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Original Article

Influence of Teacher Characteristics on Pre-Tertiary Female Students' Attitudes and Perceptions Towards Mathematics

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Self-attitudes, Interest and Engagement, Social Influence, Teacher Characteristics, Peer Influence, Performance.

ABSTRACT

Teacher characteristics have been a primary dependent variable in pedagogical research. Nonetheless, its effect on students' attitudinal and perceptual predispositions towards the learning of mathematics is rarely explored especially from the female's perspective at the high school level. This study investigated the influence of teachers' characteristics on female students' attitudes and perceptions towards mathematics. Three research questions and two hypotheses guided the conduct of the study. A descriptive research design was employed. A multi-stage sampling approach was used to sample 380 female students in some selected Senior High Schools (SHS) in Ghana. In view of the ethical clearance granted by the University, the validity and reliability of the instruments used for data analysis were strictly observed in the conduct of the study. In particular, Multiple regression analysis and Descriptive statistics were employed to analyze the data. The findings of the study revealed negative attitudes and perceptions of female students towards the learning of mathematics. Further, the study showed that teacher characteristics significantly influenced female students' negative dispositions towards mathematics. Nonetheless, a moderate correlation between female students' attitudes and perceptions towards the learning of Mathematics was found. The study recommends that mathematics teachers employ differentiated pedagogy in the classroom context to motivate students to develop interest in the learning of mathematics especially, females at the SHS.

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INTRODUCTION

Mathematics education is a critical pillar of students' academic success and future career prospects (Asomah et al., 2025). The speculative performance of students in mathematics is not only a reflection of their mathematical proficiency but also an indicator of their overall cognitive abilities (Moreno-Guerrero et al., 2020). Recent research (Ampadu et al., 2020) has revealed the benefits of attitudes and perceptions towards mathematics as a significant contributory factor in students' mathematics achievement. Additionally, understanding how teachers' characteristics influence students' attitudes and perceptions towards mathematics achievements is crucial in improving mathematics education, particularly among SHS female students (Savelsbergh & Bakker, 2016). To a greater degree, the level of mathematics literacy among a country's populace determines its capacity to successfully participate in the modern global economy. Scientific, mathematical, and technological utilization have been connected to increased production and wealth generation in a country (Asomah et al., 2024b). That's why it's critical for a country to have highly qualified people endowed with resources in science, mathematics and technology (Asomah et al., 2024a).

Building and strengthening a strong base in science, mathematics, and technology is critical to Ghana's economic development (Fletcher, 2018). Students' attitudes and perceptions have been found to be extremely important in the discussion surrounding students' poor mathematics performance (Asomah et al., 2018a). Hence, the need to initiate a paradigm shift in enhancing students' attitudes and perceptions of mathematics (Chief Examiner's Report, 2020). This narrative requires the relevant stakeholders to review the variables that necessitate such abysmal performance of female students, particularly in the Ghanaian context. Perceptions and attitudes of female students, as well as the moderation effect of teachers, have been identified in the literature to be crucial (Asomah et al., 2018b). It is worth noting that, students with favourable attitudes and perceptions towards mathematics develop interest in studying mathematics (Asomah et al., 2018a). Thus, they find the subject enjoyable and as such recognise its importance and have faith in it (Kiwanuka et al., 2022) resulting in excellent performance in the same (Wigfield et al., 2020).

According to Blazar and Kraft (2017), teachers serve central roles in shaping students' attitudes and perceptions to enhance their performance in Mathematics. Teacher characteristics, such as pedagogical approaches, and interpersonal skills, have a profound impact on the classroom environment. These characteristics can either enhance or diminish the effects of students' attitudes and perceptions on their mathematical achievements. Understanding how these teacher-related factors moderate the relationship between attitudes and perceptions is essential for crafting effective interventions and educational strategies (Asomah et al., 2023). There is a wealth of research

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on gender disparities among mathematics students, but limited research has been done on the influence of teachers' characteristics on female students' attitudes and perceptions about mathematics particularly from the SHS perspective in Ghana. Hence, examining attitudes and perceptions of female students towards the learning of Mathematics as well as teachers' characteristics in the teaching of Mathematics cannot be understated. This is because the moderating influence of teacher traits is notably lacking in the significant corpus of research works on attitudes and perceptions about mathematics as well as the gender breach in mathematics performance. In effect, this piece of work aimed at investigating the influence of teachers' characteristics on female students' attitudes and perceptions towards mathematics cannot be over-emphasized.

RELATED LITERATURE AND STUDIES

Attitudes and perceptions have been shown to have an effect on students' mathematics scores (Asomah et al., 2024a; Devine et al., 2012) which could lead to high performance in mathematics (Moreno-Guerrero et al., 2020). To this end, Charlesworth and Banaji, (2019), highlighted how researchers continue to be divided on the effect of gender in relation to their attitudes and perceptions in learning Mathematics. In a more recent study, Anokye-Poku and Ampadu, (2020), also highlight gender-based attitudes and perceptions as problematics across the breadth and length of academic education, especially when it comes to studying mathematics. As a result, there have been varied views as to who does better than the other. Some studies have it that, males perform better than females (Okafor & Egbon, 2011), others put females as performing better than males (Banjong, 2014). While, some studies have shown no significant difference between male and female performance in Mathematics (Devine et al., 2012).

The recent abysmal performance of female students in mathematics therefore calls for concern, especially in the Yendi Municipality of Ghana. In particular, the West African Examinations Council [WAEC], Chief Examiner's report indicated that most students who attempted to answer questions related to the theory section got it wrong, especially among the females who participated in the mathematics examinations (Chief Examiner's report, [WAEC], 2023). Furthermore, available statistics from the office of the Yendi Municipal Education summarizes the dwindling performance of students in mathematics as worrying especially from the perspective of the female students in the Municipality (Ghana Education Service, 2023). Thus, out of a population of 655 female candidates who took part in the 2022 West Africa Senior Secondary Certificate Examinations [WASSCE] Exams, 471 of them had D7-F9 while 184 had A1-C6. Thus, 71.9% of the female candidates failed in mathematics while 28.1% passed (WAEC, 2023). This indicates that approximately 72% of the female students had their qualification into tertiary education truncated.

From the teachers' perspective, research shows that the influence of teacher characteristics contributed greatly to poor performance in Mathematics among students (Fosu et al., 2023). Thus, it's worth considering the effects of these variables on the learning of mathematics especially from the perspective of the female students in the Yendi Municipality in Ghana with the aim of promoting their performance. It is worth noting that in contemporary literature, gender differences in attitudes and perceptions of mathematics continue to attract the attention of researchers (Asamoah-Gyawu, 2020; Moreno-Guerrero et al., 2020). This study, therefore, seeks to examine the influence of teachers' characteristics on female students' attitudes and perceptions towards mathematics performance particularly, in the Northern region of Ghana.

Theoretical Underpinning of the Study

The study hinged on several theories: Social Cognitive Theory (SCT), Expectancy-Value Theory (EVT) and Attribution Theory (AT) In particular,

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SCT according to Bandura (1994) posited that, individual perceptions about their abilities to produce designated levels of achievement. As a result, people won't do things they believe they are incapable of doing and will only attempt what they believe they can achieve. According to Bandura (1994), the most effective way to build self-confidence beliefs is through mastery experiences. In light of this, Bandura's self-efficacy theory was employed as one of the theories that underpinned the conduct of this study. SCT provides a valuable framework for kind interaction between attitudes and mathematics achievement among female SHS students' particularly, considering moderating factors such as teacher characteristics. According to this idea, behaviour, environment and personal factors interact dynamically to form learning. SCT highlights the benefits of self-efficacy or individual confidence in their ability to perform specific tasks normally. Female SHS students are likely to develop positive attitudes and perceptions towards mathematics if they possess strong self-efficacy beliefs, which can be shaped by their previous successes, encouragement from others, and emotional well-being. Bandura's theory also stresses the influence of observing others (models) on learning and behaviour. The teaching methods and conduct of mathematics teachers can act as models for students. When teachers serve as positive role models, it can help foster favourable attitudes, perceptions and improved performance among female students.

In relation to the Expectancy-Value Theory (EVT), Wigfield and Eccles (2000), suggest that students' motivation and academic performance are shaped by their attitudes and beliefs about a subject, particularly their expectations of success and the perceived importance of the subject. According to Adelson and McCoach (2011), mathematics self-confidence refers to student's perception of themselves for learning the subject, encompassing their beliefs about their capacity to learn and excel in mathematics. Hannula, Maijala, and Pehkonen (2005), showed that students' self-confidence plays a crucial task in learning, which subsequently influences students' performance in mathematics. Alternatively, students with low self-confidence were enough to avoid mathematical challenges due to a lack of belief in their abilities. In contrast, confident students who are willing to face mathematical challenges subsequently enhance their academic success.

Finally, the Attribution Theory (AT) was employed in the current study. Thus, Weiner's Attribution Theory (Weiner, 1985), explores how individuals attribute their successes and failures. Students' attitudes towards mathematics may be influenced by how they attribute their past achievements and setbacks in the subject. Teacher characteristics play a role in shaping these attributions, affecting future attitudes and performance. Graham (2020), explains that attribution theory explores the reasons behind perceived success and failure. The theory's core concepts are analyzed, focusing on the origins and effects of perceived causality. Instructor behaviours, such as providing praise or criticism, can indirectly contribute to a perception of low ability, acting as antecedents or drivers of attributions. Hence, its use in explaining the moderation effect of teachers in aiding or otherwise the attitudes and perceptions of female students at the SHS in the study.

Conceptual Framework

The variables that informed the conduct of this study were consequently conceptualized and operationalized in this study. Figure 1 provides the conceptual framework of the study.

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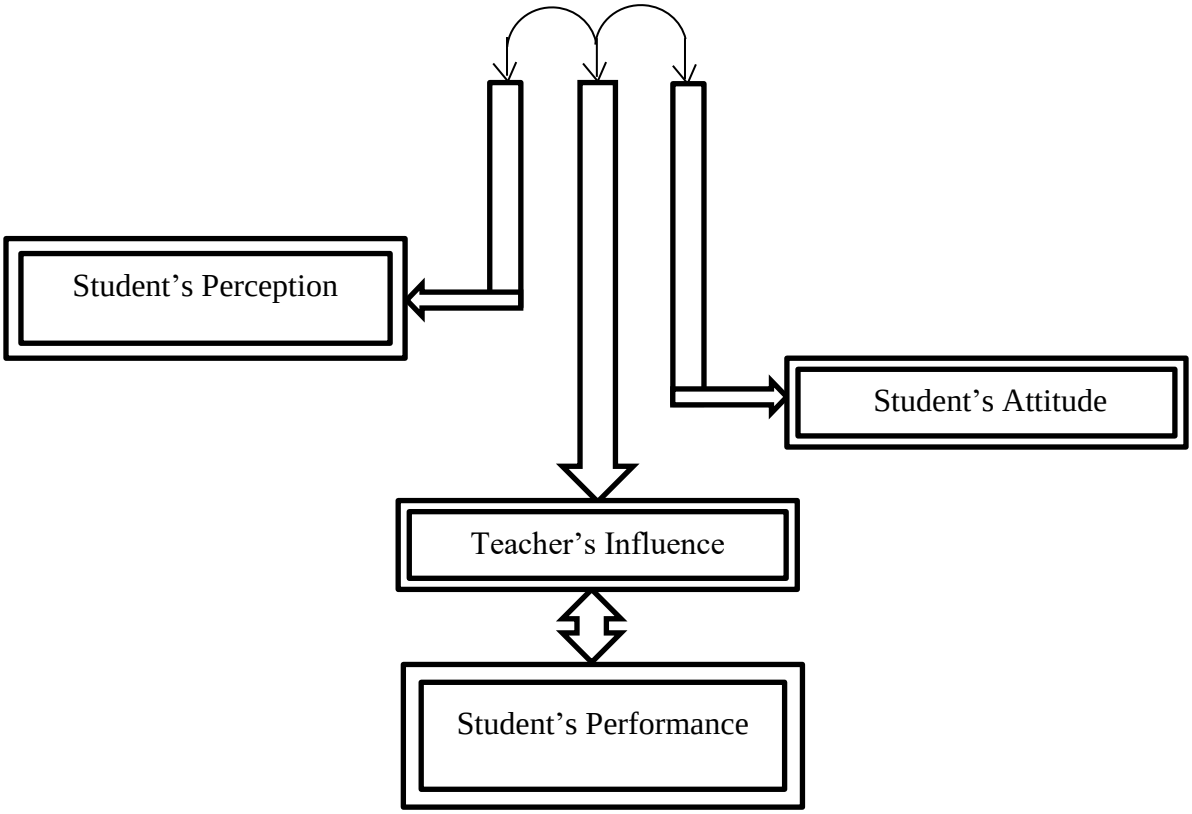
Figure 2: Conceptual Framework



Source: (Researchers' Own Construct, 2024)

In this study, it is hypothesized that improvement in the female SHS students' performance in mathematics (dependent variable) is contingent on the (independent variables) such as attitudes (self-attitudes, interest and engagement, social influence) and perceptions (self-perception of ability, perception of peer influence, difficulty perception, attitudes towards teaching and instructions) of the female students at the SHS. It is also observed that the influence of teachers' characteristics (personal traits/experience, communication skills, classroom management, pedagogical practices, motivations) also invariably affects both the dependent and the independent variables. Thus, mathematics teachers' positive and negative disposition in the classroom learning environment impacts the female student's performance in mathematics.

Research Questions

The following questions guided the conduct of the study

- What are the attitudes of female students towards the learning of Mathematics?
- What are the perceptions of female students towards learning Mathematics?
- What are teachers' characteristics towards Mathematics teaching and learning?

Research Hypothesis

Hypothesis 1:

H_0: There is no statistically significant relationship between female students' attitudes and perceptions towards learning Mathematics.

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Hypothesis 2

H_o: Teachers' characteristics will not significantly influence students' attitudes and perceptions towards learning Mathematics.

METHODOLOGY

Research Design

A descriptive survey design was employed in the study. Thus, the data was gathered using questionnaires. This design was considered suitable for the study since it sought to provide an overview of students' perceptions and attitudes towards mathematics and the consequent moderating impact of mathematics teachers in the classroom context. Additionally, the use of this design provides an avenue for research hypotheses to be developed and responded to as was used in this study (Creswell, 2015). Hence, its use in the current study was restricted to the examination of facts and positioned the researchers to verify why the realities of the teacher characteristics impacted the female students' attitudes and perceptions towards mathematics in the current context of the study (Jong & Voordt, 2002). To this end, using this design permitted the analysis of facts, while checking the developing trends in literature with an in-depth understanding of the research problem posed in this study.

Sample and Participants

The northern region is among the 16 regions of Ghana. It has been split into Northern, Savannah and North-East regions but the setting of the study was in the Yendi Municipality. The municipality is located along the eastern corridor road. The researcher deployed a multi-stage sampling procedure to determine the sample size for the work. In the first stage, the sample size determination was generated using the formula of Slovin;

$$n = \frac{N}{1+N(e)^2}$$

$N = Total\ population\ e = Error\ toleranc\ \ n = sample\ size$ N=6050

Level of Confidence interval is 95%, Margin = 5%, e=0.05.

$n = \frac{2381}{1+2381(0.05)^2}$, $n = \frac{2381}{1+2381(0.0025)}$, $n = \frac{2381}{1+5.9525}$, $n = \frac{2381}{6.9525}$, $n = 380.467$, $n = 380\ (approximately)$.

Therefore, the sample size for the work was 380 participating students. The work employed Slovin's sample size determination formula because it permits researchers to choose a representative sample from the entire population with the desired accuracy level (Ryan, 2013). In the second stage, the proportionate sampling technique was used to sample 210, 100 and 70 respondents from schools A, B, and C respectively using the formula (Number of respondents in a school divided by the total number of students in the six schools multiplied by the sample size. i.e. $\frac{x}{N}$ x sample size, where x = number of respondents in a school while N = number of students in the 3 three (3) schools). Since the schools differ in terms of population size, it was fair and proper for the purpose of generalization of the research findings to obtain a representative sample from each school. Thus, the use of proportionate sampling in stage two of the study. The final stage involved stratified and simple random sampling techniques where the students in each school were given equal chances of representation.

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Table 1: Demographic Characteristics of Respondents

Variable	Frequency	Per cent
Sex		
Females	380	100.0
Total	**380**	**100.0**
Age		
15-19	142	37.4
20-24	238	62.6
Total	**380**	**100.0**
School		
Public	142	37.4
Private	238	62.6
Total	**380**	**100.0**
Level		
Form three	380	100.0
Total	**380**	**100.0**

From the analysis of the data, there were only females (100%). Also, the majority of students were between the age of 20-24 years (62.6%), with a few students aged 15-19 years (37.4%).

Instrument

The study adopted a questionnaire with closed-ended items (Awuah, Nyarko & Owusu, 2009). The questionnaires contained sections on the influence of teachers' characteristics on female students' attitudes and perceptions about learning mathematics. The research instrument was sub-divided into three (3) sections; Section A, B and C. Section A focused on collecting students' biographical data and included four questions as well as questions on the attitudes of students towards the learning of Mathematics. Section B was on students' perceptions about learning Mathematics while Section C was on teachers' characteristics using a five-point Likert scale. Thus, a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5) was employed. Both questionnaires were in the English language as this is the medium of instruction used in SHS in Ghana. The respondents were admonished to specify the extent to which they agreed or disagreed with the items. To this end, a score of one (1) and five (5) were explained as very strong negative and positive observations respectively. Subsequently, an average score of 2.5 on the Likert scale was designated negative when it's below the average and positive when above it (Asomah et al., 2018a; 2018b; 2025).

Piloting of the Instrument

Students from SHS in Yendi Municipality with characteristics similar to those in the study area were chosen to take part in the pilot testing of the instrument. Perneger et al. (2015) suggest that a population sample size of thirty (30) is mostly accepted to ensure statistical reliability and identify key themes in a study. For this reason, 45 students were selected for the pilot phase. The pilot test yielded reliability coefficients ranging from 0.70 to 0.80. Feedback from this phase was used to refine the instrument, leading to the final Cronbach's alpha values reliability for the study. Specifically, the trustworthiness of the scores for the attitude subscales were; personal mathematics attitudes (5 items, α = .85), mathematics interest and engagement (8 items, α = .89), social influence of mathematics (5 items, α = .86). For the perception subscales, the reliability scores were: self-perception of ability (5 items, α = .85), perception of peer influence (7 items, α = .89), perceived difficulty of mathematics (4 items, α = .81), and attitudes towards the teaching of mathematics (8 items, α = .88). The teacher characteristics subscales

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had the following reliability scores: personal traits/expression (7 items, α = .89), mathematics communication skills (7 items, α = .86), mathematics classroom management (7 items, α = .87), mathematics pedagogical practices (10 items, α = .90), and motivation (4 items, α = .75). Kothari (2004) and Zohrabi (2013) indicate that reliability coefficients above 0.7 are considered acceptable, and those exceeding 0.8 are deemed excellent. To assess the content, criterion and face validity of the questionnaire, experts from the Teacher Education Department (TED), University of Ghana (UG) reviewed and provided feedback on the items tested. Their revisions were used to improve the items' relevance and consistency in achieving its intended objectives.

Data Collection and Analysis

The administration of the questionnaires with closed-ended items occurred in the respective schools of the respondents of the study. This was to report on the subscales in relation to the moderation effect of the teacher characteristics on female students' attitudes and perceptions towards mathematics (Neumann & Cohen, 2018). The second researcher submitted official letters of permission to heads of the SHS who in turn granted access to the assistant academic heads and heads of mathematics departments in the selected schools. In consultation with the heads of the mathematics departments, third-year female mathematics students were randomly selected from different programmes offered by the schools to participate in the study. The instruments were administered in the respective participating schools. This was to enable the authors to report on how things look like without disrupting the environment of the schools involved in the study (Harrison, Reilly & Cresswell, 2020). The respondents were given 1-hours to complete the three sections contained in the instruments. The completed instruments were retrieved immediately after the stipulated time period. Thereby, ensuring a 100% return rate during the data collection exercises stage of this study. Regression analysis and Pearson Correlation Coefficient were used to determine the Correlation between variables. In addition, descriptive statistics was employed to analyse survey responses. To present the findings, results were visualized using tables.

RESULTS

This section was organized into several parts along with the research questions asked in the study.

Research Question One

What are the Attitudes of Female Students Towards the Learning of Mathematics?

This research question seeks to identify students' attitudes towards learning of Mathematics. Participants were asked to specify their level of disagreement or agreement with items based on the sub-scales (Self-Perception, Interest and Engagement, Social Influence). Consequently, each of these domains that underpinned students' attitudes towards the learning of mathematics was presented in Tables 2, 3, and 4.

Personal Mathematics Attitude

The survey results indicate various perceptions among students regarding their attitudes towards learning Mathematics. Students generally disagreed that they were able to learn Mathematics by themselves (by themselves) without help from their classmates (M=1.98, SD=1.118). They also did not agree that they have the capacity to understand lessons taught in Mathematics in their class (M=2.11, SD=1.269). Table 2 presents the findings for personal Mathematics attitude.

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Table 2: Personal Mathematics Attitude

	Statement	M	SD
1.	I am capable of learning Mathematics on my own (by myself) without help from my classmates	1.98	1.118
2.	I have the capacity to understand lessons taught in Mathematics in my class	2.11	1.269
3.	I can perform well in Mathematics without help from my classmates	2.03	1.569
4.	I have confidence to learn Mathematics	2.23	1.256
5.	It is better to ask my Mathematics class teacher the answer to a Mathematics problem than to find out by trying a Mathematics problem	2.12	1.177
Overall		**2.09**	**1.27**

M-Mean, SD-Standard Deviation

Further, the results from Table 2 showed that many of the students disagreed that they had confidence in their ability to learn Mathematics (M=2.23; SD=1.256). Lastly, the students did not agree that it is better to ask their mathematics class teacher the answer to a mathematics problem than to find out by trying a mathematics problem.

Table 3: Mathematics Interest and Engagement

	Statement	M	SD
1.	There should be more Mathematics lessons each week in my class	2.26	1.296
2.	I would rather agree with the other Mathematics students in this class as to the solution to a problem than investigate it myself	2.08	1.171
3.	Mathematics is one of the most interesting school subjects.	2.15	1.230
4.	I really enjoy Mathematics lesson periods in my class	2.02	1.149
5.	The topics covered in Mathematics lesson are interesting	2.05	1.179
6.	I really expect more Mathematics lessons in my class	2.11	1.258
7.	I would enjoy school more if there were Mathematics lessons in my class	2.03	1.182
8.	I am interested in the learning of Mathematics	2.06	1.203
Overall		**2.09**	**1.20**

M-Mean, SD-Standard Deviation

Table 3 presents the results for Mathematics interest and engagement sub-scale. Students generally disagreed that there should be more Mathematics lessons each week in the class (M=2.26, SD=1.296). They also did not agree that they would rather agree with the other Mathematics students in this class as to the solution to a problem than investigate it themselves (M=2.08, SD=1.171). Furthermore, the students disagreed that they really expected more Mathematics lessons in my class (M=2.11, SD=1.258). The students also disagreed that they would enjoy school more if there were Mathematics lessons in the class (M=2.03, SD=1.182). Lastly, the students were not interested in the learning of Mathematics (M=2.06, SD=1.203)

Table 4: Social Influence of Mathematics

	Statement	M	SD
1.	I feel motivated to study Mathematics	2.61	1.346
2.	The learning of Mathematics enables you to think logically	1.97	1.174
3.	Mathematics serves as the foundation for technological advancement	2.07	1.220
4.	The learning of Mathematics enables me to pursue higher education	2.07	1.193
5.	Mathematics is very useful in our everyday activities at home	2.14	1.328
Overall		**2.17**	**1.25**

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M-Mean, SD-Standard Deviation

Table 4 presents the results for the social influence of Mathematics sub-scale. The survey results indicate various social influences among students regarding their attitudes towards learning Mathematics. Students generally disagreed that they feel motivated to study Mathematics (M=2.61, SD=1.346). They also did not agree that the learning of Mathematics enables you to think logically (M=1.97, SD=1.174). Moreover, they also did not agree that Mathematics serves as the foundation for technological advancement (M=2.07, SD=1.220). The students also did not agree that teaching and learning Mathematics enable them to pursue higher education (M=2.07, SD=1.193). Lastly, the students did not consent to the fact that Mathematics is very useful in their everyday activities at home (M=2.14, SD=1.328).

Research Question Two

What are the Perceptions of Female Students Towards the Learning of Mathematics?

This research question sought to identify students' perception towards the learning of Mathematics. Participants were asked to specify their level of disagreement or agreement to items based on sub-scales (self-perception of ability, perception of peer influence, perceived difficulty, dispositions towards teaching and learning). Thus, each of these domains that underpinned students' perception towards the learning of mathematics was presented in Tables 5, 6, 7 and 8.

Self-perception of Ability

The survey results indicate various perceptions among students regarding their attitudes towards learning Mathematics. Students generally disagreed that they were friendly to members in their Mathematics class (M=2.31, SD=1.412), and they did not enjoy being in the mathematics class (M=2.23, SD=1.280). Again, the students indicated that they did not take part (participate) in class discussions during Mathematics lessons (M =2.34; SD=1.331). This suggests an unfavourable attitudinal tendency towards the learning of Mathematics. Table 5 presents the results for self-perception.

Table 5: Self-Perception of Ability

	Statement	M	SD
1.	I am friendly to members of my Mathematics class	2.31	1.412
2.	I enjoy being in the mathematics class	2.23	1.280
3.	I take part (participate) in class discussions during Mathematics lessons.	2.34	1.331
4.	I make suggestions during Mathematics lessons.	2.23	1.238
5.	I explain my ideas in Mathematics to other students in the mathematics class.	2.27	1.254
Overall		**2.27**	**1.30**

M-Mean, SD-Standard Deviation

Further, the results from Table 5 show that they did not make suggestions during Mathematics lessons (M=2.23, SD=1.238). They also acknowledged that they did not explain their ideas in Mathematics to other students in the mathematics class. (M=2.27, SD=1.254). This indicates a level of discomfort and lack of confidence among students in pursuing elective Mathematics as a course of study.

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Table 6: Perception of Peer Influence

	Statement	M	SD
1.	I am able to study well with other colleague Mathematics students in my class.	1.75	.920
2.	I learn from other Mathematics students in my class.	2.32	1.289
3.	In my Mathematics class, there is high competition among us which leads to selfishness.	1.93	1.042
4.	I work happily with other students in my Mathematics class.	2.11	1.192
5.	My work receives as much praise as the other Mathematics students in this class.	1.96	1.061
6.	I get the same opportunity to answer questions during Mathematics lessons as the other students in the class.	2.03	1.174
7.	My Mathematics teacher trusts me to get work in Mathematics done just as he/she trusts the other Mathematics students in this class	1.93	1.033
Overall		**2.00**	**1.20**

M-Mean, SD-Standard Deviation

Table 6 presents the results for the perception of peer influence sub-scale. Students generally disagreed that they are able to study well with other colleague Mathematics students in the class (M=1.75, SD=.920). They also did not agree that they learn from other Mathematics students in the class (M=2.32, SD=1.289). Moreover, the students did not agree that in their Mathematics class, there is high competition among them which leads to selfishness (M=1.93, SD=1.042). Furthermore, the students disagreed that they get the same opportunity to answer questions during Mathematics lessons as the other students in the class (M=2.03, SD=1.174). Lastly, the students did not consent to the fact that their Mathematics teacher trusts them to get work in Mathematics done just as they trust the other Mathematics students in this class (M=1.93, SD=1.033).

Table 7: Perceived Difficulty Towards Teaching Mathematics

	Statement	M	SD
1.	I help other colleagues in this class who are having difficulty with their studies in Mathematics.	1.99	1.109
2.	When I have difficulty in studying Mathematics, I get help from other students in the mathematics class.	2.31	1.307
3.	I ask my Mathematics class teacher questions when I have difficulty following a lesson	2.20	1.240
4.	I get help from other students when I have difficulty in solving Mathematics questions.	2.27	1.336
Overall		**2.19**	**1.24**

M-Mean, SD-Standard Deviation

Table 7 presents the results for Perceived Difficulty towards teaching Mathematics sub-scale. Students generally disagreed that they help other colleagues in the class who are having difficulty with their studies in Mathematics (M=1.99, SD=1.109). They also did not agree that when they have difficulty studying Mathematics, they get help from other students in the mathematics class (M=2.31, SD=1.307). Moreover, they also did not agree that they asked their Mathematics class teacher questions when they had difficulty following a lesson (M=2.20, SD=1.240). Lastly, the students did not consent to the fact that they got help from other students when they had difficulty in solving Mathematics questions (M=2.27, SD=1.336).

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Table 8: Dispositions Towards Teaching Mathematics

	Statement	M	SD
1.	My Mathematics teacher takes a personal interest in my studies in Mathematics.	1.91	1.093
2.	My Mathematics teacher listens to and accepts my comments on how he/she teaches.	2.14	1.233
3.	My Mathematics teacher is willing to explain things again when asked to do so by any student during Mathematics lessons.	2.32	1.349
4.	My Mathematics teacher helps me when I have difficulty studying Mathematics	2.10	1.197
5.	My Mathematics teacher maintains a friendly student-teacher relationship with me even after his/her lesson has ended	2.03	1.146
6.	My Mathematics teacher talks happily about Mathematics as a subject, which encourages me and other students to study Mathematics	2.24	1.285
7.	My Mathematics teacher motivates me to bring out the best in me in Mathematics.	2.22	1.239
8.	My Mathematics class teacher asks me questions during the lessons	2.15	1.176
Overall		**2.13**	**1.21**

M-Mean, SD-Standard Deviation

Table 8 presents the results for dispositions towards teaching Mathematics sub-scale. Students generally disagreed that their Mathematics teacher takes a personal interest in their studies in Mathematics (M=1.91, SD=1.093). Again, students disagreed that their Mathematics teacher listens to and accepts their comments on how they teach (M=2.14, SD=1.233). Furthermore, students disagreed that their Mathematics teacher talked happily about Mathematics as a subject, which encouraged them and other students to study Mathematics (M=2.24, SD=1.285). Again, students disagreed that their Mathematics teacher motivated them to bring out the best in them in Mathematics (M=2.22, SD=1.239). Lastly, the students did not consent to the fact that their Mathematics class teachers asked them questions during the lessons (M=2.15, SD=1.176).

Research Question Three

What are Teachers' Characteristics Towards Mathematics Teaching and Learning?

This research question sought to identify teachers' characteristics towards teaching and learning Mathematics from the perspective of the female students on the subscales (personal traits/experience, Mathematics communication skills, Mathematics classroom management, Mathematics pedagogical practices and motivation). Accordingly, each of these domains that underpin teachers' characteristics towards Mathematics teaching and learning is presented in Tables 9, 10, 11, 12 and 13.

Personal Traits/Experience

The survey results indicate various personal traits/experiences regarding teachers' characteristics towards mathematics teaching and learning. The respondents generally disagreed that they felt happy towards emotional needs and academic initiated by the teachers in the class (M=2.08, SD=1.330) and that teachers were not patient when dealing with students' situations in the class (M=2.06, SD=1.180).

Table 9 presents the results for personal traits/experience.

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Table 9: Personal Traits/Experience

	Statement	M	SD
1.	I feel happy to learn Mathematics when the teacher attends to my needs in class.	2.08	1.330
2.	My teacher is patient when addressing Mathematics problem related issues in class	2.06	1.180
3.	My teacher is comfortable teaching Mathematics in class	2.03	1.178
4.	My teacher bounces back quickly when confronted with Mathematics problems during the lessons in class	2.07	1.140
5.	My teacher adapts quickly to new methods of solving Mathematics when questions are asked in class.	2.01	1.142
6.	My teacher engages us in collaborative activities with colleagues in the learning of Mathematics in class	1.93	1.059
7.	My teacher reflects on my learning practices to identify areas for improvement in the next lessons in Mathematics	1.98	1.119
Overall		**2.02**	**1.16**

M-Mean, SD-Standard Deviation

Further, the results from Table 9 show that their teachers do not engage them in collaborative activities with their colleagues in the learning of mathematics in class (M=1.93 SD=1.059). They also acknowledged that teacher do not reflect on their learning practices to identify areas for improvement in their next lessons in Mathematics (M=1.98, SD=1.119). This indicates a negative personal trait/experience regarding teachers' characteristics towards Mathematics teaching and learning as observed by the female students in their respective schools.

Table 10: Mathematics Communication Skills

	Statement	M	SD
1.	My teacher comfortably expresses mathematical concepts to my understanding in class	1.95	1.108
2.	My teacher effectively communicates mathematical ideas in class	1.94	1.033
3.	My teacher easily explains solutions to mathematical problems in class	1.99	1.122
4.	My teacher prefers putting us in groups to discuss mathematical problems in class	1.93	1.079
5.	My teacher uses effective communication to help in solving mathematical problems in class	1.96	1.065
6.	My teacher uses visual aids to explain mathematical concepts in class	1.87	1.009
7.	My teacher uses videos to explain mathematical concepts in my class	1.79	.892
Overall		**1.91**	**1.044**

M-Mean, SD-Standard Deviation

Table 10 presents the results for the mathematics communication skills sub-scale. Thus, from the perspective of the female students, teachers do not comfortably express mathematical concepts to their understanding in class (M=1.95, SD=1.108), and that, they were not able to effectively communicate ideas to students in their class (M=1.94, SD=1.033). Also, they generally disagreed that teachers easily explained solutions to mathematical problems in the class (M=1.99, SD=1.122). Also, the female students revealed that teachers generally disagreed with the use of visual aids to explain mathematical concepts in the class (M=1.87, SD=1.009). Lastly, mathematics teachers during their lessons do not use videos to explain mathematical concepts in the respective schools (M=1.79, SD=.892).

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Table 11: Mathematics Classroom Management

	Statement	M	SD
1.	My teacher ensures the good behaviour of students during Mathematics lessons	1.93	1.084
2.	My teacher maintains a conducive learning environment in class	1.97	1.097
3.	A well-managed classroom positively impacts the learning experience in Mathematics lessons	2.07	1.557
4.	My teacher uses diverse classroom management practices in a Mathematics class	1.94	1.012
5.	I experience difficulties in understanding mathematical concepts due to noise in the classroom	1.99	1.160
6.	The structure of the classroom environment contributes to the understanding of mathematical concepts in my class	1.98	1.081
7.	Student engagement plays an effective role in classroom management for learning Mathematics in my class	2.01	1.081
8.	I prefer mathematical tasks presented in an organized class to enhance the learning experience in my class	1.94	1.042
Overall		**2.19**	**1.24**

M-Mean, SD-Standard Deviation

Table 11 presents the results for the mathematics classroom management sub-scale. In particular, teachers were perceived as incapable of managing the classroom behaviour of their students (M=1.93, SD=1.084), and they were not capable of maintaining a conducive learning environment in the class (M=1.97, SD=1.097). Moreover, the students believe that they experience difficulties in understanding mathematical concepts due to noise in the classroom (M=1.99, SD=1.160). Also, they disagreed that the structure of the classroom environment contributes to the understanding of mathematical concepts in my class (M=1.98, SD=1.081). Likewise, student engagement plays an effective role in classroom management for learning Mathematics in class (M=2.01, SD=1.081). Lastly, the female students do not appreciate any mathematical tasks presented in an organized class to enhance their learning experience in class (M=1.94, SD=1.042).

Table 12: Mathematics Pedagogical Practices

	Statement	M	SD
1.	My teacher introduces new methods of teaching Mathematics to resolve our diverse learning needs in class	1.96	1.021
2.	My teacher integrates technology into his teaching in class	1.99	1.090
3.	My teacher engages me in a meaningful learning activity in class	1.94	1.148
4.	My teacher prefers hands-on learning activities in Mathematics class	1.91	1.127
5.	My teacher engages me to experience to solve problems in Mathematics class	1.81	1.023
6.	My teacher uses real-life examples and applications when teaching mathematical concepts in class	1.88	1.025
7.	Technology plays a role in enhancing my learning experience in mathematics classrooms	1.86	1.049
8.	Incorporating group work improves the understanding of mathematical concepts in my class	1.92	1.124
9.	I feel happy when using visual aids, manipulatives, and multimedia resources in Mathematics lessons in my class	1.84	1.014
10.	Assessment methods should be aligned with my teacher's teaching practices so as to effectively evaluate my understanding in class	1.89	1.043
Overall		**1.9**	**1.06**

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M-Mean, SD-Standard Deviation

Table 12 presents the results for the mathematics pedagogical practices sub-scale. The female students do not agree that mathematics teachers introduced new methods of teaching mathematics to resolve their diverse learning needs in class (M=1.96, SD=1.021). They also did not agree that teachers integrated technology into their teaching approach during mathematics lessons in class (M=1.99, SD=1.090). Also, they generally disagreed that teachers engage students in meaningful learning activities in class (M=1.94, SD=1.148). Again, the female students disagreed with the notion that they feel happy visual aids, manipulatives, and multimedia resources are introduced in mathematics lessons in class (M=1.84, SD=1.014). Finally, the students asserted that teachers do not consent to the fact that assessment methods should be aligned with pedagogical practices to evaluate mathematical understanding effectively in the class (M=1.89, SD=1.043).

Table 13: Motivation

Statement	M	SD
1. I am motivated to learn Mathematics in my class by my teacher	1.81	.999
2. My teacher ensures that I solve Mathematics problems in class after each lesson	1.78	.939
3. My teacher helps me set specific goals in learning Mathematics 1 in class	1.78	1.020
4. My teacher allows me to improve my understanding of Mathematics through the sharing of ideas with my colleagues in class	1.77	1.011
5. I am motivated to learn Mathematics in my class	1.81	.999
Overall	**1.79**	**0.99**

M-Mean, SD-Standard Deviation

Table 13 presents the results for the motivation sub-scale. Female students generally disagreed that they were motivated to learn mathematics internally in the class (M=1.81, SD=.999) and that their teachers were not capable of getting them to be persistent in solving mathematics problems in class during lessons (M=1.78, SD=.939). Also, they generally disagreed that teachers set specific goals for them to learn mathematics in class (M=1.78, SD=1.020). Teachers do not allow their female students to improve and understand mathematical concepts through the sharing of ideas with their colleagues in class (M=1.77, SD=1.01). Lastly, the students did not consent to the fact that they were motivated to learn Mathematics in class (M=1.81, SD=.999).

Hypothesis One:

H_0: There is no statistically significant relationship between female students' attitudes and perceptions towards the learning of Mathematics.

The Pearson product-moment correlation (r) was used to test this hypothesis. Table 14 shows the result.

Table 14: Relationship between Female Students' Attitudes and Perceptions

		Perceptions	Attitudes
Perceptions	Pearson Correlation	1	.645
	Sig (2-tailed)	.	.000
	N	379	378
Attitudes	Pearson Correlation	.645	1
	Sig (2-tailed)	.000	.
	N	378	379

**Correlation is statistically significant at the 0.01 level (2-tailed)

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From Table 14, the result clearly indicated a linear relationship between female students' attitudes and perceptions towards the learning of Mathematics. The study revealed a moderate correlation between students' attitudes and perceptions towards the learning of Mathematics (r = .645), however, the relationship was significant, p=.000).

Hypothesis 2

H_o: Teachers' characteristics will not significantly influence students' attitudes and perceptions towards the learning of Mathematics.

Table 15 shows the correlation results between the predictor variables and the criterion variable. Table 15 shows the multiple regression findings between the predictor variables and the criterion variable.

Table 15: Correlations between Variables

		Teacher characteristics	Attitudes	Perceptions
Pearson Correlation	Teacher characteristics	1.000	.564	.689
	Attitudes	.564	1.000	.645
	Perceptions	.689	.645	1.000
Sig. (1-tailed)	Teacher characteristics	.	.000	.000
	Attitudes	.000	.	.000
	Perceptions	.000	.000	.

Table 15 presents the correlation analysis between teachers' characteristics as well as students' attitudes and perceptions towards the learning of Mathematics. The correlation analysis revealed a statistically significant relationship among teachers' characteristics (p=.000) as well as students' attitudes (p=.000) and perceptions (p=.000) towards the learning of mathematics.

Table 16: Teachers' Characteristics on Students' Attitudes and Perceptions

Variables	B	R^2	*SE B*	*B*	*T*	*P*
Constant	23.444	.049	2.556		9.170	.000
Attitudes	.259		.060	.206	4.302	.000
Perceptions	.707		.061	.556	11.637	.000

F= 186.864 df= (377)

Table 16 indicates the results of a multiple linear regression analysis conducted to show the influence of teachers' characteristics on students' attitudes and perceptions towards the learning of Mathematics. The results revealed that the model predicted teachers' characteristics, F (377) = 186.864, p=.000. The model accounted for 4.9% of the variation in teachers' characteristics. This means that the model was responsible for 4.9% of the differences in teachers' characteristics.

DISCUSSIONS

In a nutshell, female students did not have favourable attitudinal and perceptual tendencies towards mathematics and this was influenced significantly by teachers' characteristics. This is discussed in relation to the research questions as delineated in this section.

Students' Attitudes Towards the Learning of Mathematics

The results of the analysis revealed that most female students had negative attitudes towards the learning of mathematics. Overall, the students asserted that they do not have a favourable attitudinal tendency towards the learning of Mathematics. The results of the present study corroborate the findings of Asomah et al., (2018b), who indicated that there were only a few factors contributing to students' favourable attitudes towards Mathematics. This is consistent with the findings of the current study as the attitudes of students were not generally positive.

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On the other hand, the findings of the present study disconfirmed the results of Asomah et al., (2018b), who found that generally, students had positive attitudes towards the learning of mathematics. Again, the findings of the present study were not consistent with the results of Mazana et al., (2019) whose findings demonstrated that while students initially have a positive attitude towards mathematics, as they advance to higher educational levels, their opinions gradually become less positive.

Students' Perceptions Towards Learning of Mathematics

The results of the analysis revealed that most female students had negative perceptions towards the learning of Mathematics. Overall, the students asserted that they do have a pessimistic view towards the learning of Mathematics. The findings of the present study confirm the findings of (Hagan et al., 2020), In particular, the findings of Hagan et al., (2020), found that perception and students' performance in mathematics had a very weak and negative association. Again, Uwineza et al. (2018) females displayed unfavourable opinions, which may account for their lack of confidence in mathematics which is consistent with the findings of the current study. Nonetheless, the findings of the current study are inconsistent with the studies of (Dauda et al., 2016; Asomah, et al., 2018a; 2023) who found that generally, students had positive perceptions towards the learning of mathematics. Also, the results of Asomah, et al., (2018a) and Asomah et al., (2022) demonstrated that although students' perceptions ranged from occasionally to frequently, they were generally more positive and favourable.

Teachers' Characteristics Towards Mathematics Teaching and Learning

The results revealed that teacher characteristics towards mathematics teaching and learning for all dimensions (personal traits/experience, communication skills, classroom management, pedagogical practices, motivation) were not favourable from the perspective of the female students. This finding is consistent with several studies (Etuk, Afangideh & Uya, 2013) which revealed that teachers possess communication skills, classroom management abilities, and content mastery in mathematics and these traits influence the teaching and learning of mathematics. Further, the current findings corroborated the studies of (Cantürk Günhan, 2020; Elçi, 2017; Evans & Field, 2020; Ren & Smith, 2018; Rubie-Davies, 2010) who also asserted significant correlations between teachers' lower mathematics achievement and unfavourable attitudes towards mathematics. Nevertheless, the findings of this study contradict the study of Mazana et al., (2020), who found that most teacher characteristics towards teaching and learning of mathematics on all the dimensions as measured in this study are positive towards mathematics teaching and learning.

Relationship Between Students' Attitudes and Perceptions Towards Learning of Mathematics

The study revealed a moderate correlation between students' attitudes and perceptions towards the learning of Mathematics, however, the relationship was significant. This means that as students' attitude towards the learning of mathematics surges, perception increases. The outcome of this study is consistent with that of Asomah (2022) whose study revealed a positively weak correlation between the student's perception and attitude towards mathematics. Again, the findings of Uwineza et al (2018) where female students studied, manifested negative perceptions with low confidence in mathematics. However, the present study unlike the findings of Kanafiah and Jumadi (2013) revealed a moderate correlation between students' perception and attitudes towards mathematics. Similarly, Giannoulas and Stampoltzis (2021) found no significant correlations between attitudes and perceptions towards Mathematics.

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Influence of Teachers' Characteristics on Students' Attitudes and Perceptions Towards the Learning of Mathematics

The regression equation predicted teachers' characteristics, F (377) = 186.864, p=.000. The variables accounted for 4.9% of the variation in teachers' characteristics. Thus, the variables employed in this study accounted for 4.9% of the differences in teachers' characteristics. The findings are therefore consistent with the study of (Etuk, Afangideh & Uya, 2013) who elucidated that, students' attitudes towards mathematics are significantly influenced by their perceptions of their teachers' communication skills, classroom management abilities, and content mastery in mathematics. Further, the findings of the present study are consistent with the findings of (Evans & Field, 2020; Ren & Smith, 2018) as their study also found significant correlations between higher mathematics achievement and favourable attitudes towards mathematics. On the contrary, the finding of this study was not in agreement with the findings of Mazana et al. (2020), who found that most lecturers and teachers of Mathematics have conflicting feelings about the abilities of their students and the environment in which they teach and learn.

CONCLUSIONS AND RECOMMENDATIONS

The study investigated the influence of teachers' characteristics on female students' attitudes and perceptions towards the learning of mathematics performance. The results of the study showed that female students had unfavourable attitudes and perceptions towards the learning of mathematics performance. The results also showed negative teacher characteristics towards teaching and learning mathematics from the perspective of the female students. Additionally, the study found that there was a significant relationship between female students' attitude and perceptions towards the learning of mathematics. Finally, the study further found that teachers' characteristics did significantly influence students' attitudes and perceptions towards the learning of mathematics.

Thus, Headteachers should consider contextualizing the social model theory advanced by Albert Bandura (1994) where successful female role models with excellent backgrounds in mathematics are used to provoke SHS female students' confidence levels and interest in mathematics. In addition, it is recommended, that mathematics teachers employ differentiated pedagogy in the classroom context to motivate students to develop interest in the learning of mathematics especially, females at the SHS.

Limitations and Further Research

The study was restricted to only students from public SHSs in the Yendi Municipality. Hence, a deficit in the generalization of the findings of this research over all SHS in Ghana. Further studies should be conducted to predict teacher characteristics that unearth detailed areas of interest that provoke female students' comprehension levels in mathematics.

Conflicts of Interest

The authors declare no conflicts of interest.

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