

Female Students' Attitude and Challenges towards Mathematics at the Department of Mathematics, Injibara College of Teachers' Education, Amhara Region, Ethiopia.

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Abstract

The main purpose of this research was to investigate the current status of female students' attitude and challenges towards mathematics at the Department of Mathematics, Injibara College of Teachers' Education (henceforth, Injibara CTE). The mixed methods approach with concurrent embedded strategy and descriptive survey design were used. A questionnaire survey was administered to 85 female mathematics department students using a comprehensive sampling technique. Moreover, face-to-face interviews were administered to the mathematics department head and the college deans purposively to gather pertinent data about the challenges female students face when learning mathematics. Both quantitative (mean, standard deviation, t-test, and post hoc test) and qualitative (thematic analysis and narration) data analysis techniques were employed. Cronbach's alpha coefficients for internal consistency reliability were calculated and reported to ensure the instrument validity. The main findings of this study were that female students in the department of mathematics had positive attitude toward mathematics on an overall and component-by-component basis (affective, cognitive, and behavioral). Moreover, they had shown a positive attitude across pre-service and in-service training programs. There was a statistically significant difference in attitude between the two programs in favor of the pre-service program. The challenges female students faced with learning mathematics were student-related, teacher-related, peer-related, material resource-related, and administrative-related. Recommendations include: mathematics teachers should encourage female students and use appropriate teaching methods, instructional media, and assessment techniques; college administration should provide material resources needed for mathematics learning; and additional research shall be conducted in this area to ensure validity and reliability.

Keywords: mathematics attitude, female students, challenges, Injibara College of Teachers' Education

Background of the Study

Mathematics is a way of life since it enables us to organize experiences and use them in life. Furthermore, it helps to prepare the student to live a life that is beneficial to himself or herself and society; it is a means of communication through the use of various symbols, numbers, and operations; it shapes the mind; and it prepares the student for various fields of study. Besides, mathematics enables students to think logically, creatively, and independently. As a result, all students should be given the opportunity and necessary support to learn mathematics in depth and with understanding (Kane & Mertz, 2012).

Lipnevich et al. (2011) explained that mathematical ability is crucial for the economic success of societies. Enu et al. (2015) added that mathematics is important for the scientific and technological development of countries. More mathematics lessons are likely to be taught in schools and colleges throughout the world than any other subject (Orton et al., 2004). Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. Teaching method, support of the school, family and students' attitude towards school affect attitudes towards mathematics. A positive attitude towards mathematics leads students towards success in the subject (Farooq & Shah, 2008).

Attempt to improve attitude towards mathematics at lower level provides base for higher studies in mathematics (Firew, 2014; Anokye-Poku & Ampadu, 2020).

Students' attitude towards mathematics is given various definitions in the literature. And hence, Kibrislioglu (2015) defines attitude towards mathematics as liking or disliking the subject; a tendency to engage in or avoid mathematical activities; a belief that one is good at or bad at mathematics; and a belief that mathematics is useful or useless. Tahar et al. (2010) define attitude as a positive or negative emotional disposition towards mathematics. Several studies have demonstrated that attitudes toward mathematics are directly and significantly associated with students' performance. In this regard, therefore, the study conducted by Mensah et al. (2013) found a significant positive correlation between students' attitude and performance. Nicolaidou and Philippou (2003) revealed in their study that attitude and achievement in mathematics are significantly related. Similarly, there is a strong positive correlation between students' attitude towards mathematics and their mathematics achievement (Firew, 2014; Gallagher & Kaufman, 2012).

Attitude refers to the learned tendency of a person to respond positively or negatively towards an object, situation, concept, or person. It is also regarded as a belief held by individuals that reflects their opinions and feelings and can sometimes manifest in behavior (Joseph, 2013). According to Syveda (2016), attitude is multidimensional. It takes into account three components: affect, cognition, and behavior. Mathematics attitude is directly and significantly influenced by factors such as parental influences, teacher affective support, and classroom instruction (Davadas & Lay, 2017). Davadas and Lay, in their studies, added that moderately predicting multifaceted factors influencing students' attitude towards mathematics include students' socio-economic status, gender, and past achievements. The research study conducted by Abaineh (2012) revealed the factors that significantly influence students' learning of mathematics, which comprised of teacher competency in mathematics education, school contexts and facilities, and students' self-directed learning and motivation.

Students' attitude toward mathematics is a major factor that might influence their performance in mathematics. Due to this, several studies have been conducted in different countries in order to find out the students' attitude towards mathematics (Tahar et al., 2010). Students' learning of and performance in mathematics is affected by a number of factors, including their attitude towards the subject, teachers' instructional practices, and the school environment (Mazana et al., 2019). Additionally, Willis (1995), Mensah et al. (2013), Nicolaidou and Philippou (2003), Firew (2014) and Anokye-Poku and Ampadu, (2020) described that poor attitude towards mathematics is one fundamental factor that can contribute to lower achievement of girls in mathematics.

Factors that can influence mathematics performance are demonstrated by Kupari and Nissinen (2013), who argue that poor performance in mathematics is due to factors related to students, teachers, and schools. Among the students' factors, attitude is regarded by many researchers as a key contributor to higher or lower performance in mathematics (Mohamed & Waheed, 2011; Ngussa & Mbuti, 2017). Furthermore, students' attitude towards mathematics and their mathematics performance are affected by teacher-student interaction in the classroom, teacher qualification and his/her teaching, teacher's and student's attitude towards mathematics, students' previous knowledge and experience, family background, and teaching-learning resources (Mulala, 2015). Moreover, the research conducted by Enu et al. (2015) revealed that the socioeconomic status of the parents, teacher quality and performance, availability of teaching resources, motivation on the part of both teacher and student, and the student's attitude towards mathematics affect mathematics achievement.

Statement of the Problem

Previous studies revealed that students' performance in mathematics is very low. It is also believed that failure in science and mathematics contributes to repeat class years and eventually leads to their dropping out. Moreover, mathematics education has had a bad reputation because many students do not like the mathematics and many students find it difficult (Eshetu et al., 2009, as cited in Awol, 2020). The negative attitude towards mathematics seems to be a source of challenge. When students have negative attitude towards mathematics such as perceiving as difficult and very confusing to learn, they will quickly lose interest and motivation to learn course, and hence students don't perform well in mathematics (Gomez-Chacon, 2000, as cited in Rameli & Kosnin, 2016). There has been a long-held belief about the nature and extent of gender-related differences in mathematics, with men considered to be better at it than women (Foley, 2016). Early findings showed that girls tend to have more negative attitudes towards mathematics than boys do, and those attitudes tend to become more negative as students move from elementary to secondary school or as grade levels advance (Zan & DiMartino, 2007).

There is a stereotyped belief in mathematics that mathematics is male-dominated. According to this study, nature tends to favor male dominance over the feminine gender in mathematics. The phenomenon is further confounded in Africa, where sex stereotyping is so pervasive that from birth, society fixes gender roles and conditions males to play and act within the confines of intellectually and physically more challenging tasks like construction, football, agriculture, fishing, and the like. Female students in the school tend to choose subjects like biology, whereas chemistry, physics, and mathematics are male-dominated fields (Fennema & Sherman, 1977, 1978, as cited in Abaineh, 2012).

Annot et al. (1989) described that girls are often discouraged from mathematical work in their primary years. They, therefore, dislike it in the secondary years and other higher studies. So, they drop it at high grade levels in far greater numbers than boys. As a result, fewer women are employed in industry in positions needing mathematical ability. Poor attitude towards mathematics is one fundamental factor that has contributed to lower participation and success of girls in mathematics (Willis, 1995). Attitudes tend to become more negative as student moves from elementary to secondary school or as grade level advances (Zan & DiMartino, 2007).

The students of mathematics department of Injibara CTE grade analysis were made for major courses for 2015 to 2019 entry in terms of modality (Generalist, Specialist and Linear) and program (Regular, Extension and summer). By taking training modality and program altogether, male (60% scored A or B and 40% scored C or below) and female (35.0% scored A or B and 65.0% scored C or below). Therefore, female students' mathematics major course grades were found much lesser than their counterpart male students. And hence, female students' college mathematics grade analysis together with others, served as a rationale for the searcher to go through this study.

Basic Research Questions

The basic questions that guided this study were:

1. What is the current status of female students' attitude towards mathematics at the department of mathematics, Injibara CTE?
2. Does female students' attitude towards mathematics differ significantly with regard to types of training programs (pre-service and in-service)?
3. What challenges do female students of the department of mathematics at Injibara CTE face in learning mathematics?

Objectives of the Study

The main purpose of this research was to investigate the mathematics department female students' attitude towards mathematics and challenges they face in learning of mathematics at Injibara College of Teachers' Education. The specific objectives that this study aimed to achieve were the following:

1. To investigate the current status of female students' attitude towards mathematics at Injibara CTE, department of mathematics.
2. To examine whether or not female students' attitude towards mathematics differs significantly with regard to types of training program (pre-service & in-service).
3. To explore the challenges, if any, that female students of the department of mathematics at Injibara CTE face towards learning mathematics.

Significance of the Study

The findings of this research are expected to benefit Injibara College of Teachers' Education, as an institution to understand the mathematics department female students' attitude towards mathematics and the potential challenges they face in learning mathematics and take remedial actions to these problems; the Amhara Region Education Bureau, Ministry of Education, Zone Education Department and other governmental and non-governmental agencies working in areas of education can use the findings of this research to improve the mathematics results of female students; the participants (female students of mathematics department of Injibara College of Teachers' Education) will be aware of the research findings and recommendations so far made; and finally, the research study can make valuable contribution to existing body of knowledge and can serve as source of data for further study.

Delimitation of the Study

This research was geographically bounded to Injibara CTE with the participants being female students of mathematics department. Besides, the study was delimited to variables in that attitude and challenges towards mathematics were independent variables whereas learning of achievement in mathematics was dependent variable.

Conceptual Framework of Mathematics Attitude

According to Zan and DiMartino (2007), a large portion of studies about attitude do not provide a clear definition of the construct itself, which can be suitable for all situations. The three definitions (simple definition, multidimensional definition, and bidimensional definition) given to attitude towards mathematics are the following: A simple definition of attitude describes it as the positive or negative degree of affect or emotional disposition toward mathematics, and According to a bidimensional definition, attitude toward mathematics is the pattern of beliefs and emotions associated with mathematics. A multidimensional definition divides mathematical attitude into three components: affective, behavioral (conative), and cognitive by the three models such as ABC, CAC and Tripartite. Tripartite Model: The attitude model proposed by Spooner (1992) is known as Tripartite Model. This model consists of three components of attitude such as Feelings, Beliefs and Behavior. Feeling includes an individual's emotion, Belief component includes an individual's cognitive response and the Behavior component includes an individual's overt actions such as past actions and future intentions associated with the attitude object.

ABC Model: ABC model is one of the most cited models of attitude. This model suggests that attitude has three elements i.e. Affect, Behavior and Cognition. Affect denotes the individual's feelings about an attitude object. Behavior denotes the individual's intention towards to an attitude object.

Cognitive denotes the beliefs an individual has about an attitude object (Eagly & Chaiken 1998; Van den Berg et al, 2006; as cited in Jain, 2014).

Cognitive-Affective-Conative (CAC) Model: In CAC Model, Schiffman and Kanuk (2007) suggested that attitudes are constructed around three components: (1) A cognitive component (beliefs); (2) An affective component (feelings); and (3) A conative component (behavior).

Multidimensional definition to mathematics attitude is in line with the models of attitude towards mathematics such as ABC, CAC and tripartite. In this view, an individual's attitude toward mathematics is defined in a more complex way by the emotions that he/she associates with mathematics (a positive or negative value), by the individual's beliefs towards mathematics, and by how he/she behaves towards mathematics (Hart, 1989). And hence, a multidimensional definition which sees and measures attitude towards mathematics in terms of three components was considered in this research.

Research Methodology

The main purpose of this research was to examine the current status or state of the female students' attitude towards mathematics and the challenges they face to learn mathematics at the mathematics department in Injibara CTE, Amhara Region, Ethiopia. In realizing its objectives, therefore, the study used pragmatism research paradigm, mixed methods approach with concurrent embedded strategy and descriptive survey design.

Research Paradigm: The research paradigm or worldview considered in this research was pragmatism. According to Creswell (2014), pragmatism as a philosophical worldview is problem-centered, pluralistic, and practice-oriented in the actual world. It also emerges from the effects of actions. Pluralistic refers to pragmatism using a variety of data gathering and analysis techniques; the pragmatism paradigm makes use of a mixed methods approach to gain a deeper understanding of a research subject. Additionally, according to Creswell, the pragmatic philosophical lens starts with a thorough survey in order to extrapolate the sample's findings to the entire community.

Research Method: To serve the prime purpose of this research, a mixed-methods approach (combined use of quantitative and qualitative data) was applied. Creswell (2014) describes how the use of quantitative and qualitative approaches in combination provides a better understanding of problems and complex phenomena than using either approach alone. A mixed methods approach, according to Poth and Munce (2020), integrates and synergizes multiple data sources, which can aid in the study of complex problems.

The strategy of the mixed methods approach employed in this research was concurrent embedded (nested). According to Terrell (2012), an unequal emphasis was placed during the use of the concurrent nested (embedded) strategy, and the concurrent nested (embedded) strategy helps to gain a broader perspective than could be obtained from using only the predominant data collection method. In this research, the quantitative method was emphasized (priori) and the qualitative method was supportive (nested), and hence, unequal emphasis was placed on these research methods.

Research Design: The research design used in this study was a descriptive survey, which consisted of both open-ended and closed-ended questions. By examining a sample of a population, this sort of research provides a numerical description of that population's attitude, beliefs, or trends. It is a quick and efficient way to collect a lot of data usually numerical data from a lot of people (McNeill & Chapman, 2005). Descriptive survey design has the ability to describe the characteristics of a specific situation, person, or group as they naturally occur (Kothari, 2004).

Population, Sample and Sampling Techniques

The source of data employed to gather information in this study were both primary and secondary data sources. The primary data used to collect the pertinent first-hand information were questionnaire and face-to-face interview. Moreover, document analysis of journal articles, books and other sources as secondary data were used. The major sources of this study were all female students of the mathematics department of Injibara CTE. Moreover, the mathematics department head and the deans of Injibara CTE were also informants. All female students of the mathematics department of the Injibara CTE were taken by the use of comprehensive sampling technique.

Data Collection Instruments

The data collection instruments employed to obtain the pertinent information about female students' attitude and challenges they face towards mathematics of the department of mathematics at Injibara College of Teachers' Education were two namely questionnaire and face to face interview. A questionnaire with both closed-ended and open-ended questions was administered to female students of mathematics department to assess their current status of attitude and challenges towards mathematics. Attitude measurement items were adapted from a modified Fennema-Sherman mathematics scale by Garriott et al. (2014) and the University of Massachusetts (2011). A five-point Likert scale, a type of psychometric response scale in which the respondents specify their level of agreement to a given attitude measurement item, was employed with five alternative points which range from strongly agree (5) through undecided (3) to strongly disagree (1). Besides, face to face interview was administered to mathematics department head and the college dean administration of Injibara CTE to explore challenges female students facing towards learning mathematics.

Data Analysis Techniques

In this study, both quantitative and qualitative methods of data analysis were used. Both descriptive and inferential statistics were used for analyzing the quantitative data gathered through closed-ended questions of a survey questionnaire. Thematic analysis, description and narration were employed for analyzing the qualitative data.

Analysis and interpretation

Table 1. One-sample t-test for female learners attitude towards mathematics across attitude components (N=85, Expected Mean=3.00 & confidence level $\alpha = 0.05$)

Component of Attitude	Mean	Standard Deviation (SD)	t	df	Sig.(2-tailed)
Cognitive	4.1368	0.40533	25.856	84	.000
Affective	4.0071	0.60647	15.309	84	.000
Behavioral	4.0912	0.56312	17.865	84	.000

A one-sample t-test result of female students' attitude across its three components, shown in Table 1, reveals that all components have positive values and there is a statistically significant difference between the expected mean (3.00) and the calculated mean, $t(84) = 25.86$, $p < .001$ for cognitive, $t(84) = 15.31$, $p < .001$ for affective and $t(84) = 17.87$, $p < .001$ for cognitive showing that the female students have favorable attitude towards mathematics for all three components.

Table 2. One-Sample t-test for female learners' Overall attitude (all three components together) towards mathematics (N=85, Expected Mean=3.00 & $\alpha = 0.05$)

Variable	Mean	SD	t	df	Sig.(2-tailed)
Overall Attitude	4.0783	0.41473	23.971	84	.000

The calculated mean (4.0783) and the expected mean (3.00), as the one-sample t-test in Table 2 showed, were found to have a statistically significant difference, $t(84) = 23.97$, $p < .001$. And hence, female students had shown a positive overall attitude (all cognitive, affective and behavioral attitude components together) towards mathematics with an observed standardized effect size of 2.60 which is large.

Table 3. Summary of independent samples t-test of female learners' attitude towards mathematics by program type and attitude components ($\alpha = 0.05$)

Attitude Component	Program type		Levene's Test for Equality of Variances		N	Mean	SD	t	Sig. (2-tailed)
			F	Sig.					
Cognitive	Pre-service	Equal variances assumed	0.451	.504	60	4.162	0.40015	0.906	.368
	In-service (Summer)				25	4.075	0.41926		
Affective	Pre-service	Equal variances assumed	0.414	.522	60	4.141	0.54967	3.358	.001
	In-service (Summer)				25	3.684	0.62495		
Behavioral	Pre-service	Equal variances assumed	0.173	.679	60	4.183	0.53996	2.403	.018
	In-service (Summer)				25	3.870	0.56651		

Independent samples t-test results illustrated in Table 3 showed that the female students' cognitive component of attitude didn't reveal a statistically significant difference between the pre-service and in-service (summer) programs, $t(83) = 0.91$, $p = .036$. However, for both affective and behavioral components of attitude, female students' perceptions at the pre-service and in-service training programs were found to have a statistically significant difference, $t(83) = 3.36$, $p = .001$ and $t(83) = 2.40$, $p = .018$ respectively in favor of pre-service program trainees. The effect size for the affective component and behavioral component became 0.8 (large) and 0.57 (medium) respectively.

Table 4. Summary of independent samples t-test on female learners' attitude towards mathematics with regard to program type ($\alpha = 0.05$)

Type of training program		Levene's Test for Equality of Variances		N	Average age	Mean attitude	SD	t	df	Sig. (2-tailed)
		F	Sig.							
Pre-service (Regular & Extension)	Equal variances assumed	0.096	.757	60	21	4.1625	0.3	3.03	83	.003
In-service (Summer)				25	29	3.8763	0.3			

The average age of female pre-service (prospective mathematics teachers) was 21, while that of in-service or summer program trainees was 29, as indicated in Table 4. The female students' attitude towards mathematics concerning the training program (pre-service and in-service) had shown a statistically significant difference vis-à-vis the type of training, $t(83) = 3.04$, $p = .003$ in favor of pre-service students with an effect size of 0.72, which is medium.

Although the quantitative data analysis showed that female students have a positive overall attitude towards mathematics, thematic analysis of supplementary data obtained from female students of the mathematics department through open-ended questions in a questionnaire and a face-to-face interview with the department head and dean administration of the Injibara CTE revealed five problems with learning mathematics, namely student-related, teacher-related, peer, material resource-related, and college administration-related problems.

Discussion

The major purpose of this research was to investigate the current status of the female students' attitude towards mathematics and the challenges they face in learning it. To this end, one-sample t-test results for female students' attitude with regard to attitude components in Table 1 and the overall female students' attitude towards mathematics in Table 2 revealed that female students of the mathematics department of Injibara CTE were found to have a positive or favorable attitude towards mathematics. The overall attitude as well as the attitude by components of female students towards mathematics, according to the category set based on the range of scores given by Jamil (2001), cited in Mohamed and Waheed (2011), were designated as high for the 3.67–5.00 value measure. This result is in agreement with the findings of Kosgey et al. (2015) and Anokye-Poku and Ampadu (2020), which state that girls have a positive attitude towards mathematics.

The result in Table 1 agreed with the ABC (affective-behavioral-cognitive) model, the CAC (cognitive-affective-conative) model, and the tripartite model of attitude suggested by Jain (2014) in that in each model the overall attitude was measured in terms of these three components, and all of them were pointing in the same direction. Moreover, the result was in accordance with the PPP (Positive-Positive-Positive) triode presented by Jain (2014) in that the combination occurs when all three components (affective, cognitive, and behavioral) were positive, signifying that the female students of the mathematics department at Injibara CTE have an overall positive attitude towards an attitude object, which is mathematics in this particular case. The effect sizes for the cognitive ($d = 2.8$), affective ($d = 1.66$), and

behavioral ($d = 1.94$) components of attitude are huge, very large, and very large, respectively, by the new effect size rule of thumb given by Sawilowsky (2009).

According to Anjum (2015), the findings of this study on female students' attitudes toward mathematics looked to be consistent with the idea that female students were found to be strongly opposed to the stereotype that mathematics is not their subject. This finding agreed with Mahanta (2012) and Mahapatra and Sahoo (2022), who reported that most of the girls have a positive overall attitude towards mathematics. Besides, the result of this study was in agreement with the finding of Awol (2020) who stated that students, regardless of gender differences, have an almost positive attitude toward mathematics.

Pre-service and in-service program female trainees have favorable component wise and overall attitude, and there was statistically significant difference between pre-service and in-service program trainees (Table 3) for both the affective and behavioral components of attitude in favor of pre-service program. However, a statistically significant difference was not observed between these two programs (pre-service and in-service) for cognitive component. This might be because relatively longer training time and planned tutorial support provided to pre-service program trainees might have positively affected their cognition, affect and behavior towards mathematics. Whereas, absence of planned tutorial support and short training time to in-service program might have negatively influenced their affect and behavior. Besides, teaching experience in-service program trainees had might have positive impact for their better knowledge, understanding and perceived importance in mathematics. This result matches with the findings of Reynolds and Walberg (1992), which describe that [sufficient time allotment] and appropriate use of the instructional time have an effect on students' attitude and their mathematics achievement.

As depicted in Table 4, female students of both pre-service (prospective math teachers who are not currently teachers) and in-service or summer (currently engaged in teaching) training programs, with an average age of 21 and 29 years, respectively, were found to have a positive attitude towards mathematics. The difference in attitudes of female students in pre-service and in-service training programs, on the other hand, was found to be statistically significant using an independent samples t-test measure with a medium post hoc test value for the observed standardized effect size in favor of pre-service program. This result is supported by the research findings of Dowker et al. (2012), which claim that students show a relatively positive attitude towards mathematics, but their attitude tends to be negative or less positive as they grow older; and the research findings by Yildiz et al. (2020) emphasized the pre-service training program apart from others, describing that female pre-service mathematics students were found to have a positive attitude towards mathematics.

Moreover, the results of the study by Kunwar (2020) revealed that the students' attitude towards mathematics is positive. However, the effects of students' attitude towards mathematics in terms of demographic variables such as age, gender, and others were found to be low. Besides, the attitude of students at different age level showed a greater decline in attitude as the students' grade level increased, which consequently results in an increase in age, making the results of this research worth coinciding with these research findings. The research finding by Syeeda (2016), in line with this research result, disclosed that age, socio-economic status, and language can influence attitude towards mathematics. Besides, a study by Mahapatra and Sahoo (2022) showed that girls' attitude towards mathematics declines with age. The results of this study show that girls initially have more positive attitudes towards mathematics, but as they progress through school they become more negative.

According to the quantitative data analysis, female students had an overall positive attitude toward mathematics. However, thematic analysis of data obtained from female mathematics department

students via open-ended questions in a questionnaire and a face-to-face interview with the department head and dean administration of the Injibara CTE revealed five problems with mathematics learning such as student-related, teacher-related, peer-related, material resource-related, and college administration-related.

The findings of this study were consistent with the findings of Rameli and Kosnin (2016), who asserted that challenges in mathematics learning include self-factors or student-related factors (negative perception), teacher factors (behaviors, practices, and characteristics), peer factors (lack of cooperation and support), and other factors (nature of mathematics and assessment pressure). Furthermore, Michael (2015) and Mazana et al. (2019) revealed that poor teaching (teachers' instructional practices), inadequate self-practice, and student motivation and attitude towards the subject and school environment are factors affecting students' learning of and achievement in mathematics; moreover, Sakilah et al. (2018) stated that students' assumptions that mathematics is a difficult lesson, a lack of use of teaching aids in learning mathematics, and teachers' use of less varied methods of teaching were challenges to the learning of mathematics; besides, Ayebale et al. (2020) explained that teaching methods, their attitude towards mathematics, the classroom environment, and their previous mathematics performance affect their learning. Likewise, problems associated with learning mathematics, as suggested by Gafoor and Kurukkan (2015), primarily include cognitive, affective, and environmental reasons and hence all these agree with the results of this study.

Tetteh and Agyei (2022) discovered that teaching-learning conditions, motivation, parents' educational background, valuing mathematics, and health and safety issues influence pre-service program trainees' mathematics performance. Besides, according to Awol (2020), factors contributing to poor performance include a lack of practice, a language deficit, societal influence, comprehensive subject content, a lack of background on the course, the development of the examination in mathematics, the absence of a tutorial, the need for more recreation, and a lack of confidence. Finally, the study conducted by Ober et al. (2021) has addressed that student background characteristics, parent characteristics and teacher support to students have an effect to mathematics learning and performance to it. And, therefore, the studies by Tetteh and Agyei (2022), AWOL (2020) and Ober et al. (2021) were all consistent with the findings of this research results.

Conclusion

The main purpose of this research was to investigate female students' attitude and challenges towards mathematics at the Injibara CTE. It was disclosed that female students had a positive attitude towards mathematics. Furthermore, female students in both pre-service and in-service programs were found to have a positive attitude toward mathematics, despite a statistically significant difference in favor of female students in the pre-service program. Besides, the challenges that female students face towards learning mathematics were classified into five thematic areas, such as student, teacher, peer, material resource, and administrative-related problems. In general, the investigated female students' favorable attitude towards mathematics will have profound importance for girls' learning of and achievement in it.

Recommendation

Based on the major findings of the research, the following recommendations were made:

- ✚ Department of Mathematics of Injibara College of Teachers' Education should create awareness to female students joining the mathematics department at the time of admission
- ✚ Department of Mathematics should teach female students about the basics of mathematics before beginning major mathematics courses so as to alleviate their poor mathematical background.

- ✚ Department of Mathematics should provide the tutorial service with due attention to low-performing female students.
- ✚ Department of Mathematics should establish/ strengthen mathematics club so that female students of the department can be fully engaged in to develop different mathematical skills.
- ✚ Mathematics teachers should properly plan and implement mathematics instruction, in doing so; they should use varied teaching methods, appropriate instructional media, and assessment and evaluation techniques.
- ✚ Mathematics teachers should motivate students, and encourage their active participation during the lesson through the use of both self- and cooperative-learning approaches.
- ✚ Female students of mathematics department should develop positive attitude towards mathematics as far as they have already joined it.
- ✚ Injibara College of Teachers' Education should strengthen the counseling and guidance service so as to provide the necessary advisory support.
- ✚ Injibara College of Teachers' Education should fulfill material resources necessary, including mathematics lab, so that female students can learn and achieve better in mathematics.
- ✚ Injibara CTE should encourage/provide reward to high performing female students.
- ✚ Further research should be conducted in this area to maintain the validity and reliability.

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