the overall atmosphere of learning. When students learn in a conducive environment—where they feel safe, supported, and encouraged—they are more likely to actively participate, focus on tasks, and develop a positive attitude toward mathematics. This finding aligns with previous research that social classroom environment that promotes collaboration and peer interaction helps students learn from one another and share different perspectives; and positive emotional classroom climate reduces mathematics anxiety and increases students' willingness to engage in mathematical tasks. Teachers who cultivate a calm, inclusive, and respectful classroom environment encourage greater student effort and participation (Uya, 2024; Cohen et al. 2021). This highlight the fact that a well-structured classroom environment provides opportunities for student autonomy, fosters a sense of competence through encouragement and feedback, and nurtures social connections that drive engagement. Improving classroom environments will ultimately lead to better student participation, higher confidence, and improved academic performance in mathematics among secondary school students in Akwa Ibom North-East Senatorial District.

5. Conclusions

The study concludes that students' engagement in studying mathematics among secondary schools in Akwa Ibom North-East Senatorial District is significantly influenced by parental involvement, language background, teachers' classroom interactions, and the classroom environment. Parental support enhances students' motivation and participation, as those with involved parents are more likely to engage actively in mathematical learning. Language background plays a crucial role in students' ability to comprehend mathematical concepts, with proficiency in the language of instruction facilitating better engagement. Teachers' classroom interactions also impact student involvement, as facilitative and interactive teaching methods foster higher levels of participation, interest, and confidence in mathematics. Additionally, a well-structured and supportive classroom environment creates a conducive atmosphere for learning, encouraging students to stay focused and actively engage in mathematical activities. In all, these factors collectively shape students' experiences in learning mathematics, emphasizing the need for collaborative efforts among parents, teachers, and school administrators to enhance student engagement and academic performance in the subject.

5.1 Recommendations

i. Schools and teachers should promote parental involvement by encouraging parents to take an active role in their children's mathematics education through home support, monitoring, and participation in school activities.
ii. Educational stakeholders should address language barriers by incorporating bilingual support, simplified instructional materials, and language-enhancement programs to aid students with diverse language backgrounds.
iii. Teachers should adopt student-centered teaching approaches that foster interaction, collaboration, and inquiry-based learning to increase engagement in mathematics.
iv. Schools should ensure a conducive classroom environment by providing adequate infrastructure, reducing class sizes, and fostering a positive and supportive learning atmosphere.
v. Policy makers should integrate these factors into educational planning by formulating policies that encourage parental involvement, improve language accessibility, enhance teaching strategies, and upgrade learning environments.

5.2 Contributions to Knowledge

This study provides empirical evidence that multiple socio-educational factors influence students' engagement in mathematics, offering a more holistic understanding of learning engagement; that parental involvement, language background, and classroom factors as key determinants of student participation and performance in mathematics; offers practical insights for educators and policymakers on how to improve mathematics engagement through improved teaching strategies and learning environments; and adds to the body of literature on factors affecting student engagement in mathematics education, particularly within the Nigerian secondary school context.

5.3 Educational Implications

The study underscores the need for schools to involve parents in academic activities to foster students' interest and commitment to mathematics learning; language support programs should be integrated into the curriculum to assist students from diverse linguistic backgrounds in understanding mathematical concepts; teachers should receive training on interactive and facilitative teaching approaches to improve engagement levels in mathematics classrooms; schools and educational authorities should prioritize improving the classroom environment, ensuring that students have access to conducive learning spaces with adequate resources; and addressing these engagement factors can lead to better student participation and performance, ultimately improving mathematics achievement rates.

References

Association of Teacher Educators' Commission. (2024). The effects of language on children's conceptual understanding of mathematics. *Electronic Journal of Research in Science & Mathematics Education, 28*(2), 45–67.

Attard, C. (2011). Motivation and engagement in mathematics: A qualitative framework for teacher-student interactions. *Proceedings of the 34th Annual Conference of the Mathematics Education Research Group of Australasia*, 68-75.

Barwell, R. (2020). *Mathematics education and language diversity: A critical perspective.* Springer.

Boaler, J. (2019). *Limitless mind: Learn, lead, and live without barriers.* HarperOne.

Cohen, J., Muthén, L. K., & Muthén, B. O. (2021). The role of classroom climate in improving student engagement in mathematics education. *Journal of Educational Psychology, 113*(5), 815-829. https://doi.org/10.1037/edu0000447

Cummins, J. (2000). *Language, power, and pedagogy: Bilingual children in the crossfire.* Multilingual Matters.

Fan, W., & Williams, C. M. (2018). The impact of parental involvement on students' academic self-efficacy and engagement. *Educational Psychology, 38*(3), 341-356.

Fredricks, J. A., Filsecker, M., & Lawson, M. A. (2016). Student engagement, context, and adjustment: Addressing definitional, measurement, and methodological issues. *Educational Psychologist,* 51(3), 193-214.

Gonida, E. N., & Cortina, K. S. (2021). Parental involvement in mathematics learning: An international perspective. *Journal of Educational Psychology, 113*(4), 682-697.

Ing, M., Webb, N. M., Franke, M. L., Turrou, A. C., & Wong, J. (2015). Student participation in elementary mathematics classrooms: The missing link between teacher practices and student achievement? *Educational Studies in Mathematics,* 90(3), 341-356.

Jansen, A., Webb, D. C., & Marsha, B. (2021). Classroom discourse and student engagement in mathematics. *Mathematics Education Research Journal, 33*(2), 185-204.

Jansen, M., Kunter, M., & Brunner, M. (2023). The impact of classroom management and environment on secondary school students' mathematics engagement. *Educational Psychology Review, 35*(3), 593–615. https://doi.org/10.1007/s10648-023-09675-w

Lerkkanen, M. K., Kiuru, N., Pakarinen, E., Poikkeus, A. M., Siekkinen, M., Rasku-Puttonen, H., &Nurmi, J. E. (2018). *Maternal and paternal teacher–student relationships and children's academic achievement in primary school. Learning and Instruction, 56*, 69–77. https://doi.org/10.1016/j.learninstruc.2018.04.001

Liu, X., Wang, Y., Li, Q., & Wang, Z. (2023). The relationship between parental homework involvement and students' mathematics achievement: A meta-analysis. *Frontiers in Psychology, 14*, 1218534. https://doi.org/10.3389/fpsyg.2023.1218534

Moschkovich, J. (2018). Language and the learning of mathematics. *Journal for Research in Mathematics Education, 49*(2), 204-218.

Moschkovich, J. (2015). Academic literacy in mathematics for English learners. *The Journal of Mathematical Behavior, 40*, 43–62. https://doi.org/10.1016/j.jmathb.2015.01.002

OECD (2022). *Mathematics performance and equity: Findings from PISA 2021.* Paris: OECD Publishing.

Pianta, R. C., Hamre, B. K., & Allen, J. P. (2012). Teacher-student relationships and engagement: Conceptualizing, measuring, and improving the capacity of classroom interactions. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of Research on Student Engagement* (pp. 365-386). Springer. doi:10.1007/978-1-4614- 2018-7_17

Planas, N., & Civil, M. (2024). Language and mathematics education: Challenges for multilingual learners. *Educational Studies in Mathematics, 117*(1), 23–45. https://doi.org/10.1007/s10649-024-10321-9

Prediger, S., & Wessel, L. (2020). Designing for language-responsive mathematics teaching: Theoretical principles and empirical evidence. *ZDM–Mathematics Education, 52*(4), 789–803. https://doi.org/10.1007/s11858-020-01213-2

Ryan, R. M., & Deci, E. L. (2020). *Self-determination theory: Basic psychological needs in motivation, development, and wellness.* Guilford Publications.

Sari, I., Suryadi, D., & Sabandar, J. (2023). Effective teaching, teacher-student relation, student engagement, and student mathematical achievement. *Eurasia Journal of Mathematics, Science and Technology Education, 19*(1), em2210. doi:10.29333/ejmste/12852

Schukajlow, S., Rakoczy, K., & Pekrun, R. (2018). Emotions and motivation in mathematics education: Theoretical considerations and empirical analyses. *ZDM Mathematics Education, 50*(4), 571–587. https://doi.org/10.1007/s11858-018-0943-1

Setati, M. (2018). *Researching mathematics education and language in multilingual South Africa. In Mathematics education and language diversity: The 21st ICMI study* (pp. 313–332). Springer.

Silinskas, G., & Kikas, E. (2019). Parental involvement in math homework: Links to children's performance and motivation. *Scandinavian Journal of Educational Research, 63*(1), 17– 37.

Uya, A. O. (2024). Teachers' didactic strategies and students' proficiency in learning mathematics in Oron Education Zone of Akwa Ibom State, Nigeria. *Journal of Curriculum Studies, 32*(1), 37-53.

Uya, A. O. (2026). Curriculum alignment strategies and students' critical thinking skills in mathematics among secondary schools in Akwa Ibom State, Nigeria. *International Journal of Modern Science and Research Technology, 4*(2), 351-362.

Vygotsky (1978) Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Wang, M. T., & Degol, J. L. (2021). Classroom climate and students' growth mindset in mathematics: The role of teacher-student relationships and feedback. *Learning and Instruction, 72*, 101-115. https://doi.org/10.1016/j.learninstruc.2021.101199

Webb, N. M. (2019). The role of collaborative learning in promoting student engagement. *Educational Psychologist, 54*(4), 277-293.

Zhang, J., Li, H., & Wang, T. (2023). The role of parental support in mathematics learning: A cross-cultural study. *International Journal of Educational Research, 118*, 10354365. https://doi.org/10.1016/j.ijer.2023.10354365