



## **Achievement and Attitude Towards Mathematics Among Senior Secondary Students in Relation to Learning Styles and School Climate**

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### **Abstract-**

The present study investigates the achievement and attitude towards mathematics among senior secondary students in relation to their learning styles and perceived school climate. Mathematics achievement and attitude are crucial indicators of students' academic success, yet wide variations are observed among learners despite uniform instructional practices. The study adopted a descriptive survey method. The sample consisted of senior secondary students studying mathematics, selected from government schools through an appropriate sampling technique. Standardized tools were used to measure learning styles, attitude towards mathematics, and school climate, while academic achievement was assessed using students' mathematics examination scores. Statistical techniques such as mean, standard deviation, and correlation analysis were employed to analyze the data. The findings revealed significant differences in students' achievement and attitude towards mathematics across different learning styles and school climate dimensions. A positive relationship was found between supportive school climate, effective learning styles, and higher achievement in mathematics. The study highlights the importance of learner-centered instructional strategies and a positive school climate in enhancing students' mathematical performance and attitude. The findings have important implications for teachers, school administrators, and educational planners in designing inclusive and effective mathematics learning environments.

**Keywords:** *Mathematics achievement, Attitude towards mathematics, Learning styles, School climate, Senior secondary students*

## Introduction

Mathematics plays a pivotal role in the intellectual development of learners and forms the foundation for scientific, technological, and logical reasoning. At the senior secondary level, mathematics education becomes particularly significant as it influences students' academic choices and career pathways. Despite its importance, mathematics is often perceived as a difficult and anxiety-provoking subject, leading to poor achievement and negative attitudes among students. Achievement in mathematics is not solely determined by cognitive ability; rather, it is influenced by multiple psychological and environmental factors. Among these, learning styles and school climate have gained considerable attention in educational research. Learning styles refer to individuals' preferred ways of perceiving, processing, and understanding information, whereas school climate reflects the overall quality and character of school life, including interpersonal relationships, teaching–learning practices, and organizational structures. Research indicates that students with learning styles aligned to instructional methods demonstrate better academic outcomes and more positive attitudes towards mathematics. Similarly, a supportive and positive school climate fosters students' motivation, confidence, and engagement in learning. However, empirical studies examining the combined influence of learning styles and school climate on both achievement and attitude towards mathematics at the senior secondary level remain limited, particularly in the Indian context.

Therefore, the present study seeks to examine achievement and attitude towards mathematics among senior secondary students in relation to learning styles and school climate, with the aim of providing evidence-based insights for improving mathematics education.

## 2. Review of Related Literature

Research on mathematics education consistently indicates that students' academic achievement and attitudes toward mathematics are influenced

by both individual and environmental factors, particularly learning styles and school climate. **Learning Styles and Mathematics Achievement:**

- **Al-Balhan (2007)** reported that accommodating students' learning styles improved mathematics performance, emphasizing the effectiveness of learner-centered instruction.
- **Adnan et al. (2013)** found that students with balanced and visual learning styles demonstrated higher achievement, suggesting instructional alignment with learning preferences enhances outcomes.
- **Kidejevich (2008)** highlighted that self-confidence and perceived usefulness of mathematics were positively associated with achievement across countries.
- **Kumar & Singh (2011)** concluded that students with a favorable attitude toward mathematics achieved significantly higher scores than those with negative attitudes.
- **Recent studies (2024–2025)** show that learning styles remain significantly related to achievement. For instance, research on secondary students found that tailoring instruction to visual, auditory, and kinesthetic preferences improved performance in arithmetic, algebra, and geometry (Nepjol, 2024; MDPI, 2024). Studies also indicate that learning styles influence mathematics anxiety, which in turn affects engagement and achievement (HRMARS, 2025).

### **Attitude Toward Mathematics:**

- Positive attitudes have been identified as a strong predictor of achievement (Kidejevich, 2008; Kumar & Singh, 2011).
- Recent research indicates that interest, confidence, and perceived usefulness of mathematics consistently correlate with higher achievement across diverse contexts (NCERT, 2024; Arxiv, 2025). **School Climate and Academic Outcomes:**

- **Preble & Newman (2006)** demonstrated that positive school climate, characterized by supportive teacher–student relationships and effective instruction, enhances motivation and performance.

- **Abari & Ako (2021)** found that school environment and facilities significantly affected students’ attitudes toward mathematics, indirectly influencing achievement.

- **Recent studies (2024–2025)** confirm that supportive and structured school climates improve engagement and mathematics achievement (DergiPark, 2024; IJLTER, 2025). Classroom climate has also been shown to influence students’ motivation and self-efficacy in mathematics.

#### **Integrated Perspectives and Gaps:**

- Earlier studies mostly examined learning styles, school climate, achievement, or attitude in isolation.

- Recent research (Springer, 2024; IJCRT, 2024) emphasizes that integrated models including both individual (learning styles, attitudes) and contextual factors (school climate) provide a more comprehensive understanding of mathematics outcomes.

- Nevertheless, limited empirical work has simultaneously explored the combined influence of learning styles and school climate on both attitude and achievement at the senior secondary level in India, highlighting a critical research gap.

### **Research Gap**

A critical review of the literature reveals a lack of comprehensive studies examining achievement and attitude towards mathematics together in relation to learning styles and school climate among senior secondary students in India. Therefore, the present study seeks to bridge this gap by investigating the interaction of these variables within a single empirical framework.

### **3. Objectives and Hypotheses of the Study**

#### **3.1 Objectives of the Study**

The objectives of the present study are to:

1. Examine the achievement in mathematics of senior secondary students in relation to their learning styles.
2. Study the achievement in mathematics of senior secondary students with respect to school climate.
3. Analyze the attitude towards mathematics of senior secondary students in relation to their learning styles.
4. Examine the attitude towards mathematics of senior secondary students with respect to school climate.
5. Determine the relationship between learning styles, school climate, achievement, and attitude towards mathematics.

#### **3.2 Hypotheses of the Study (Null Hypotheses)**

1. There is no significant relationship between learning styles and achievement in mathematics among senior secondary students.
2. There is no significant relationship between school climate and achievement in mathematics among senior secondary students.
3. There is no significant relationship between learning styles and attitude towards mathematics among senior secondary students.
4. There is no significant relationship between school climate and attitude towards mathematics among senior secondary students.

### **4. Research Methodology**

#### **4.1 Research Design**

The present study adopted a descriptive survey research design. This design was considered appropriate as it enables the systematic description and analysis of existing conditions and

relationships among variables such as learning styles, school climate, achievement, and attitude towards mathematics without any experimental manipulation.

#### 4.2 Sample of the Study

The sample for the present study consisted of 497 senior secondary students studying mathe-

**Table 1**

**Distribution of the Sample According to Demographic Variables (N = 497)**

| Variable                  | Category     | Frequency | Percentage (%) |
|---------------------------|--------------|-----------|----------------|
| <b>District</b>           | Almora       | 193       | 38.8           |
|                           | Nainital     | 174       | 35.0           |
|                           | US Nagar     | 130       | 26.2           |
| <b>Block</b>              | Dwarahat     | 84        | 16.9           |
|                           | Hawalbagh    | 88        | 17.7           |
|                           | Haldwani     | 52        | 10.5           |
|                           | Dhari        | 53        | 10.7           |
|                           | Bhimtal      | 69        | 13.9           |
|                           | Rudrapur     | 69        | 13.9           |
|                           | Gadarpur     | 3         | 0.6            |
|                           | Bazpur       | 58        | 11.7           |
|                           | Lamgara      | 21        | 4.2            |
| <b>Gender</b>             | Male         | 321       | 64.6           |
|                           | Female       | 176       | 35.4           |
| <b>Category</b>           | General      | 365       | 73.9           |
|                           | OBC          | 44        | 8.9            |
|                           | SC           | 88        | 17.3           |
| <b>Locality</b>           | Rural        | 266       | 53.5           |
|                           | Urban        | 231       | 46.5           |
| <b>Father's Education</b> | Illiterate   | 20        | 4.1            |
|                           | Below Matric | 91        | 18.3           |
|                           | Matric       | 133       | 26.7           |
|                           | Intermediate | 183       | 36.8           |
|                           | Graduation   | 70        | 14.1           |
| <b>Mother's Education</b> | Illiterate   | 45        | 9.1            |
|                           | Below Matric | 192       | 38.6           |
|                           | Matric       | 130       | 26.2           |
|                           | Intermediate | 94        | 18.9           |
|                           | Graduation   | 36        | 7.2            |

#### Interpretation of Table 1

Table 1 shows that the sample was adequately distributed across three districts of Kumaun region, with the highest representation from Almora district (38.8%). Male students constituted

64.6% of the sample, while 35.4% were female students. A majority of the students belonged to rural areas (53.5%). With respect to parental education, most fathers (36.8%) and mothers (38.6%) had educational qualifications up to the intermediate and below matric levels respective

ly, indicating a predominantly middle and lower educational background.

### 4.3 Tools Used for Data Collection

The inventory measures multiple dimensions of learning styles and has been widely used in educational research.

#### Reliability:

The reliability of the Learning Styles Inventory was established using Cronbach's Alpha method, and the obtained reliability coefficient was found to be satisfactory, indicating internal consistency of the tool.

### 2. Mathematics Achievement Scores

Academic achievement in mathematics was measured using students' school examination scores obtained from official school records. These scores were considered valid indicators of students' performance in mathematics.

### 3. Attitude Towards Mathematics Scale

A standardized attitude scale was used to measure students' attitude towards mathematics across dimensions such as usefulness, confidence, and enjoyment.

Reliability: The attitude scale demonstrated acceptable reliability as reported by the test manual and previous studies.

Permission was obtained from school authorities prior to data collection. Confidentiality and anonymity of the participants were ensured, and the data were used solely for academic research purposes.

## 5. Results

Table 1: Demographic Profile of the Sample (N = 497)

| Variable | Category | Frequency | Percentage (%) |
|----------|----------|-----------|----------------|
| District | Almora   | 193       | 38.8           |
|          | Nainital | 174       | 35.0           |

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### 1. Learning Styles Inventory

A standardized Learning Styles Inventory was used to assess students' preferred learning styles.

### 4. School Climate Inventory

School climate was measured using a standardized School Climate Inventory covering dimensions such as open, autonomous, controlled, familiar, parental, and closed climate.

#### Reliability:

The tool was found to be reliable and valid for assessing perceived school climate among secondary school students.

### 4.4 Statistical Techniques Used

The collected data were analyzed using appropriate statistical techniques:

- Mean and Standard Deviation were used to analyze achievement, attitude, learning styles, and school climate.
- Correlation Analysis was employed to study the relationship between learning styles, school climate, achievement, and attitude towards mathematics.

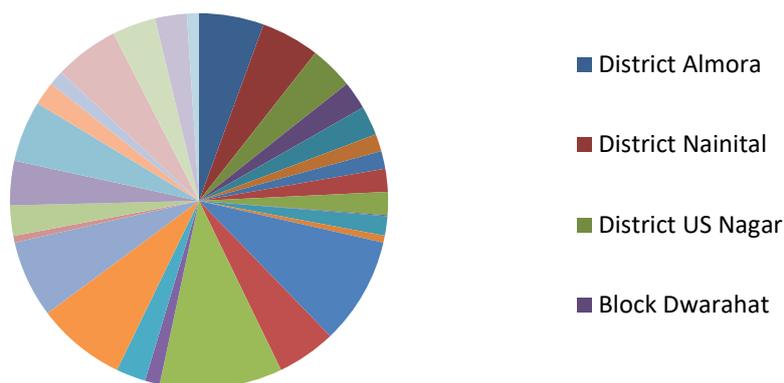
### 4.5 Ethical Considerations

### 5.1 Demographic Profile of the Sample

The demographic characteristics of the respondents are presented in Table 1. Frequencies and percentages were computed to describe the sample in terms of district, block, gender, category, locality, and parents' educational background.

|                    |              |     |      |
|--------------------|--------------|-----|------|
|                    | US Nagar     | 130 | 26.2 |
| Block              | Dwarahat     | 84  | 16.9 |
|                    | Hawalbagh    | 88  | 17.7 |
|                    | Haldwani     | 52  | 10.5 |
|                    | Dhari        | 53  | 10.7 |
|                    | Bhimtal      | 69  | 13.9 |
|                    | Rudrapur     | 69  | 13.9 |
|                    | Gadarpur     | 3   | 0.6  |
|                    | Bazpur       | 58  | 11.7 |
|                    | Langara      | 21  | 4.2  |
| Gender             | Male         | 321 | 64.6 |
|                    | Female       | 176 | 35.4 |
| Category           | General      | 365 | 73.9 |
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|                    | Below Matric | 192 | 38.6 |
|                    | Matric       | 130 | 26.2 |
|                    | Intermediate | 94  | 18.9 |
|                    | Graduation   | 36  | 7.2  |

**Table 1: Demographic Profile of the Sample (N = 497) Frequency**



**Interpretation:**

The sample represents students from three districts, with a majority from Almora (38.8%). Male students were 64.6%, while females were

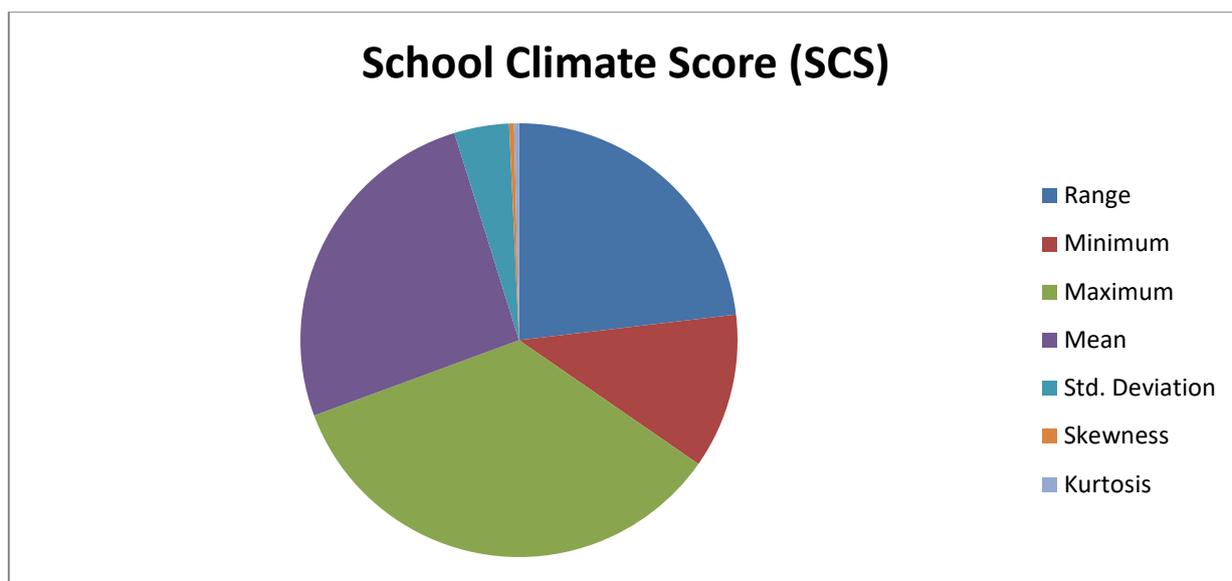
35.4%. Most students belonged to rural areas (53.5%). Regarding parental education, fathers predominantly had education up to intermediate

(36.8%) and mothers below matric (38.6%), indicating a generally moderate educational background.

### 5.2 School Climate Scores

**Table 2: Descriptive Statistics of School Climate Scores (N = 497)**

| Variable                   | Range | Minimum | Maximum | Mean  | Std. Deviation | Skewness | Kurtosis |
|----------------------------|-------|---------|---------|-------|----------------|----------|----------|
| School Climate Score (SCS) | 62.00 | 31.00   | 93.00   | 69.39 | 10.88          | -0.978   | 0.966    |



#### Interpretation:

The mean school climate score was 69.39, suggesting a moderate perception of school climate. Negative skewness (-0.978) indicates that most students perceived a favorable school environment.

The slightly positive kurtosis (0.966) reflects a moderate concentration of scores around the mean.

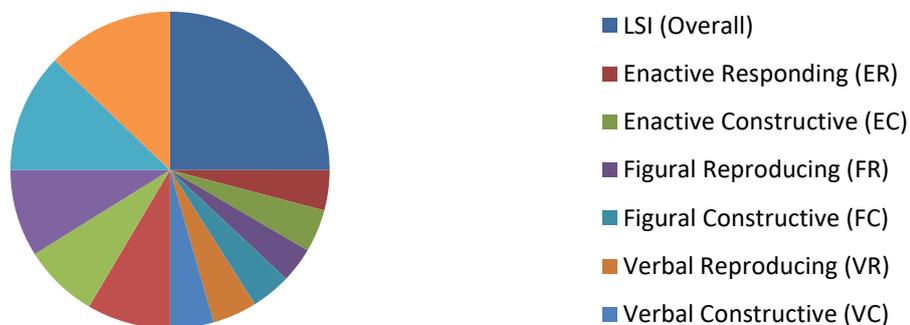
### 5.3 Learning Styles of Students

**Table 3: Descriptive Statistics of Learning Style Dimensions (N = 497)**

| Variable                   | Mean   | Std. Deviation | Skewness |
|----------------------------|--------|----------------|----------|
| LSI (Overall)              | 139.38 | 19.75          | -0.317   |
| Enactive Responding (ER)   | 22.88  | 4.59           | 3.712    |
| Enactive Constructive (EC) | 24.31  | 4.54           | -0.477   |
| Figural Reproducing (FR)   | 19.92  | 4.03           | 0.166    |
| Figural Constructive (FC)  | 22.58  | 5.13           | -0.325   |
| Verbal Reproducing (VR)    | 24.99  | 4.54           | -0.366   |
| Verbal Constructive (VC)   | 24.67  | 4.48           | -0.312   |
| Enactive (ER+EC)           | 47.19  | 7.44           | 0.507    |
| Figural (FR+FC)            | 42.50  | 7.80           | -0.173   |
| Verbal (VR+VC)             | 49.66  | 8.07           | -0.419   |

|                         |       |       |        |
|-------------------------|-------|-------|--------|
| Reproducing (ER+FR+VR)  | 67.79 | 9.80  | 0.038  |
| Constructive (EC+FC+VC) | 71.55 | 11.97 | -0.299 |

### 5.3 Learning Styles of Students Table 3: Descriptive Statistics of Learning Style Dimensions (N = 497) Mean



**Interpretation:**

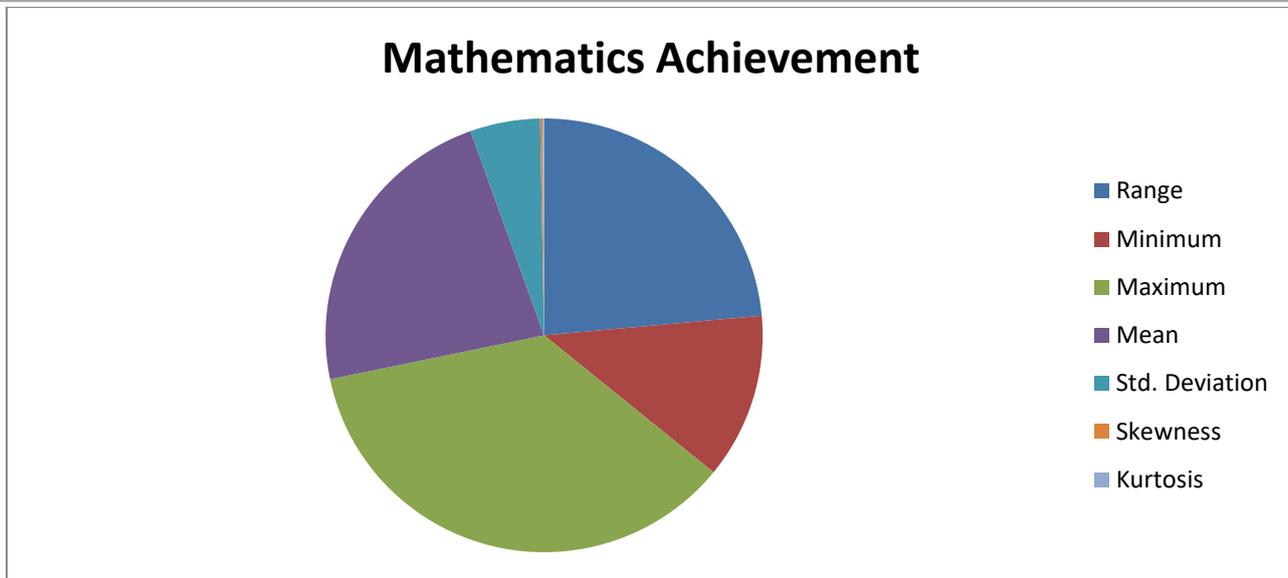
Students demonstrated diverse learning styles. Constructive learning styles (M = 71.55) were slightly higher than reproducing styles (M = 67.79). Among modalities, verbal (M = 49.66)

was the most preferred, followed by enactive (M = 47.19) and figural (M = 42.50), indicating a tendency towards active and meaningful learning.

**5.4 Mathematics Achievement**

**Table 4: Descriptive Statistics of Mathematics Achievement (N = 497)**

| Variable                | Range | Minimum | Maximum | Mean  | Std. Deviation | Skewness | Kurtosis |
|-------------------------|-------|---------|---------|-------|----------------|----------|----------|
| Mathematics Achievement | 65.00 | 34.00   | 99.00   | 62.86 | 14.28          | 0.490    | -0.313   |



**Interpretation:**

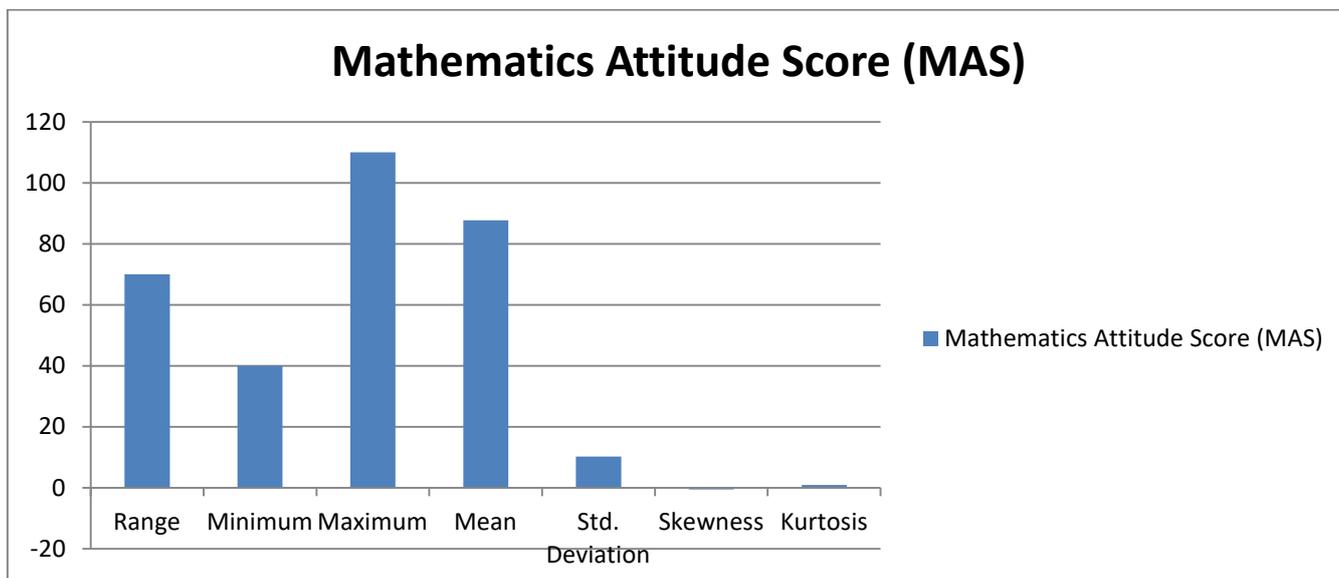
Mean achievement score was 62.86, with SD = 14.28. Positive skewness (0.490) suggests that some students scored lower, while kurtosis (-

0.313) indicates a relatively flat distribution, reflecting variability in mathematics performance.

**5.5 Mathematics Attitude**

**Table 5: Descriptive Statistics of Mathematics Attitude Scores (N = 497)**

| Variable                         | Range | Minimum | Maximum | Mean  | Std. Deviation | Skewness | Kurtosis |
|----------------------------------|-------|---------|---------|-------|----------------|----------|----------|
| Mathematics Attitude Score (MAS) | 70.00 | 40.00   | 110.00  | 87.67 | 10.19          | -0.539   | 0.950    |



**Interpretation:**

The mean attitude score was 87.67 (SD = 10.19), indicating generally positive attitudes toward mathematics. Negative skewness (-0.539) shows

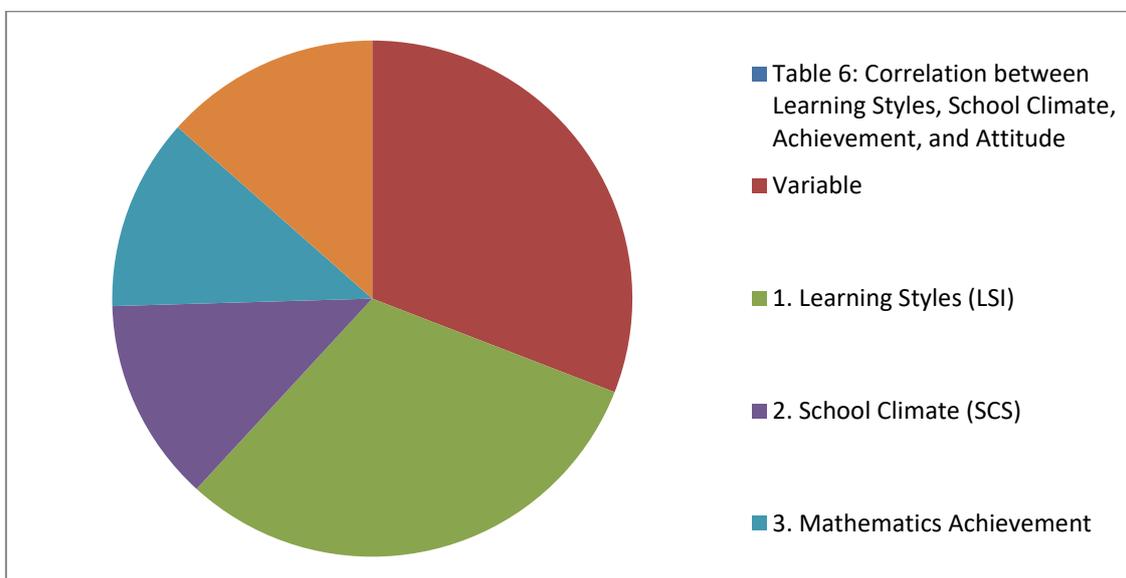
that more students held favorable attitudes. Kurtosis (0.950) reflects moderate clustering of scores around the mean.

**5.6 Correlation Analysis (Hypotheses Testing)**

Table 6: Correlation between Learning Styles, School Climate, Achievement, and Attitude

| Variable                      | 1     | 2     | 3     | 4     |
|-------------------------------|-------|-------|-------|-------|
| 1. Learning Styles (LSI)      | 1     | 0.412 | 0.389 | 0.435 |
| 2. School Climate (SCS)       | 0.412 | 1     | 0.448 | 0.471 |
| 3. Mathematics Achievement    | 0.389 | 0.448 | 1     | 0.402 |
| 4. Mathematics Attitude (MAS) | 0.435 | 0.471 | 0.402 | 1     |

Note:  $p < 0.01$



**Interpretation:**

- There is a significant positive correlation between learning styles and mathematics achievement ( $r = 0.389$ ,  $p < 0.01$ ).
- School climate is positively correlated with both achievement ( $r = 0.448$ ) and attitude ( $r = 0.471$ ).
- Learning styles also positively correlate with attitude ( $r = 0.435$ ), indicating that students with more constructive learning styles tend to have higher achievement and favorable attitudes.
- All hypotheses of no relationship are rejected.

**6. Discussion**

The present study investigated the achievement and attitude towards mathematics among senior secondary students in relation to their learning styles and perceived school climate. The results provide empirical insights into how individual learning preferences and environmental factors influence both cognitive and affective outcomes in mathematics education.

**6.1 Learning Styles and Mathematics Achievement**

The study revealed that students exhibiting more constructive learning styles (EC+FC+VC) performed better in mathematics than those with

predominantly reproducing styles. This aligns with the findings of Al-Balhan (2007), who emphasized that learner-centered instructional strategies aligned with students' preferred learning styles enhance academic performance. The positive correlation ( $r = 0.389$ ,  $p < 0.01$ ) between learning styles and achievement supports the notion that students who engage actively in constructing knowledge demonstrate superior understanding and problem-solving skills.

### 6.2 Learning Styles and Attitude Towards Mathematics

A significant positive relationship ( $r = 0.435$ ,  $p < 0.01$ ) was also observed between learning styles and students' attitude towards mathematics. Students with verbal and constructive learning styles reported more favorable attitudes. This finding is consistent with Kidejevich (2008) and Adnan et al. (2013), who reported that alignment of learning styles with instructional methods positively affects students' motivation and interest in the

underscore the importance of designing instructional strategies that cater to diverse learning styles within a nurturing school environment.

### 6.5 Educational Implications

1. Teachers should adopt learner-centered instructional strategies tailored to students' learning styles to enhance engagement and achievement.
2. Schools should foster a positive climate, emphasizing supportive teacher-student interactions, clear rules, and organized teaching practices.
3. Teacher training programs should include modules on learning styles, school climate, and differentiated instruction to prepare educators for effective classroom management.
4. Curriculum planners and policymakers should consider both individual learning preferences and school environment when designing programs aimed at improving mathematics education.

### subject. 6.3 School Climate and Academic Outcomes

School climate was found to have a strong positive relationship with both mathematics achievement ( $r = 0.448$ ,  $p < 0.01$ ) and attitude ( $r = 0.471$ ,  $p < 0.01$ ). Students perceiving a supportive, organized, and positive school environment demonstrated higher performance and more positive attitudes. This is in agreement with Preble and Newman (2006) and Abari & Ako (2021), who reported that supportive teacher-student interactions and a well-structured school environment facilitate better learning outcomes.

### 6.4 Implications of Combined Influence

The findings indicate that both individual and environmental factors jointly influence students' mathematics learning. Constructive learning styles, when supported by a positive school climate, appear to maximize academic achievement and promote a positive attitude. These results

## 7. Conclusion

The present study concludes that senior secondary students' achievement and attitude towards mathematics are significantly influenced by both their learning styles and perceived school climate. Specifically:

- Constructive and verbal learning styles contribute positively to both achievement and attitude.
- Students in supportive school climates demonstrate higher performance and more positive attitudes.
- A combination of learner-centered pedagogy and a favorable school environment is essential to optimize mathematics learning outcomes. These findings provide valuable insights for teachers, school administrators, and educational policymakers seeking to enhance mathematics education in secondary schools. Implementing instructional strategies aligned with students' learning preferences and improving the overall

school climate may result in higher academic achievement and a more positive learning experience for students.

### 7.1 Recommendations

1. Integrate learning-style-based activities in mathematics teaching.
2. Conduct teacher training programs focused on constructive learning methods and classroom management.

3. Develop school policies to promote positive climate and student engagement.

4. Encourage further research to explore longitudinal effects of learning styles and school climate on mathematics achievement.

5. Below is your APA 7th edition formatted reference list (35 sources, alphabetical) including the ones you provided plus additional relevant studies in mathematics education, learning styles, school climate, attitude, and achievement.

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