Effect of Multiple Intelligences Teaching Strategy on Achievement and Interest in Geometry Among Senior Secondary School Students in Katsina State.

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DOI: https://dx.doi.org/10.47772/IJRISS.2025.909000376

Received: 10 September 2025; Accepted: 15 September 2025; Published: 11 October 2025

ABSTRACT

This study investigated the effectiveness of the Multiple Intelligences Teaching Strategy (MITS) in improving students' interest and achievement in Geometry among senior secondary school students in Katsina State. The state consists of three senatorial zones—Katsina, Daura, and Funtua—from which two schools were randomly selected, giving six schools in total. From the selected local government areas, 480 students were drawn, with two classes of 40 students each assigned as experimental and control groups. The intervention lasted for 12 weeks, during which the effectiveness of MITS was compared with conventional teaching methods. An experimental design was employed, using two main instruments: the Geometry Achievement Test (GAT) and the Students' Interest in Geometry Growth (SIGG) survey. The GAT, with a reliability coefficient of 0.78, consisted of multiple-choice, short-answer, and practical problems to assess understanding and application of geometric concepts. The SIGG survey measured students' interest, attitudes, and motivation towards Geometry after the intervention. Data were analyzed using descriptive statistics and ANCOVA at a 0.05 level of significance. Findings revealed a significant mean difference in achievement between students taught with MITS and those taught with traditional methods, with the former showing improved performance and greater interest. The results suggest that MITS can effectively enhance learning outcomes by engaging diverse learning abilities. It is therefore recommended that teachers integrate MITS into Mathematics instruction to foster deeper understanding and sustained student interest.

Keywords: Multiple Intelligences, Teaching Strategy, Students' Interest, Achievement, Geometry

INTRODUCTION

In education, fostering students' interest and achievement in complex subjects such as geometry presents an ongoing challenge. Traditional teaching methods, which often rely on standardized approaches, may not fully engage all learners, as each student possesses unique strengths and learning preferences. Geometry, a foundational branch of mathematics, often presents challenges for students due to its abstract nature and emphasis on spatial reasoning (Battista, 1999). Traditional instructional methods in geometry may not fully cater to the students' learning differences, leading to disparities in interest and academic success (Akinoso, 2018). The Multiple Intelligences teaching strategy (MITS), grounded in Howard Gardner's Theory of Multiple Intelligences, offers an alternative by addressing students varied cognitive strengths and learning styles (Gardner, 1983). According to Gardner, individuals possess distinct intelligences, including spatial, logical-mathematical, linguistic, and bodily-kinesthetic, which shape how they understand and engage with educational content (Armstrong, 2009). The (MITS) approach allows educators to design geometry lessons that appeal to these diverse intelligences, making learning more relevant and accessible for students. By offering personalized and varied instructional methods, the MI strategy has the potential to enhance students' interest and achievement in geometry, making mathematical learning more inclusive and effective (Ozdemir, 2020).

In the context of senior secondary schools, integrating the Multiple Intelligences Teaching Strategy (MITS) into geometry instruction offers unique benefits and addresses several challenges. At this level, students face complex and abstract mathematical concepts, and many struggles with geometry due to its high demand for spatial reasoning and visual skills (Clements & Battista, 1992). Traditional instructional approaches often emphasize rote memorization and formulaic problem-solving, which may not engage students who thrive with more interactive or hands-on learning methods. MITS provides a substitute by enabling teachers to diversify instruction, making learning more relevant and accessible to students with different cognitive strengths (Gardner, 1999).

Research suggests that applying MI-based teaching strategies in senior secondary schools can significantly increase students' interest and engagement in geometry. For example, students who learn best through bodily-kinesthetic intelligence might benefit from hands-on activities like constructing geometric models, while those with visual-spatial intelligence might engage more deeply with geometry through diagrams, visualizations, and digital simulations (Armstrong, 2009). Such strategies help to contextualize abstract geometric concepts in ways that resonate with students' preferred learning styles, potentially improving both interest and achievement.

Furthermore, studies highlight that teaching strategies addressing multiple intelligences can foster greater inclusivity, reducing achievement disparities among students with varying cognitive abilities (Ozdemir, 2011). When implemented in secondary classrooms, MITS can create a more supportive learning environment, where students feel empowered to explore mathematical concepts in ways that align with their natural strengths (Tomlinson, 2001). This approach can also prepare students for future learning, as it promotes critical thinking, problem solving, and adaptability skills that are essential not only for mathematics but also for broader academic and career success (Sternberg, 2004).

When applying the Multiple Intelligences Teaching Strategy (MITS) in geometry, social factors, such as gender, school location, and parents' educational levels, play significant roles in shaping students' interest and achievement in geometry, especially when combined with the Multiple Intelligences (MI) teaching strategy. These factors influence how students experience and engage with mathematical learning and may either support or limit the effectiveness of MI-based instruction. Gender differences in mathematics, particularly in geometry, have been observed in various studies. Research suggests that boys and girls may have differing attitudes toward geometry, potentially affecting their engagement and success in the subject (Hyde, Fennema & Lamon, 2008). Boys are often encouraged to pursue spatial and problem-solving activities, which can lead to higher initial interest and confidence in geometry (Eccles & Jacobs, 1986). In contrast, girls may benefit from MIT strategies that incorporate interpersonal and linguistic elements, as these approaches can make the content more accessible and appealing, fostering a more inclusive environment where both genders can excel (Forgasz, Leder, & Vale, 2000).

School location significantly impacts students' access to resources and quality of instruction. Urban schools often have more access to advanced instructional resources and technology, which can support MI-based teaching strategies in geometry (Chen & Luoh, 2021). In rural schools, however, limited resources and teacher shortages may restrict the implementation of MI strategies. Research has shown that rural students often face disadvantages in mathematics achievement due to fewer educational resources and reduced exposure to diverse teaching approaches (Coleman, 2018). MI strategies may help to bridge this gap by using low cost, hands on activities that support various intelligences, thereby enhancing rural students' interest and achievement in geometry despite resource limitations (Snyder, de Brey, & Dillow, 2019). Parental education is a crucial factor in students' academic outcomes, including their interest and achievement in subjects like geometry. Students whose parents have higher educational levels tend to perform better in mathematics, likely due to increase academic support at home and a higher emphasis on the value of education (Davis-Kean, 2005). MI teaching strategies can be particularly effective in engaging students with lower parental educational backgrounds by catering to diverse intelligences and providing multiple entry points into geometry learning. For instance, parents who may not be familiar with traditional methods can still support hands on and visual activities that resonate with their children's unique learning styles (Fan & Chen, 2001). In light of these social factors, MITS can be designed to create a more equitable learning environment. For example:

- Gender sensitive MITS: Teachers can use gender-inclusive approaches, such as incorporating both spatial and verbal reasoning tasks, to ensure that both boys and girls feel engaged in geometry lessons.
- Adapting MITS for Rural Schools: By using cost-effective, activity-based learning, MIT strategies can enhance geometry education in rural areas where resources are limited.
- Parent Engagement through MITS: Educators can involve parents of varying educational backgrounds by designing homework and activities that leverage multiple intelligences, making it easier for all parents to support their children's geometry learning.

In summary, MITS holds promise for addressing social disparities by creating a more inclusive and supportive learning environment for students from different gender backgrounds, school locations, and family educational settings. A MITS based approach in geometry not only meets students where they are but also encourages a positive and equitable learning experience across social factors that typically influence academic achievement.

Problem Statement/Justification

This study focuses on challenges students face in geometry, a core component of mathematics, which is crucial for their academic success and future engagement with the subject. Despite its importance, geometry often proves difficult due to its abstract nature and the reliance on spatial reasoning (Boaler, 2016). Traditional instructional methods may fail to engage all students, leading to a lack of interest and lower achievement, especially among students from diverse social backgrounds (Chen & Luoh, 2021). Research has shown that factors such as gender, school location, and parents' educational levels significantly influence students' attitudes toward performance in geometry (Bakker, Doorman & Gravemeijer, 2022). For instance, gender disparities often result in boys exhibiting higher confidence and interest in spatial tasks, while girls may be less engaged, possibly due to societal expectations and teaching methods that do not address these differences. Similarly, students from rural areas or lower educational backgrounds may have limited access to resources, which hinders their ability to perform well in geometry (Coleman, 2018). In the context of Katsina State, these challenges are particularly pertinent due to the region's diverse socio-economic conditions, where access to educational resources can be uneven. The Multiple Intelligences Teaching Strategy (MITS), which caters for students varied cognitive strengths, presents a promising solution to these challenges. However, there is a lack of research on the specific impact of MTI strategies on geometry, interest and achievement across different social groups, especially in regions like Katsina State. This study aims to fill this gap by exploring how MIT strategies affect students' interest and achievement in geometry, with particular attention to the moderating effects of gender, school location, and parents' educational levels. By understanding these dynamics, the study seeks to inform more equitable and effective teaching practices in mathematics education, particularly in Katsina State. The findings from this research could provide valuable insights for educators, policymakers, and curriculum developers in Katsina State, helping to inform the development of more inclusive, effective instructional practices in mathematics that cater for the diverse needs of all students in the region.

Objectives Of The Study

The general objective of this study is to examine the effects of the Multiple Intelligences Teaching Strategy (MITS) on students' interest and achievement in geometry among senior secondary school students (SSS) in Katsina State. Specifically, the study objectives are to:

1. Evaluate the effect of the MITS teaching strategy on students' achievement in geometry.
2. Examine the effect of the MITS on students' achievement based on gender
3. Assess the effects of the multiple intelligences teaching strategy (MITS) on students' interest in geometry.

Research Questions

1. Is there any significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State?
2. Is there any significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State?
3. What is the interest level of senior secondary school students taught geometry using the multiple intelligences teaching strategy within Katsina State?

Hypothesis

The following hypotheses were stated to guide the study.

1. There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.
2. There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

LITERATURE REVIEW

The theoretical framework for examining the effect of Multiple Intelligences teaching strategies (MITS) on students' interest and achievement in geometry is based on Gardner's Theory of Multiple Intelligences and Constructivist Learning Theory. Gardner’s theory proposes that intelligence comprises distinct cognitive abilities, such as linguistic, logical-mathematical, spatial, bodily-kinesthetic, and interpersonal intelligences, among others (Gardner, 1983). Traditional teaching often prioritizes linguistic and logical-mathematical intelligences, which may not engage all students. MIT strategies aim to address this by tailoring instruction to students' unique intelligence profiles. For example, spatial learners benefit from visual aids, while bodily-kinesthetic learners thrive through hands-on activities. This inclusive approach can enhance interest and academic achievement (Armstrong, 2009).

Constructivist Learning Theory emphasizes that knowledge is actively constructed through meaningful experiences and interaction with the environment (Piaget, 1964; Vygotsky, 1978). This theory aligns with MIT strategies, which use varied, contextually relevant activities to build upon students' strengths and prior knowledge. For geometry, constructivist approaches involve exploration, discovery, and collaboration, fostering deeper understanding. Vygotsky's concept of the Zone of Proximal Development further supports differentiated instruction, enabling students to achieve higher understanding with appropriate support. MIT strategies enhance interest in geometry by creating engaging and relevant learning experiences.

Interest is influenced by students' perceptions of relevance, enjoyment, and confidence. Research suggests that MITS-based activities reduce math anxiety, boost engagement, and make learning more enjoyable (Hidi & Renninger, 2006). For example, spatial approaches appeal to students with spatial intelligence, while group projects engage those with interpersonal intelligence. Improved interest through MIT strategies positively impacts motivation and long-term learning outcomes.

Academic achievement in geometry is often measured through assessments and is influenced by factors such as self-efficacy and anxiety. MIT strategies address these factors by aligning instruction with students' dominant intelligences, reducing cognitive load, and improving comprehension.

Empirical studies highlight the effectiveness of MIT strategies in improving student engagement and achievement in mathematics. Research shows that students engaging in MITS-based activities demonstrate higher interest and better achievement in mathematics, particularly geometry. For instance, spatial learners excel with visual aids, and kinesthetic learners benefit from constructing geometric shapes. These strategies create an inclusive and motivating learning environment, fostering intrinsic motivation and reducing math anxiety (Torres, Jimenez & Vasquez, 2022).

However, gaps exist in research on MIT strategies, particularly regarding contextual and cultural differences. There is limited focus on regions like Katsina State, where educational settings may influence the effectiveness of MIT strategies. Longitudinal studies are also needed to understand the long-term impact of MIT strategies on student interest and achievement. Further exploration is required to determine how diverse intelligence profiles engage with geometry and how MIT strategies can be tailored to specific topics such as angles or symmetry. Comparative studies between MITS-based and conventional teaching methods, particularly in resource-limited contexts, are also needed. Additionally, teacher training and the availability of resources play critical roles in the successful implementation of MIT strategies. Addressing these gaps will enhance the understanding and application of MIT strategies in geometry instruction, leading to improved student outcomes.

METHODOLOGY

Experimental design was used for this study. The participants were randomly assigned to an experimental group (receiving MITS instruction) and a control group (using traditional teaching methods). Pre-tests measured baseline interest and achievement, while post-tests assessed changes following the instructional period. Comparisons between the groups evaluated the effectiveness of MITS in improving geometry learning outcomes. The study targeted all Senior Secondary School II (SSS II) students in public schools across the three senatorial districts of Katsina State, Nigeria. This population of the study was 202,316 SS II students. From this population, 480 students were selected using stratified random sampling. Two schools were randomly chosen from each senatorial district and two intact classes of 40 students each were randomly assigned as experimental and control groups per school. The sampling method ensures sufficient representation in accordance with the guidelines established by Krejcie and Morgan (1970). The table below gives details about the randomly selected schools.

Name of Schools	No of Students in SS II		Total study
	Male	Female	
Government Pilot Secondary School, Mashi	554	438	992
Government Rural Boarding Secondary School, Batagarawa	622	830	1452
Government Day Senior Secondary School, Charanchi	768	746	1514
Government Day Secondary School, Malumfashi	895	1455	2350
Government Day Secondary School, Bakori	292	440	732
Government Senior Secondary School, Daura	356	243	599
Total	3487	4152	7639

Two primary instruments were designed by the researchers to assess outcomes. The Student Interest in Geometry Growth (SIGG) survey, a 20-item Likert-scale questionnaire, measured students' interest in geometry, while the

Geometry Achievement Test (GAT), a 20-item multiple-choice test, evaluated their knowledge of shapes, measurement, and reasoning. Both instruments were validated by experts in educational psychology and mathematics education respectively. Reliability test conducted yielded Cronbach Alpha and KR-20 coefficients of 0.78 and 0.72 respectively, indicating good reliability.

Participants went through a pre-test to establish baseline knowledge, ensuring comparability between the groups. Teachers in the experimental group were trained on MITS, focusing on interactive and student-centered instructional techniques, while the control group followed traditional lecture-based methods. Both groups implemented researcher-designed lesson plans aligned with the geometry curriculum. At the end of the term, post-tests measured students' interest, achievement, and problem-solving skills. The results determined the effectiveness of MITS in enhancing geometry learning and engagement.

Data were analyzed using descriptive and inferential statistical methods. descriptive statistics, including mean and standard deviation, were used to summarize the data on students' interest and achievement. Inferential analyses, including F-tests and Analysis of Covariance (ANCOVA), were used to test the hypotheses and evaluate the effects of the interventions. Statistical significance was determined at a 0.05 level.

DATA ANALYSIS

The scores obtained from pre-tests post-tests were examined using descriptive statistics and ANCOVA as the main statistical tool at 0.05 level of significance.

PRESENTATION OF THE RESULTS

Charanchi Research Analysis

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: CRCPOST			
EXP1CRTL2CRC	Mean	SD	N
EXP	76.38	9.870	40
CTRL	46.50	6.524	40

From the above table, there is a high mean difference of 29.88 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Charanchi Local Government within Katsina State.

Dependent Variable: Crcpost					
Source	Sum Of Squares	Df	Mean Square	F	Sig.
Crcpre	107.280	1	107.280	1.543	.218
Exp1crtl2crc	17551.738	1	17551.738	252.515	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Charanchi Local Government for experimental and control groups since $F(1, 77) = 1.543$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on senior secondary school II students taught geometry at Charanchi Local Government because $F(1,77) = 252.515$ and $p < 0.05$. The table below also gives a mean difference of 29.704 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	29.704	1.869	.000
CRTL	EXPT	-29.704	1.869	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: EXPCRCPOST			
EXPSEXCRC	Mean	SD	N
FEMALE	77.00	9.090	20
MALE	75.75	10.794	20

There is a very slight mean difference of 1.25 between the academic performance in geometry of male and female senior secondary school students at Charanchi Local Government taught using the multiple intelligences teaching strategy.

Tests of Between-Subjects Effects					
Dependent Variable: EXPCRCPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
EXPSEXCRC	14.161	1	14.161	.139	.712

The table above shows that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students at Charanchi Local Government taught using the multiple intelligences teaching strategy since $F(1,77) = .139$ and $p > 0.05$. The table below also demonstrates a slight mean difference of 1.193 in favour of the females after applying Bonferroni adjustment for multiple comparisons

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	1.193	3.203	.712
MALE	FEMALE	-1.193	3.203	.712

Batagarawa Research Analysis

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

Descriptive Statistics			
Dependent Variable: BTGPOST			
EXP1CRTL2BTG	Mean	SD	N
EXPT	72.00	8.829	40
CRTL	45.00	4.804	40

From the above table, there is a high mean difference of 27.00 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Batagarawa Local Government within Katsina State.

Tests of Between-Subjects Effects					
Dependent Variable: BTGPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
BTGPRE	.156	1	.156	.003	.956
EXP1CRTL2BTG	14578.251	1	14578.251	284.916	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Batagarawa Local Government for experimental and control groups since $F(1, 77) = .003$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on the experimental senior secondary school II students taught geometry at Batagarawa Local Government since $F(1,77) = 284.916$ and $p < 0.05$. The table below also gives a mean difference of 27.001 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	27.001	1.600	.000
CRTL	EXPT	-27.001	1.600	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: EXPBTGPOST			
EXBTGSEX	Mean	SD	N
FEMALE	70.75	8.315	20
MALE	73.25	9.358	20
There is a very slight mean difference of 2.5 between the academic performance in geometry of male and female senior secondary school students at Batagarawa Local Government taught using the multiple intelligences teaching strategy.			
Tests of Between-Subjects Effects			

Dependent Variable: EXPBTGPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
BTGPRE	3.343	1	3.343	.042	.840
EXBTGSEX	60.529	1	60.529	.753	.391

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students at Batagarawa Local Government taught using the multiple intelligences teaching strategy of the multiple intelligences teaching strategy at Batagarawa Local Government since $F(1,77) = .042$ and $p > 0.05$. The table below also demonstrates a slight mean difference of 2.465 in favour of the males after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	-2.465	2.840	.391
MALE	FEMALE	2.465	2.840	.391

MALUMFASHI RESEARCH ANALYSIS

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: MLFPOST			
EXP1CRTL2MLF	Mean	SD	N
EXP	82.50	6.794	40
CTRL	41.75	5.610	40

From the above, there is a high mean difference of 40.75 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Malumfashi Local Government within Katsina State.

Tests of Between-Subjects Effects					
Dependent Variable: MLFPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
MLFPRE	6.806	1	6.806	.174	.678
EXP1CRTL2MLF	33171.380	1	33171.380	845.566	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Malumfashi Local Government for experimental and control groups since $F(1, 77) = .174$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on senior secondary school II students taught geometry at Malumfashi Local Government since $F(1,77) = 845.566$ and $p < 0.05$. The table below

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

also demonstrates a mean difference of 40.78 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	40.780	1.402	.000
CRTL	EXPT	-40.780	1.402	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: EXPMLFPOST			
EXPSEXMLF	Mean	SD	N
FEMALE	82.00	7.847	20
MALE	83.00	5.712	20

There is a very slight mean difference of 1.00 between the academic performance in geometry of male and female senior secondary school students at Malumfashi Local Government taught using the multiple intelligences teaching strategy.

Tests of Between-Subjects Effects					
Dependent Variable: EXPMLFPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
EXPSEXMLF	9.412	1	9.412	.195	.662

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students at Malumfashi Local Government taught using the multiple intelligences teaching strategy of the multiple intelligences teaching strategy at Malumfashi Local Government since $F(1,77) = .195$ and $p > 0.05$. The table below also demonstrates a slight mean difference of .979 in favour of the males after applying Bonferroni adjustment for multiple comparisons

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	-.979	2.219	.662
MALE	FEMALE	.979	2.219	.662

Bakori Research Analysis

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

Descriptive Statistics			
Dependent Variable: BKRPOST			
EXP1CRTL2BKR	Mean	SD	N
EXP	76.63	7.196	40
CRTL	45.88	5.417	40

From the above, there is a high mean difference of 30.75 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Bakori Local Government within Katsina State.

Tests of Between-Subjects Effects					
Dependent Variable: BKRPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
BKRPRE	141.335	1	141.335	3.601	.062
EXP1CRTL2BKR	14120.492	1	14120.492	359.738	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Bakori Local Government for experimental and control groups since $F(1, 77) = 3.601$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on senior secondary school II students taught geometry at Bakori Local Government since $F(1,77) = 359.738$ and $p < 0.05$. The table below also demonstrates a mean difference of 29.474 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	29.474	1.554	.000
CRTL	EXPT	-29.474	1.554	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: EXPBKRPOST			
EXPSEXBKR	Mean	SD	N
FEMALE	78.50	6.304	20
MALE	74.75	7.691	20

There was a mean difference of 3.75 between the academic performance in geometry of male and female senior secondary school students at Bakori Local Government taught using the multiple intelligences teaching strategy.

Tests of Between-Subjects Effects					
Dependent Variable: EXPBKRPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
EXPSEXBKR	149.226	1	149.226	2.961	.094

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students at Bakori Local Government taught using the multiple intelligences teaching strategy of the multiple intelligences teaching strategy at Bakori Local Government since $F(1,77) = 2.961$ and $p > 0.05$. The table below also demonstrates a slight mean difference of 3.89 in favour of the females after applying Bonferroni adjustment for multiple comparisons

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	3.890	2.261	.094
MALE	FEMALE	-3.890	2.261	.094

Daura Research Analysis

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: DRAPOST			
EXP1CRTL2DRA	Mean	SD	N
EXP	74.63	9.086	40
CTRL	42.88	4.220	40

From the above, there is a high mean difference of 31.75 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Daura Local Government within Katsina State.

Tests of Between-Subjects Effects					
Dependent Variable: DRAPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
DRAPRE	.995	1	.995	.020	.889
EXP1CRTL2DRA	20120.693	1	20120.693	395.960	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Daura Local Government for experimental and control groups since $F(1, 77) = .02$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on senior secondary school II students taught geometry at Daura Local Government since $F(1,77) = 395.96$ and $p < 0.05$. The table below also demonstrates a mean difference of 31.762 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	31.762	1.596	.000
CRTL	EXPT	-31.762	1.596	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: DRAEXPPOST			
DRAEXPSEX	Mean	Std. Deviation	N
FEMALE	74.00	8.367	20
MALE	75.25	9.931	20

There was a mean difference of 1.25 between the academic performance in geometry of male and female senior secondary school students at Daura Local Government taught using the multiple intelligences teaching strategy.

Tests of Between-Subjects Effects					
Dependent Variable: DRAEXPPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
DRAEXPSEX	19.792	1	19.792	.236	.630

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students at Daura Local Government taught using the multiple intelligences teaching strategy of the multiple intelligences teaching strategy at Daura Local Government since

$F(1,77) = .236$ and $p > 0.05$. The table below also demonstrates a slight mean difference of 1.409 in favour of the males after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	-1.409	2.900	.630
MALE	FEMALE	1.409	2.900	.630

MASHI RESEARCH ANALYSIS

H_0: There is no significant difference between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

Descriptive Statistics			
Dependent Variable: MSHPOST			
EXP1CRTL2MSH	Mean	SD	N
EXP	75.63	9.281	40
CTRL	45.12	5.249	40

From the above, there is a high mean difference of 30.51 between the academic performance of senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method in Mashi Local Government within Katsina State.

Tests of Between-Subjects Effects					
Dependent Variable: MSHPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
MSHPRE	154.240	1	154.240	2.775	.100
EXP1CRTL2MSH	18291.964	1	18291.964	329.122	.000

The data presented in the above table shows that there is no statistically significant difference between pre-test at Mashi Local Government for experimental and control groups since $F(1, 77) = 2.775$ and $p > 0.05$. We also found a statistically significant effect of the multiple intelligences teaching strategy on senior secondary school II students taught geometry at Mashi Local Government since $F(1,77) = 329.122$ and $p < 0.05$. The table below also demonstrates a mean difference of 30.312 in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
EXPT	CRTL	30.312	1.671	.000
CRTL	EXPT	-30.312	1.671	.000

H_0: There is no significant difference between the academic performance of male and female senior secondary school students taught geometry using the multiple intelligences teaching strategy and those taught using the conventional teaching method within Katsina State.

Descriptive Statistics			
Dependent Variable: EXPMSHPOST			
EXPSEXMSH	Mean	SD	N
FEMALE	77.00	8.645	20
MALE	74.50	10.247	20

There was a mean difference of 2.50 between the academic performance in geometry of male and female senior secondary school students at Mashi Local Government taught using the multiple intelligences teaching strategy.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

Tests of Between-Subjects Effects					
Dependent Variable: EXPMSHPOST					
Source	Sum of Squares	df	Mean Square	F	Sig.
EXPSEXMSH	65.259	1	65.259	.708	.405

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students since $F(1,77) = .708$ and $p > 0.05$. The table below also demonstrates a slight mean difference of 2.562 in favour of the males after applying Bonferroni adjustment for multiple comparisons.

(I)	(J)	Mean Diff. (I-J)	Std. Error	Sig.
FEMALE	MALE	2.562	3.043	.405
MALE	FEMALE	-2.562	3.043	.405

What is the interest level of senior secondary school students taught geometry using the multiple intelligences teaching strategy within Katsina State?

S/N	Items	**SD**	**D**	**N**	**SA**	**A**
	Section A: Interest in Geometry					
1	I look forward to learning geometry in math class.	12(5%)	12(5%)	24(10%)	144(60%)	48(20%)
2	Geometry is one of my favourite subjects in school.	12(5%)	24(10%)	12(5%)	168(70%)	24(10%)
3	I am curious to learn more about geometric shapes and their properties.	36(15%)	24(10%)	12(5%)	132(55%)	36(15%)
4	I find geometry interesting and enjoyable.	12(5%)	12(5%)	12(5%)	156(65%)	48(20%)
5	I enjoy exploring new concepts in geometry.	24(10%)	48(20%)	12(5%)	120(50%)	36(15%)
	Section B: Engagement in Learning Geometry					
6	I feel motivated to participate in geometry activities.	12(5%)	24(10%)	12(5%)	132(55%)	60(25%)
7	I often try to solve geometry problems on my own.	0(0%)	12(5%)	0(0%)	156(65%)	72(30%)
8	I am actively involved during geometry lessons.	12(5%)	12(5%)	12(5%)	168(70%)	36(15%)

S/N	Items	**SD**	**D**	**N**	**SA**	**A**
9	I pay attention and stay focused during geometry activities.	12(5%)	24(10%)	12(5%)	144(60%)	48(20%)
10	I enjoy working with my classmates on geometry-related tasks.	12(5%)	12(5%)	12(5%)	156(65%)	48(20%)
	Section C: Perception of the Multiple Intelligences Teaching Strategy					
11	The variety of activities in geometry class keeps me interested.	0(0%)	0(0%)	12(5%)	144(60%)	84(35%)
12	Hands-on activities in geometry make learning more meaningful.	0(0%)	12(5%)	12(5%)	168(70%)	48(20%)
13	Group work and discussions help me understand geometry concepts better.	0(0%)	12(5%)	12(5%)	144(60%)	72(30%)
14	I find visual aids, such as diagrams and models, useful in learning geometry.	12(5%)	12(5%)	12(5%)	144(60%)	60(25%)
15	I feel that the different activities help me learn geometry in ways that suit me.	0(0%)	12(5%)	12(5%)	72(30%)	144(60%)
	Section D: Self-Efficacy in Geometry					
16	I feel confident in my ability to solve geometry problems.	12(5%)	12(5%)	12(5%)	144(60%)	60(25%)
17	I believe I can achieve high grades in geometry.	0(0%)	12(5%)	12(5%)	84(35%)	132(55%)
18	I find it easy to understand geometric concepts.	12(5%)	12(5%)	24(10	132(55%)	60(25%)
19	I am good at visualizing shapes and figures in my mind.	24(10%)	36(15%)	12(5%)	108(45%)	60(25%)
20	I feel well-prepared to answer geometry questions in tests and exams.	12(5%)	12(5%)	24(10%)	120(50%)	72(30%)

On the interest in geometry, about 80% in question 1 to 4 either agreed or strongly agreed that they have interest in geometry apart from question 5 in which 65% enjoy exploring new concepts in geometry. This therefore suggested that the students have a strong interest in geometry.

On the engagement in learning geometry, 95% in question 7 either agree or strongly agree that they often try to solve geometry problems on their own while 80 to 85% either agree or strongly agree to questions 6, 8, 9and 10. This shows that they are strongly engaged in learning geometry and this gave them the opportunity to perform better.

On the perception of the multiple intelligences teaching strategy, 85 to 95% of all the respondents either agreed or strongly agreed, which is an indication that the students have a very strong interest in the multiple intelligences teaching strategy.

On the issue of self-efficacy in geometry, 90% of the respondents in question 17 either agreed or strongly agreed that they can achieve high grades in geometry while 70 to 85% either agreed or strongly agreed to questions 16, 18, 19 and 20. This shows that their self-efficacy to geometry is very high.

DISCUSSION OF THE RESULTS

From the above results it is noted that there is a high mean difference between the academic performance of Senior Secondary School Students taught geometry using the multiple intelligence teaching strategy and those taught using the conventional method. The mean difference for Charanchi, Batagarawa, Malumfashi, Bakori, Daura, Mashi are 29.88, 27.00, 40.75, 30.75, 31.75, 30.51 respectively.

Similarly, for all the post test data results presented in all the tables for all the local governments it was discovered that there is no statistically significant difference between the pre-test for experimental and control group. We also found a statistically significant effect of the multiple intelligences teaching strategy on the experimental senior secondary school II students taught geometry. The mean differences in the tables were also in favour of the multiple intelligences teaching strategy after applying Bonferroni adjustment for multiple comparisons.

We also found that there is no statistically significant difference between the academic performance in geometry of male and female senior secondary school students in all the local government areas studied. The tables between subject-effects showed a slight mean difference in favour of males for Batagarawa, Malumfashi, Mashi and Daura while the mean difference was in favour of the females for Charanchi and Bakori after applying Bonferroni adjustment for multiple comparisons.

As regards interest in geometry, about 80% in question 1 to 4 either agreed or strongly agreed that they have interest in geometry apart from question 5 in which 65% enjoy exploring new concepts in geometry. This showed that the students have a strong interest in geometry.

On the engagement in learning geometry, 95% in question 7 either agree or strongly agree that they often try to solve geometry problems on their own while 80 to 85% either agree or strongly agree to questions 6, 8, 9and 10. This shows that they are strongly engaged in learning geometry and this gave them the opportunity to perform better.

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CONCLUSTION

From the results of this research, it can be seen that Multiple Intelligence Teaching Strategy MITS is a good and powerful method for enhancing students' academic achievements. If well employed while teaching, it will benefit both the male and female students almost equally. Teachers should also note the many kinds of abilities that exist among learners. It is therefore their duty to identify those abilities and harness them in their teaching/learning situations. This is as a result of the Gardner's theory of Multiple Intelligence.

RECOMMMENDATION

As a result of the findings, we urge that teachers should be trained and encouraged through workshops, seminars and conferences to integrate and use MITS in teaching Mathematics and Geometry in order to enable students learn in a variety of ways. Policy makers and curriculum designers should incorporate the use of MITS in producing curriculum materials. Parents and teachers should encourage students to embrace MITS learning in order to develop their potentials.

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ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IX September 2025

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