Mediterranean Journal of Social & Behavioral Research
2023, 7(3), 169-176
ISSN 2547-8559 (Print)
ISSN 2547-8567 (Online)
https://www.mjosbr.com/

Research Article **OPEN ACCESS**

Examining pre-service teachers' attitudes towards mathematics teaching and learning

Samuel Kwasi Kabbah [1], Saviour Kofi Kabe [1], Julius Kudjo Ametepey [1], Ernest Frimpong Akosah [1], Bernice Yawa Tsitsia [1]*

[1]Department of Mathematics/Computer Studies, Peki College of Education, Peki, GHANA
***Corresponding Author:** yawabern@pekicoe.edu.gh

Citation: Kabbah, S. K., Kabe, S. K., Ametepey, J. K., Akosah, E. F., & Tsitsia, B. Y. (2023). Examining pre-service teachers' attitudes towards mathematics teaching and learning. *Mediterranean Journal of Social & Behavioral Research*, 7(3), 169-176. https://doi.org/10.30935/mjosbr/13402

ABSTRACT

The study examined pre-service teachers' perceptions of learning mathematics. The study involved a total of 482 teacher-trainees from chosen colleges of education in Ghana. The study's methodology was quantitative. With the help of a structured survey questionnaire, the main data was gathered. The questionnaire was broken down into four sections (or constructs), including the students' self-sufficiency in learning mathematics, their perception of how learning mathematics has affected them, their concerns about learning mathematics, and their evaluations of Mathematics teaching. The constructs' respective Cronbach's alpha reliability analysis values are 0.96, 0.90, 0.96, and 0.93, respectively. The majority of the students demonstrated a high level of independence in their mathematics learning, according to the results of the teacher trainees' self-sufficiency assessments. The results also showed that 74.3% can solve math problems even when they struggle with a mathematics course; 53.6% have less trouble learning mathematics; 65.7% find solving mathematics problems to be very satisfying; and 60.2% have a lot of self-confidence in learning mathematics. Then, 63.7% of the students said they also really enjoyed mathematics. A total of 82.4% of students agreed that learning mathematics has a variety of positive effects on one's life. However, the mean value of about 2.8% confirmed that the majority of students disagreed with the claim that "the tutors incorporate information and communication technologies (ICTs) into the teaching of mathematics." The study suggests mathematics tutors at the colleges make efforts to incorporate ICTs in lessons, and management at the colleges also provide enough ICT resources and equipment to facilitate ICT integration.

Keywords: pre-service teachers, teacher trainees', self-sufficiency, self-efficacy colleges of education

Received: 16 Jan. 2023 ◆ Accepted: 27 May 2023

INTRODUCTION

One of the most effective means of enhancing success in life is education. Ghanaian schools cover a wide range of subjects. Some of which are regarded as essential and control how quickly students advance from one level to the next. Mathematics is one of these subjects. As a logical body of knowledge, mathematics can be used as a map to arrive at conclusions in a methodical way. It is a way of thinking that includes both working and how people organize their daily lives.

Several disciplines in higher education, including engineering, economics, agriculture, pharmaceuticals, and health sciences, among others, require an in-depth knowledge of mathematics (Gradwohl & Eichler, 2018). Mathematics plays crucial roles in a variety of fields in human endeavor. Thus, achievement in mathematics is seen as a key to economic success around the world, and studying mathematics improves precision, continuity, and mental discipline. Carey et al. (2017) affirmed that acquiring mathematics skills is important for successful and responsible problem solving and decision making in everyday life.

Many higher education fields, including engineering, economics, agriculture, pharmaceuticals, and health sciences, among others, require a solid grasp of mathematics (Gradwohl & Eichler, 2018). Mathematics is a very important part of many human endeavors. Thus, mastery of mathematics is regarded as a requirement for economic success on a global scale, and learning the subject improves one's accuracy, consistency, and ability to concentrate. According to Carey et al. (2017), understanding mathematics is essential for making ethical decisions and solving problems in daily life. Smith (2004) asserts that mathematics provides a useful and pervasive mental toolkit for consideration, generalization, and blending for its purported purpose. Smith (2004) purported that "acquiring at least fundamental mathematics skills, which are commonly referred to as "numeracy," is essential to individual citizens' life prospects and accomplishments" (p. 13). In a similar vein, Cuthbert and Standish (2017) argued that mathematics is a pervasive, socially constructed operation, meaning

that every known human society has created a mathematical lens on the world and utilized that lens to aid in its fostering. Cockcroft (1986, p. 1) wrote in his submissions that "it would be very difficult, perhaps impossible, to live a normal life in very many parts of the world in the twentieth century without making use of mathematics of some kind".

Due to its special nature, learning mathematics is obviously very important on a global scale. Smith (2004) affirmed that mathematics is unique in both good and bad ways. Due to its fundamental existence as a common abstract language, its foundation in the sciences, technology, and engineering, and its significance in a variety of contexts, including the workplace and for individual citizens in projecting its positive nature, it has an intrinsically different status from most other disciplines. On the downside, mathematics in particular is viewed as being challenging and boring and presents disproportionate challenges to achieving educational goals, both in terms of workload and the possibility of achieving high grades.

Theoretical Framework

Self-efficacy motivation model is the basis of this study. As a component of the social cognitive theory, Bandura (1986) first introduced the idea of self-efficacy (Kulcsár, 2020). Self-efficacy, according to Bandura (1986, 1997), is the belief that an individual can perform at a given level and exercise control over circumstances that have an impact on their lives. A comparable definition of self-efficacy according to García and de Caso (2006), includes self-assurance in one's capacity to complete a task and the conviction that one is endowed with the necessary skills. Suraya et al. (2009) claim that self-efficacy development is a continuous process. This is consistent with Bandura's (1989) claim that people's self-efficacy increases and develops as they learn new things, have new experiences, and have new insights throughout their lives.

In relation to mathematics learning, Negara et al. (2021) suggested that, in addition to cognitive factors, the affective factor plays a significant role in the learning of mathematics. One of the emotional components that can affect how students learn is self-efficacy (Skaalvik et al., 2015; Wang et al., 2017). According to Negara et al. (2021), student's actions, efforts, perseverance, flexibility in handling differences, and goal achievement are all indicators of how well they are doing in their inquiry, which has an effect on their self-efficacy. The ability to achieve the desired or determined level of performance, which will affect subsequent actions, is also mentioned as being a student's perception of self-efficacy.

Garfield and Ben-Zvi (2009) highlighted that in order to be able to do mathematics, it is important to have self-efficacy as well as knowledge of the subject. Thus, the motivation level demonstrated in the efforts made and the amount of time committed to finishing and producing certain results are determined by self-efficacy. Pintrich (1999) contends that the development of motivation, which promotes learner self-regulation and academic success, is significantly influenced by students' perceptions and attitudes toward their own mathematical self-efficacy.

Students' Attitude towards Mathematics Learning

A person's attitude towards mathematics can be described as "a liking or disliking of mathematics, 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" (Kibrislioglu, 2015, p. 65). Numerous studies have looked into how students' attitudes affect their mathematical learning behaviors. Positive attitudes towards any subject are frequently found to increase students' interest in and motivation for learning. Braten and Stromso (2006) were of the view that, students' attitudes towards learning have an impact on how actively they engage in learning activities. Research has it that a student's attitude affects how they perform in mathematics. It establishes the level of commitment, enthusiasm, and personal effort necessary for performance (Smith, 2004). Students' attitudes towards particular subjects have an impact on how well they perform in those subjects, either negatively or positively. As said by Tahar et al. (2010), one's attitude towards mathematics can be characterized by their positive or negative emotional response to it. It is thereby necessary for mathematics educators to take into consideration the attitude of students towards the subject as they teach them.

Students' Perceptions about Mathematics Learning

Teh and Fraser (1995) assert that considering students' perceptions is crucial when assessing the effectiveness of their education. Aguilar et al. (2012) and Rensaa (2006) assert that one's perceptions about learning mathematics are formed through previous interactions with the subject in accordance with its cognitive and affective components. The cognitive aspect refers to what a person thinks or believes about mathematics, whereas the affective aspect refers to the person's feelings or emotions regarding learning of the subject (Mensah et al., 2013). Similar to this, Di Martino and Zan (2011) asserted that the cognitive and affective components are intricately linked and interdependent, and that these components have an impact on how learners feel about learning the subject. The primary objective of this study is to examine college students' (pre-service teachers [PSTs]/teacher-trainees) perceptions of learning mathematics based on the aforementioned conceptual and literature explanations.

Objectives of the Study

Examining college students' (PSTs'/teacher-trainees') perceptions of learning mathematics is the main goal of this study. The study specifically investigates PSTs' perceptions on

1. Self-sufficiency of mathematics learning,
2. Impact of mathematics learning,
3. Concerns about mathematics learning, and,
4. Assessing of mathematics teaching.

METHODOLOGY

Research Design

Research design is described as a blueprint or a road map for data collection, measurement, and analysis (Kothari, 2004). This study seeks to examine PSTs' perceptions of mathematics learning. The study used a quantitative descriptive survey design approach. According to Kabungaidze et al. (2013), quantitative research design allows researcher to answer questions about relationships between measured variables in order to understand, predict, and monitor specific phenomena. The teacher-trainees of the public colleges of education in Ghana were the focal groups of this study. Five colleges of education were purposively selected as the study areas. Both level 100 and 200 (1st and 2nd year) students from the colleges formed targeted population. Purposive sampling technique was used to select 100 students from each of five study areas giving sample size of 500 students.

Table 1. Scale reliability statistics

Items	Mean	Cronbach's alpha
Self-sufficiency in learning mathematics	2.43	0.962
Impacts of mathematics	1.79	0.898
Attitude towards mathematics learning	3.39	0.958
Assessments based on mathematics teaching	2.11	0.927

Table 2. Frequencies on students' self-sufficiency in learning mathematics

Items	SA		A		N		D		SD	
	n	%	n	%	n	%	n	%	n	%
Even when I battle with mathematics I know I can solve problem.	204	42.3	154	32.0	68	14.1	30	6.2	26	5.4
I have less trouble learning mathematics than other subjects.	117	24.3	141	29.3	67	13.9	106	22.0	51	10.6
I get a great deal of satisfaction out of solving mathematics problems.	179	37.1	138	28.6	65	13.5	62	12.9	38	7.9
It makes me nervous to even think about having to solve mathematics problems.	102	21.2	124	25.7	77	16.0	104	21.6	75	15.6
I have a lot of self-confidence when it comes to mathematics learning.	146	30.3	144	29.9	75	15.6	63	13.1	54	11.2
I am able to solve mathematics problems without much difficulty.	92	19.1	140	29.0	90	18.7	101	21.0	59	12.2
I expect to do fairly well in any mathematics class I partake.	199	41.3	168	34.9	64	13.3	31	6.4	20	4.1
I am comfortable expressing my ideas on how to look for solutions to difficult problems in math.	124	25.7	172	35.7	75	15.6	72	14.9	39	8.1
I am comfortable answering questions in mathematics class.	121	25.1	146	30.3	97	20.1	68	14.1	50	10.4
I really like mathematics.	152	31.5	155	32.2	78	16.2	43	8.9	54	11.2

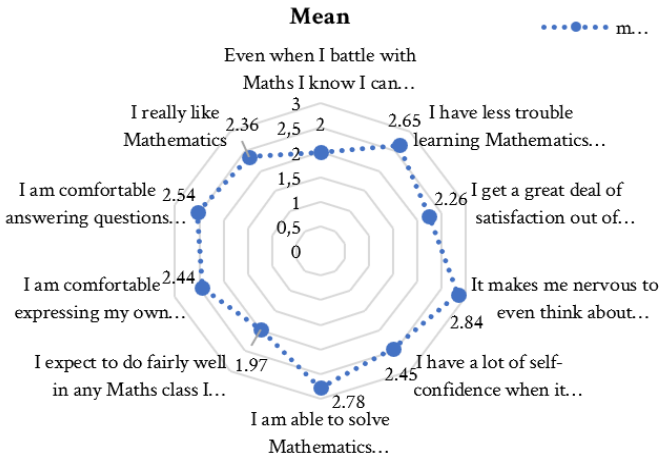

Figure 1. Mean responses on students' self-sufficiency in learning mathematics (Source: Field work in 2022)

Instrument Used

The primary data was collected using a structured survey questionnaire that extracted information about the teacher-trainees' perceptions of mathematics learning. Questions were measured using a 5-point Likert-type response format: (1=strongly agree [SA], 2=agree [A], 3=neutral [N], 4=disagree [D], and 5=strongly disagree [SD]). The questionnaire was divided into four sections: section 1 had 10 items to determine their self-sufficiency in the learning of mathematics. Section 2 contained seven items intended to examine the students' perceptions of the impact of mathematics learning. Section 3 included ten items that gathered information on students' attitudes towards mathematics learning, and section 4 presented items to examine students' assessments based on mathematics teaching.

The questionnaire was piloted with 30 teacher-trainees who were not involved in the main survey. Cronbach's alpha reliability analysis was conducted on the constructs separately. The alpha values produced on the constructs of self-sufficiency in learning mathematics, impact of mathematics learning, attitude toward mathematics learning, and assessments based on mathematics teaching are 0.962, 0.898, 0.958, and 0.927, respectively. The alpha values obtained showed strong internal consistency of items. Miller (2006) asserts that a reliable test produces coherent outcomes when it is being tested. In all, 500 questionnaires were distributed, and 482 (96.4%) were retrieved (**Table 1**).

Data Analysis

All copies of questionnaires were checked for precision and completeness and inputted into computer for coding. Microsoft Excel application tool and the Jamovi statistical data analysis package were used to analyze the statistical data. The descriptive statistics were displayed using charts, absolute numbers, and fundamental percentages.

FINDINGS

According to objectives, the study's findings are divided into four major categories. The frequencies of respondents on the created items are represented using frequency distribution tables. Figures are used to illustrate the mean scores of the responses to the items. Items are with the following values: 1=SA, 2=A, 3=N, 4=D, and 5=SD.

Objective 1

Objective 1 is to examine teacher-trainees' self-sufficiency in learning mathematics. **Table 2** and **Figure 1** present findings on the students' responses to their self-sufficiency in learning mathematics. From **Table 2**, more than 50.0% of the respondents either strongly agreed or agreed: they can solve mathematics problems even when they battle with a mathematics course; have less trouble learning mathematics; get a great deal of satisfaction out of solving mathematics problems; and, have a lot of self-confidence when it comes to mathematics learning. These responses had 74.3, 53.6, 65.7, and 60.2 percentages, respectively. The rest include I expect to do fairly well in any mathematics class in which I partake (76.2%); I am comfortable expressing my own ideas on how to look for solutions to difficult problems in mathematics (61.4%); I am comfortable answering questions in mathematics class (55.4%); and I really like mathematics (63.7%). Also, 53.1%, and 51.1% disagreed or strongly disagreed on the statements: "I feel nervous to even think about having to solve mathematics problems, and I am able to solve mathematics problems without much difficulty."

Table 3. Frequencies on impacts of mathematics learning

Items	SA		A		N		D		SD	
	n	%	n	%	n	%	n	%	n	%
Mathematics helps develop mind and teaches a person to think.	310	64.3	139	28.8	20	4.1	6	1.2	7	1.5
Mathematics is very worthwhile and a necessary subject.	233	48.3	176	36.5	45	9.3	15	3.1	13	2.7
Mathematics is important in everyday life.	304	63.1	138	28.6	22	4.6	8	1.7	10	2.1
Mathematics is one of the most important subjects for everyone to study.	249	51.7	136	28.2	44	9.1	23	4.8	30	6.2
I can think of many ways that I use mathematics outside school.	198	41.1	171	35.5	66	13.7	28	5.8	19	3.9
I believe studying mathematics helps me with problem solving in other areas.	176	36.5	161	33.4	86	17.8	29	6.0	30	6.2
A strong mathematics background could help me in my professional life.	243	50.4	146	30.3	44	9.1	24	5.0	25	5.2

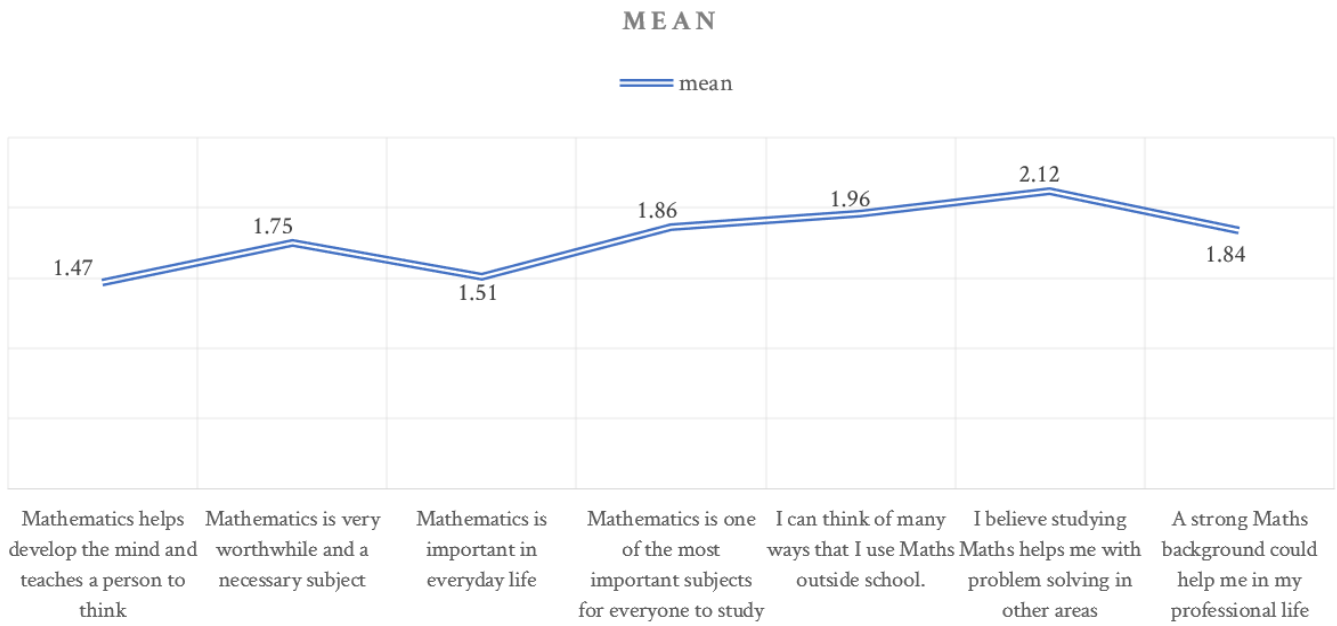

Figure 2. Mean responses on impacts of mathematics learning (Source: Field work in 2022)

Table 4. Students' attitude towards mathematics learning

Items	SA		A		N		D		SD	
	n	%	n	%	n	%	n	%	n	%
I want to develop my mathematical skills, but I fear mathematics.	123	25.5	109	22.6	48	10.0	108	22.4	94	19.5
I feel a sense of insecurity when attempting to solve mathematics problems.	89	18.5	105	21.8	67	13.9	129	26.8	92	19.1
I do not have a mathematical mind.	60	12.4	60	12.4	58	12.0	153	31.7	151	31.3
Mathematics is one of my most dreaded subjects.	87	18.0	76	15.8	56	11.6	125	25.9	138	28.6
I am unable to think clearly when working with mathematics.	73	15.1	70	14.5	64	13.3	150	31.1	125	25.9
Studying mathematics makes me feel nervous.	67	13.9	69	14.3	62	12.9	148	30.7	136	28.2
Mathematics makes me feel uncomfortable.	68	14.1	66	13.7	55	11.4	143	29.7	150	31.1
I am always under a terrible strain in mathematics class.	60	12.4	66	13.7	56	11.6	147	30.5	153	31.7
When I hear the word mathematics, I have a feeling of dislike.	63	13.1	63	13.1	48	10.0	136	28.2	172	35.7
I am always confused in mathematics class.	58	12.0	59	12.2	73	15.1	133	27.6	159	33.0

The radar chart in **Figure 1** graphically supports the results in **Table 2**. **Figure 1** shows the mean responses largely lying in the ranges between the least value of 1.97 and the highest value of 2.85. Majority of the items 1, 3, 5, 7, 8, and 10, respectively have mean responses of less than 2.5, and the items 2, 4, 6, and 9 have mean responses of 2.65, 2.85, 2.78, and 2.54, respectively.

Objective 2

Objective 2is students' perception on the impact of mathematics learning. From **Table 3**, totals of 93.1%, 84.8%, 91.7%, 79.9%, 76.6%, 69.9%, and 80.7%, strongly agreed or agreed, respectively on mathematics helps develop the mind and teaches a person to think; mathematics is a very worthwhile and necessary subject; mathematics is important in everyday life; mathematics is one of the most important subjects for everyone to study; mathematics can be used in many ways outside school; mathematics helps solve problems in other disciplines; and a strong mathematics background could help in professional life. The mean responses to the items mentioned are supported by the radar chart as presented in **Figure 2**. Mean values are 1.47, 1.75, 1.51, 1.86, 1.96, 2.12, and 1.84, respectively. This indicates that students largely agreed that mathematics positively impacts one's life in so many ways.

Objective 3

Objective 3 is assessing teacher-trainees' attitude towards mathematics learning. From the **Table 4**, 63.0%, 54.5%, 57.0%, 58.9%, 60.8%, 62.2%, 63.9%, and 60.6% respectively disagreed on statements: "I

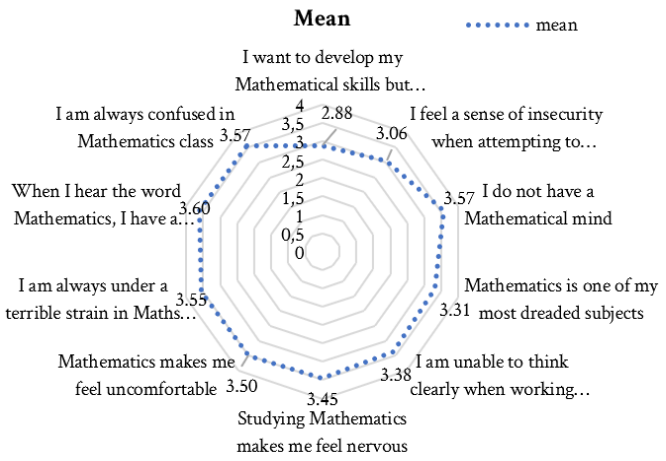

Figure 3. Students' attitude towards mathematics learning (Source: Field work in 2022)

do not have a mathematical mind"; "mathematics is one of my most dreaded subjects"; "I am unable to think clearly when working with mathematics"; "studying mathematics makes me feel nervous"; "mathematics makes me feel uncomfortable"; "I am always under a terrible strain in mathematics class"; "when I hear the word mathematics, I have a feeling of dislike"; and "I am always confused in mathematics class." Also, 41.9% and 45.9% of respondents, respectively, disagreed on the statements, "I want to develop my mathematical skills, but I fear mathematics" and "I feel a sense of insecurity when attempting to solve mathematics problems." The mean responses of items, as indicated in **Figure 3**, show a range from 2.9 to 3.6, indicating high disagreement on the items assessed.

Objective 4

Objective 4 is assess teacher-trainees' perceptions of mathematics teaching. **Table 5** illustrates students' responses to the items based on their perceptions of the teaching of mathematics. With the exception of the 6th item (the tutor incorporates information and communication technologies [ICTs] into mathematics teaching), which had a score of 44.8% (less than 50%), all the remaining seven items had values ranging from 62.9% to 88.0%. **Figure 4** also shows the mean responses to items. The items are tutor is knowledgeable in mathematics, tutor always gives exercises during class, tutor discusses the exercises or quizzes after marking, tutor uses varieties of techniques in delivering, tutor's methods of teaching mathematics cater for diverse needs, students are allowed to integrate technologies to solve mathematical problems, and tutor's method of teaching encourages an interactive mathematics classroom, received mean responses within the range of 1.64 to 2.38, indicating students' agreement on the variables tested. The variable "tutors incorporate ICTs into mathematics teaching" however, presents a mean response of 2.78, showing low agreement on teachers' incorporation of technologies in teaching mathematics.

DISCUSSION

This study examined the college of education students' perceptions of mathematics learning as a whole. All-inclusive, the study examined the students': self-sufficiency in learning mathematics, perceptions of the impact of mathematics learning; attitudes towards mathematics learning; and assessments of mathematics teaching.

The results of the assessments of the teacher-trainees' self-sufficiency in learning mathematics, showed respectively the mean scores of 2.0, 2.3, 2.4, 2.0, 2.4, and 2.4, on the items: even when I battle with mathematics I know I can solve the problem; I get a great deal of satisfaction out of solving mathematics problems; I have a lot of self-confidence when it comes to mathematics learning; I expect to do fairly well in any mathematics class in which I participate; I am comfortable expressing my own ideas on how to look for solutions to difficult problems in mathematics; and I really like mathematics. The item, "it makes me nervous to even think about having to solve mathematics problems," showed a mean score of 2.9; this sign posted much disagreement with the statement. The results on the items showed most of the students exerted much autonomy in learning mathematics. On the other hand, the items: "I have less trouble learning mathematics than other subjects", "I am able to solve mathematics problems without much difficulty" and "I am comfortable answering questions in mathematics class" respectively recorded the mean values of 2.7, 2.8, and 2.5. In addition, this shows that the majority of the students disagreed with the statements, indicating low self-containment on the items. In relation to this study, the study of Aisyah et al. (2020) showed that students' self-confidence in learning and mathematics learning achievement were both in the fair range.

In terms of assessing the students' perceived impacts of mathematics learning, the results showed all responses on items: mathematics helps develop the mind and teaches a person to think; mathematics is very worthwhile and a necessary subject; mathematics is important in everyday life; mathematics is one of the most important subjects for everyone to study; mathematics can be used in many ways outside school; mathematics helps in solving problems in other disciplines; and a strong mathematics background could help in professional life, showed respectively low mean values of 1.5, 1.8, 1.5, 1.9, 2.0, 2.1, and 1.8. The results showed students' high agreement that learning mathematics really positively impacts one's life in varying ways. In contrast, Chaudhry et al. (2019) reported that students do not believe that mathematics is useful in their everyday lives. The results on assessing the teacher-trainees' attitudes towards mathematics learning showed high mean values of 2.9, 3.1, 3.6, 3.0, 3.4, 3.5, 3.5, 3.6, 3.6, and 3.6, respectively on the items: I want to develop my mathematical skills, but I fear mathematics; I feel a sense of insecurity when attempting to solve mathematics problems; I do not have a mathematical mind; mathematics is one of my most dreaded subjects; I am unable to think clearly when working with mathematics; studying mathematics makes me feel nervous; mathematics makes me feel uncomfortable; I am always under a terrible strain in mathematics class; when I hear the word mathematics I have a feeling of dislike; and, I am always confused in mathematics class.

The analysis of the responses explained that the majority of the students do not have as much nervousness towards mathematics learning as the items tested portrayed. Instead, the students showed they have confidence in learning the course. This finding is in line with the findings of Akhter and Akhter (2018) and Kanafiah and Jumadi (2013), which suggested that students find mathematics to be a fascinating subject and are enthusiastic about learning it. In a similar vein, the studies of Setapa et al. (2016) and Zulkarnain et al. (2011) affirmed that students' attitudes towards mathematics are positive. This study's result is however contradictory to the study results of Chaudhry et al. (2019) and Setapa et al. (2016), which showed that students exhibited a negative attitude towards learning.

Table 5. Students' perceptions on mathematics teaching

Items	SA		A		N		D		SD	
	n	%	n	%	n	%	n	%	n	%
Tutor is knowledgeable in mathematics.	270	56.0	154	32.0	29	6.0	19	3.9	10	2.1
Tutor always gives exercises during class.	173	35.9	174	36.1	75	15.6	34	7.1	26	5.4
Tutor discusses the exercises or quizzes after marking.	158	32.8	155	32.2	101	21.0	39	8.1	29	6.0
Tutor uses varieties of techniques in delivering.	256	53.1	145	30.1	40	8.3	25	5.2	16	3.3
Tutor's methods of teaching mathematics caters for diverse needs.	188	39.0	172	35.7	60	12.4	38	7.9	24	5.0
Tutor incorporates ICTs into mathematics teaching.	87	18.0	129	26.8	122	25.3	91	18.9	53	11.0
Students are allowed to integrate technologies to solve mathematical problems.	132	27.4	171	35.5	85	17.6	50	10.4	44	9.1
Tutor's method of teaching encourages interactive mathematics classroom.	212	44.0	150	31.1	61	12.7	30	6.2	29	6.0

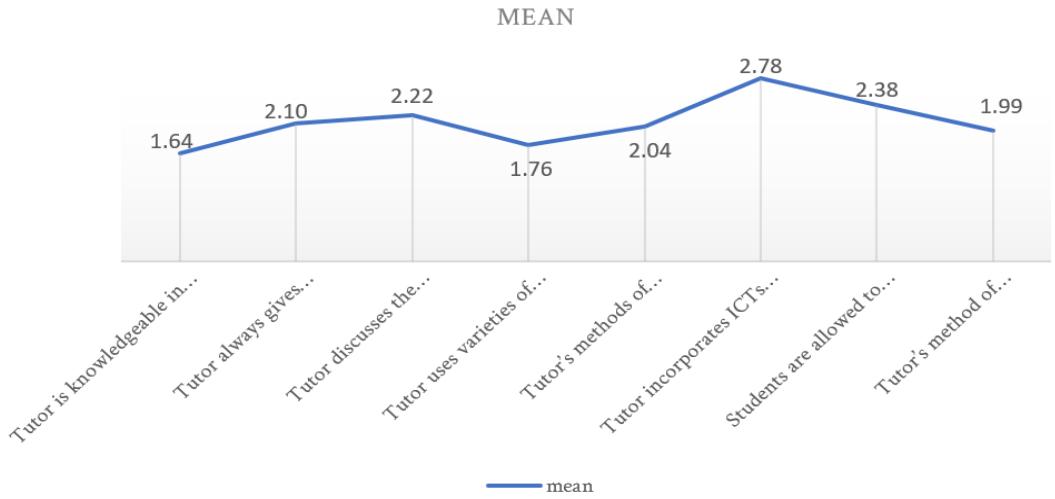

Figure 4. Mean responses on perception of mathematics teaching (Source: Field work in 2022)

The results of the trainees' perceptions on assessing the teaching of mathematics revealed the following items: the tutor is knowledgeable in mathematics; the tutor always gives exercises during class; the tutor discusses the exercises or quizzes after marking; the tutor uses a variety of techniques in delivering; the tutor's methods of teaching mathematics cater for diverse needs; students are allowed to integrate technologies to solve mathematical problems; and the tutor's method of teaching encourages an interactive mathematics classroom. The mean values are: 1.6, 2.1, 2.2, 1.8, 2.0, 2.4, and 2.0, respectively. This showed the students' high rate of assessment of mathematics teaching. The item: "tutor incorporates ICTs into mathematics teaching" obtained a high mean value of 2.8, indicating students' low assessment of tutors' incorporations of ICTs in teaching the course. The study by Ahmad and Aziz (2009), disclosed that students believe that their teachers' teaching methods have a direct and positive impact on their learning experiences. In relation to the integration of ICTs in teaching, Agyei and Voogt (2011) conveyed that as a result of teachers' low ICT competencies and access levels, the ICT integration has obtained low levels in their teaching activities.

CONCLUSIONS

This study investigated PSTs' perception of learning mathematics. self-sufficiency in learning mathematics, the effects of learning mathematics, attitudes toward learning mathematics, and evaluations of mathematics teaching were all examined. The results of this study demonstrated that most teacher trainees had developed strong resourcefulness sufficient for learning mathematics. The outcomes also demonstrated how strongly students supported the value of learning mathematics. Finally, the findings regarding the various approaches to teaching mathematics showed that all of the activities were supported by the students, with the exception of the factor involving the incorporation of ICTs by the tutors. The mean value of about 2.8 confirmed that the majority of students disagreed with the claim that "the tutors incorporate ICTs into the teaching of mathematics," hence, signifying mathematics tutors ICTs incorporation in teaching the course is low in the colleges.

Recommendations

This study suggests that mathematics tutors at the colleges try to use more ICTs when delivering lessons. This will give the students the chance to experiment and create their own models that can aid in their comprehension of mathematical ideas. Technology makes it simpler for students to share their research and take part in discussions about a range of subjects, according to Becta ICT Research (2003). Even without teacher supervision, technology helps students interact with one another. To improve mathematics teaching and learning, the management of the colleges of education should provide enough ICT resources and equipment, including network and internet accessibilities in the colleges.

Study Limitations

Despite the fact that the study's sample size was adequate to permit generalization of our findings, it is crucial to keep in mind that it was only carried out in one of Ghana's 10 regions. As a result, this outcome might not accurately reflect Ghana's overall situation. Future research may use samples from various geographical areas across nation.

Author contributions: All authors were involved in concept, design, collection of data, interpretation, writing, and critically revising the article. All authors approve final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Acknowledgements: The authors would like to thank teacher-trainees who took advantage of chance to voluntarily participate in this study. The authors would also like to thank everyone and all sources that has supported in various ways and improve the work.

Ethics declaration: The authors declared that the research presented in this article has been conducted in accordance with the highest ethical standards and guidelines. All procedures involving human subjects have been conducted in compliance with the applicable laws and regulations. Participants were provided with clear and comprehensive information regarding the purpose, procedures, potential risks, and benefits of the study, and their voluntary participation was ensured. The confidentiality and anonymity of participants have been strictly maintained. Data collection and analysis were conducted with integrity and in a transparent manner. All data were collected in accordance with established research protocols, and steps were taken to ensure accuracy and reliability. The data were analysed objectively, and appropriate statistical methods were applied. The authors further declared that they have complied with the publication ethics guidelines of the journal. The article does not contain any fraudulent or unethical data manipulation, and all sources and references have been appropriately cited. Any errors or inaccuracies discovered after publication will be promptly communicated to the journal and corrected. The authors declared that there are no conflicts of interest that could have influenced the design, conduct, or reporting of this research. The work presented in this article is original, and proper credit has been given to all sources used.

Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

REFERENCES

Aguilar, M. S., Rosas, A., & Zavaleta, J. G. M. (2012). *Mexican students' images of mathematicians* [Paper presentation]. The 12th International Congress on Mathematical Education.

Agyei, D. D., & Voogt, J. (2011). Use in the teaching of mathematics: Implications for professional development of pre-service teachers in Ghana. *International Journal of Science and Mathematics Education, 14*, 527-548. https://doi.org/10.1007/s10639-010-9141-9

Ahmad, F., & Aziz, J. (2009). Students' perception of their teachers' teaching of literature communicating and understanding through the eyes of the audience. *European Journal of Social Science, 7(3)* 17-26.

Aisyah, N., Akib, I., & Syamsuddin, A. (2020). Identifying the influence of anxiety and self-reliance in learning towards mathematics learning performance of elementary school's students grade V. *International Journal of Scientific & Technology Research, 9*, 3238-3242.

Akhter, N., & Akhter, N. (2018). Learning in mathematics: Difficulties and perceptions of students. *Journal of Educational Research, 21*(1), 147-163.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Prentice-Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*, 1175-1184. https://doi.org/10.1037/0003-066X.44.9.1175

Becta ICT Research. (2003). What the research says about using ICT in maths. *British Educational Communications and Technology Agency.* http://webarchive.nationalarchives.gov.uk/20130401151715/

Braten, I., & Stromso, H. (2006). Epistemological beliefs, interest, and gender as predictors of internet-based learning activities. *Computers in Human Behavior, 22*, 1027-1042. https://doi.org/10.1016/j.chb.2004.03.026

Carey, E., Hill, F., Devine, A., & Szucs, D. (2017). The modified abbreviated math anxiety scale: A valid and reliable instrument for use with children. *Frontiers in Psychology, 8*, 11. https://doi.org/10.3389/fpsyg.2017.00011

Chaudhry, A. Q., Malik, M., & Rafiq, N. (2019). Attitude of students about learning mathematics at elementary level. *Journal of Elementary Education, 29*(1), 109-120.

Cockcroft, W. H. (1986). Mathematics counts. HMSO.

Cuthbert, A. S., & Standish, A. (Eds.). (2021). *What should schools teach?: Disciplines, subjects and the pursuit of truth.* UCL Press. https://doi.org/10.2307/j.ctv14t475s

Di Martino, P., & Zan, R. (2011). Attitude towards mathematics: A bridge between beliefs and emotions. *The International Journal on Mathematics Education, 43*(4), 471-482. https://doi.org/10.1007/s11858-011-0309-6

Garfield, J., & Ben-Zvi, D. (2009). Helping students develop statistical reasoning: Implementing a statistical reasoning learning environment. *Teaching Stattistics, 31*(3), 72-77. https://doi.org/10.1111/j.1467-9639.2009.00363.x

García, J. N., & de Caso, A. M. (2006). Changes in writing self-efficacy and writing products and processes through specific training in the self-efficacy beliefs of students with learning disabilities. *Learning Disabilities: A Contemporary Journal, 4*(2), 1-27.

Gradwohl, J., & Eichler, (2018). Predictors of performance in engineering mathematics. *University of Agder.* https://hal.science/hal-01849947v1/file/INDRUM2018_gradwohl_eichler_final_revised.pdf

Ismail, M. E., Amiruddin, M. H., Sulaiman, J., & Ismail, I. M. (2020). Effects of using "welding position tutorial" (wpt) applications for the fillet joints by using android platform. *International Journal of Management, 11*(10).

Kabungaidze, T., Mahlatshana, N., & Ngirande, H. (2013). The impact of job satisfaction and some demographic variables on employee turnover intentions. *International Journal of Business Administration, 4*(1), 53-65. https://doi.org/10.5430/ijba.v4n1p53

Kanafiah, S. F. H. M., & Jumadi, A. (2013). Students' perception towards mathematics: Attitudes, interests and lecturers' teaching. In *Proceedings of the International Symposium on Mathematical Sciences and Computing Research.*

Kibrislioglu, N. (2015). An investigation about 6th grade students' attitudes towards mathematics. *Procedia-Social and Behavioral Sciences, 186*, 64-69. https://doi.org/10.1016/j.sbspro.2015.04.024

Kothari, C. R. (2004). *Research methodology: Methods & techniques.* New Age International.

Kulcsár, N. (2020). Mathematics self-efficacy, learning approaches, academic performance in the light of the number of failed attempts. In *Proceedings of the SEFI* (pp. 297-307).

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: Does the teacher attitude matter? *Journal of Education and Practice, 4*(3), 132-139.

Miller, D. J. (2006). Technological diversity, related diversification, and firm performance. *Strategic Management Journal, 27*(7), 601-619. https://doi.org/10.1002/smj.533

Negara, H., Nurlaelah, E., Wahyudin, W., Herman, T., & Tamur, M. (2021). Mathematics self efficacy and mathematics performance in online learning. *Journal of Physics: Conference Series, 1882*, 012050. https://doi.org/10.1088/1742-6596/1882/1/012050

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research, 31*, 459-470. https://doi.org/10.1016/S0883-0355(99)00015-4

Rensaa, R. J. (2006). The image of a mathematician. *Philosophy of Mathematics Education Journal, 19*, 1-18.

Setapa, M., Mustapha, W. A. H. W., Kanafiah, S. F. H. M., & Zaman, L. K. (2016). A study of students' perception toward mathematic. *Journal of Applied Environmental and Biological Sciences, 6*(7), 28-33.

Skaalvik, E. M., Federici, R. A., & Klassen, R. M. (2015). Mathematics achievement and self- efficacy: Relations with motivation for mathematics *International Journal of Educational Research, 72*, 129-136. https://doi.org/10.1016/j.ijer.2015.06.008

Smith, A. (2004). *Making mathematics count. The report of Professor Adrian Smith's inquiry into post-14 mathematics education.* The Stationery Office Limited.

Suraya, A., Yunus, M., Zah, W., & Ali, W. (2009). Motivation in the learning of mathematics. *European Journal of Social Sciences, 7*(4), 93-101.

Tahar, N. F., Ismail, Z., Zamani, N. D., & Adnan, N. (2010). Students' attitude toward mathematics: The use of factor analysis in determining the criteria. *Procedia Social and Behavioral Research, 8,* 476-481. https://doi.org/10.1016/j.sbspro.2010.12.065

Teh, G. P. L., & Fraser, B. J. (1995). Development and validation of an instrument for assessing the psychosocial environment of computer-assisted learning cassrooms. *Journal of Computer and Education Research, 12*, 177-193. https://doi.org/10.2190/PKXE-VTTA-4PTA-B3JW

Wang, Y., Liang, J., Lin, C., & Tsai, C. (2017). Identifying Taiwanese junior-high-school students' mathematics learning profiles and their roles in mathematics learning self-efficacy and academic performance Learn. *Individual Differences, 54*, 92-101. https://doi.org/10.1016/j.lindif.2017.01.008

Zulkarnain, Z., Saim, M., & Talib, R. A. (2011). *Hubungan antara minat, sikap dengan pencapaian pelajar dalam kursus CC301–quantity measurement* [*The relationship between interest, attitude and student achievement in the CC301-quantity measurement course*]. https://www.academia.edu/7322625/hubungan

❖❖❖