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Assessing Preservice Mathematics Teachers' Perception of their Readiness for Senior High School Mathematics Instruction

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Abstract
This study investigated the perspectives of pre-service mathematics teachers regarding their readiness to teach mathematics at the senior high school level. The study utilised a descriptive survey design and positivist methodology. A multi-stage sampling approach was utilised. The study involved 110 volunteers from a public university in Ghana. Information was gathered through a questionnaire. Descriptive statistics, including frequencies, means, standard deviations, and percentages, were used for data analysis. Inferential statistics were also used. The study revealed that pre-service mathematics teachers felt prepared to teach mathematics at the senior high school level and deemed the mathematics curriculum they had studied to be adequate and relevant. They also discovered that the teaching methodology courses they had taken were appropriate. A Pearson's Chi-square test was used to determine the relationship between the preparation of pre-service mathematics teachers and their readiness to teach mathematics. The study found a statistically significant relationship between the preparation of pre-service mathematics teachers and their readiness to teach mathematics at the senior high school level. Institutions preparing future mathematics instructors should regularly evaluate and revise their courses to match the senior high school mathematics curriculum. Training institutes should dedicate more time to teaching students about mechanics, covering both statics and dynamics.

Keywords: Preservice Mathematics Teachers, Methodology, Courses, Relationship, Preparation, Readiness.

Introduction

Mathematics is a fundamental subject taught in educational institutions worldwide, mandatory for students from elementary school to Senior High School. Murugan and Rajoo (2013) stated that maths was developed to cultivate individuals who are educated, skilful, and successful in using maths in their daily activities, enhancing their problem-solving and decision-making skills. Mathematics significantly influences how individuals manage various elements of their public, private, and social life (Anthony & Walshaw, 2009). Proficiency in mathematics is often considered crucial for the success of students and nations. Consequently, the primary goal of education in nearly every country is today to equip students to succeed in mathematics (Butakor, 2016). Educational systems worldwide need students to have basic mathematical knowledge by the end of the first grade in order to progress to higher levels of education such as secondary school and university (Zakaria et al., 2010). This highlights the importance of mathematics as a topic and the need for well-trained pre-service mathematics educators who possess both the procedural and content expertise required for effective teaching. Furthermore, in order to gain admission to a tertiary institution in Ghana, Senior High School students need to achieve a minimum grade of C6 (equivalent to 50% to 54%) in their core mathematics exam in the West African Senior School Certificate Examination (WASSCE) based on the WAEC grading system in 2021. Whether pupils achieve a passing mark is contingent on the quality of preparation or training given to pre-service mathematics teachers at Ghana's Institutes of Education.

Furthermore, pre-service instructors who have completed their education at both Ghana's Universities of Education and Colleges of Education typically teach mathematics at various school levels, as mathematical abilities are

essential in many areas of life. Tertiary institutions are responsible for adequately training future teachers to ensure they are competent, efficient, and skilled in their teaching careers. The University of Education, Winneba and the University of Cape Coast were the only institutions responsible for training pre-service mathematics teachers for Ghana's second-cycle schools at first. Other universities have started vying to provide training for pre-service mathematics professors to teach in Ghana's secondary schools. Pre-service teachers' efforts to learn how to teach mathematics for understanding are significantly affected by two fundamental tensions present in mathematics teacher education (Ball, 1990). The lack of proficiency in mathematics among pre-service instructors is responsible for the first tension, while the duration of the pedagogical courses is responsible for the second, as stated by Wilmot in 2008. Teacher educators have expressed concerns that pre-service mathematics teachers may lack sufficient mathematical content knowledge and pedagogical understanding when they begin their classroom placements, as documented by Toh et al. (2007). Teachers' content and pedagogical skills are crucial factors in students' academic performance in modern classrooms (Darling-Hammond, 2000). Each country has its criteria for training pre-service teachers on an international level. Since the implementation of the Common Core State Standards for Mathematics (CCSSM) in 2010, mathematics teachers in the USA must possess a profound comprehension of the subject. It is crucial to offer thorough training to upcoming mathematics instructors because 45 states have committed to implementing the CCSSM in their educational systems (Goertz, 2010). Both the Common Core State Standards for Mathematics (CCSSM) and the Principles and Standards for School Mathematics (PSSM) emphasise the importance of logical reasoning, conjecture, and mathematical discussion in the study of mathematics. The main goals of CCSSM are to improve the consistency and depth of the mathematics curriculum and to help students understand intricate mathematical ideas.

Pre-service teachers were required to acquire specific qualifications and breadth of subject knowledge outlined by the CCSSM and the PSSM during their teacher training programmes (National Council of Teachers of Mathematics (NCTM), 2000). This advice was provided to guarantee that pre-service instructors (PSIs) could deliver consistent and top-notch education to their students after finishing their programmes. Australia has established prerequisites for pre-service teacher training. National Professional Standards for Teachers (2011) demand that teacher training programmes include seven specific criteria detailing the talents and attributes teachers must possess. They include understanding individual learning styles, mastering subject matter and teaching methods, creating and implementing effective instruction, fostering safe learning environments, assessing student learning, providing feedback, engaging in professional development, and collaborating with colleagues, parents, and the community. The standards are categorised into three areas: professional knowledge, professional practice, and professional involvement.

African countries have set standards for training pre-service educators and supervising in-service teachers. The National Teacher Education Policy (2009) in Nigeria has been put into effect to guarantee the standard of education. The National Teacher Education Policy (2009) delineates Nigeria's vision, objectives, and rationale for teacher education. Section 7.1 of the Policy describes Nigeria's Teacher Education Vision, aiming to create highly qualified and innovative teachers through training programmes to educate students who can compete on a global scale. Ghana has implemented Teachers' Standards to educate prospective mathematics teachers in the country to produce top-tier educators for Ghana (National Teachers' Standards for Ghana, 2017). The National Teachers' Standards for Ghana Guidelines document specifies the criteria for prospective teachers and present instructors. The Cabinet of the Republic of Ghana endorsed the pre-service standards on September 28, 2017, which later influenced the creation of the in-service standards. Preservice courses at universities and colleges of education should comprehensively evaluate pre-service instructors using the Standards throughout their training. It is essential to provide in-depth and tightly supervised instruction sessions in the classroom during the school teaching practice. Pre-service teachers should undergo a fair and precise evaluation according to the Teachers' Standards to reflect the requirements for teachers in training.

The teacher education system in Ghana aims to provide future educators with the necessary skills, knowledge, attitudes, and values to adjust to evolving circumstances, utilise inclusive methods, and participate in ongoing learning. The teachers must connect effectively with persons both within and outside the school, demonstrate a strong passion for teaching and leadership, and serve as agents for change. The Standards aim to set guidelines that define the qualities of a proficient teacher in Ghana to improve educational results and experiences for students and

to elevate the standing of teachers in their communities and nations. The criteria take into account the opportunities and difficulties of the twenty-first century, as well as Ghana's goals. Their purpose is to help Ghana achieve Goal 4 of the Sustainable Development Goals for 2030, which focuses on ensuring universal access to quality education and lifelong learning opportunities.

The teachers' standards are divided into three primary groups, each containing its own subdivisions. The key components include Professional Values and Attitudes, Professional Knowledge, and Professional Practice. Professional Values and Attitudes encompass professional development and a community of practice. Professional Knowledge involves understanding educational frameworks, curriculum, and learners. Professional Practice focuses on managing the learning environment, teaching, and assessment.

The study examines pre-service mathematics teachers' readiness to teach mathematics at the Senior High School level by utilising theories such as the Constructivist Theory of Perception and the Transformative Learning Theory from the literature.

Gregory's Constructivist Theory of Perception

Gibson proposed a Direct Theory of Perception in 1966 and 1979. Gibson argues that perception is innate and does not depend on top-down processes like forming interpretations. Gibson contended that our senses offer complex information that is sufficient for us to comprehend what we see without the necessity for interpretation or inference, meaning sensory input is enough for perceiving reality without the need for interpretation. We instantly comprehend what we see and how to interact with it only based on sensory information. Gregory (1970) proposed a different interpretation of how perception operates. Richard Gregory's Constructivist Theory of Perception suggests that our visual perception is influenced by our prior experiences and current emotions, leading to an interpretation of what we see. He argues that perception cannot be fully elucidated by sensory information alone. Gregory argues that drawing conclusions and interpretations from previous knowledge, experience, and context is a dynamic aspect of perception. Perception constructs a version of reality by combining experiences and assumptions, rather than providing an unbiased reflection of sensory input. The constructivist theory of perception posits that humans form and assess hypotheses about our perceptions by combining sensory input with existing knowledge (perceptual hypothesis). Perception is influenced by both sensory input and acquired knowledge. Pre-service mathematics teachers have undergone specific training, enabling them to assess the adequacy of the training they received to prepare them for teaching mathematics at the Senior High School level.

Transformative Learning Theory (TLT)

Mezirow and Marsick introduced the Transformative Learning Theory (TLT) in 1978. This concept was incorporated into the study to explore how the thoughts and perspectives of pre-service mathematics instructors can improve. Transformative learning, according to Mezirow (2003, p. 58–59), is a type of learning that changes problematic frames of reference, fixed assumptions, and expectations to make them more inclusive, discriminating, open, reflective, and emotionally adaptable. These frames of reference are superior because they are more likely to generate thoughts and opinions that are more correct and valid, serving as a reliable basis for action. Christie, Carey, Robertson, and Grainger's (2015) idea of frames of reference suggests that each individual has a distinct viewpoint on the cosmos. No one is born with a clean slate. Similarly, every pre-service mathematics teacher at the Universities of Education in Ghana has some perception about the training they are receiving. This frame of reference may have a negative or good connotation. Positive aspects should be improved, while unfavourable aspects should be modified.

The framework focuses on elements that influence the preparedness of pre-service mathematics teachers to teach mathematics at the senior high school level. The study focuses on the importance and sufficiency of the subject substance delivered to pre-service mathematics educators, as well as the suitability and sufficiency of their pedagogical training. The bottom section of the framework, named "Readiness to Teach Mathematics," is derived from the data collection and analysis procedures using questionnaires. The final results can evaluate how well pre-service mathematics instructors believe they are equipped and capable of teaching mathematics at the senior high school level.

The Conceptual Framework

According to Kombo and Tromp (2006), a conceptual framework is necessary for a researcher to successfully shape his or her thoughts and carry out research.

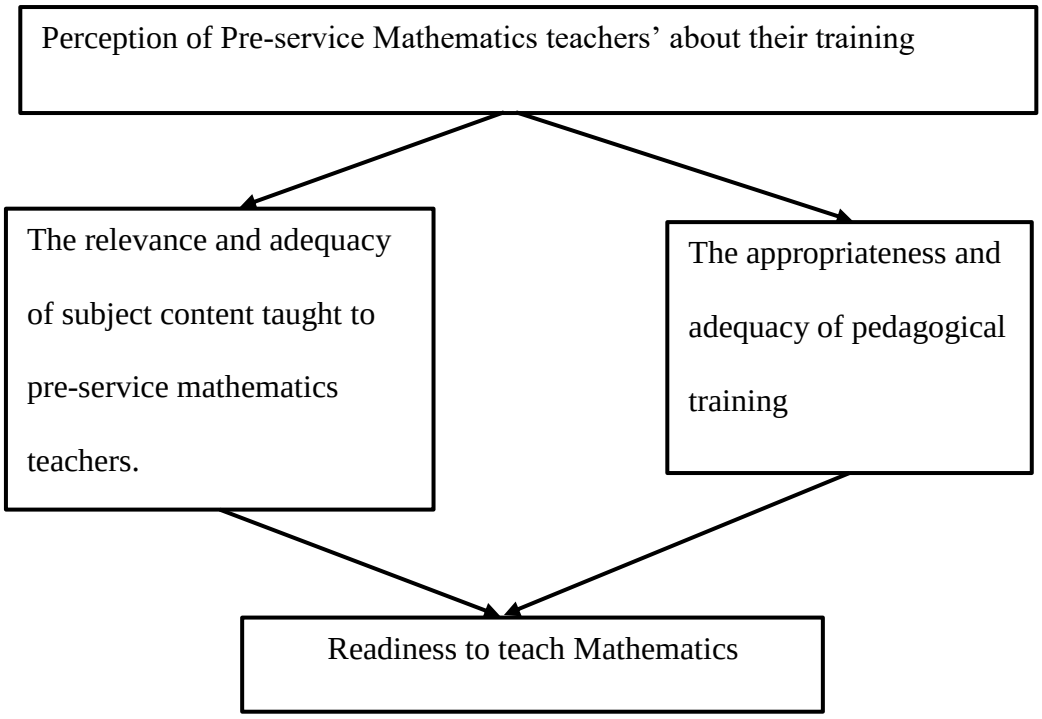

Figure 1: Conceptual Framework
Source: Researchers' Concept.

Scope of the Senior High School Elective Mathematics Content

The senior high school elective mathematics teaching curriculum in Ghana covers the following subject areas: The subjects include Algebra, Coordinate Geometry, Vectors and Mechanics, Logic, Trigonometry, Calculus, Matrices and Transformation, Statistics, and Probability (Teaching syllabus for Senior High School Elective Mathematics, 2010). Upon completing their four-year training course, pre-service mathematics teachers are required to teach all topics, regardless of whether they have been covered during their undergraduate education. Therefore, pre-service mathematics instructors must ensure they have a thorough understanding of all senior high school core issues before they begin teaching in a classroom.

Table 1: Mathematics subject content courses offered by two different Universities for the Bachelor of Education Degree Programme

	University A	University B
1.	Introduction to ICT Systems and Tools for Mathematics Teachers	1. Nature of Mathematics.
2.	Algebra 1	2. Advanced Algebra and Calculus
3.	Geometry 1	3. Introductory Statistics 1
4.	Probability and Statistics 1	4. Introductory Statistics 11
5.	Trigonometry 1	5. Vectors and Mechanics
6.	Geometry 11	6. Computer Applications in Mathematics Education
7.	Fundamentals of Computer Programming	7. Teaching Problem Solving in Mathematics
8.	Linear Algebra	8. Introduction to Abstract Algebra
9.	Vector Algebra	9. Advanced Calculus I
10.	Mechanics	10. Advanced Calculus II
11.	Introduction to Computer Programming for Mathematics Teachers	11. Ordinary Differential Equations
12.	Ordinary Differential Equations	
13.	Partial Differential Equations	

Source: Two public Universities that train pre-service mathematics teachers in Ghana.

Juxtaposing the scope of the Senior High School Elective Mathematics syllabus content to that of the Subject content courses offered by the two Universities that train pre-service mathematics teachers in the Central Region of Ghana, it can be deduced that, the type of preparation or training given to the pre-service mathematics teachers in Ghana is geared towards Elective Mathematics. This, however, informed the decision of the researcher to do his research in Elective Mathematics.

Statement of the Problem

Internationally, there are concerns about the training of pre-service instructors for different educational settings. Rosas and West's (2011) study found that most pre-service teachers in Ohio enter the classroom without a strong understanding of the topic matter. Rosas and West (2011) emphasised the importance of enhancing subject content in teacher preparation programmes to provide future teachers with the necessary abilities for their profession. Australian research shows that pre-service teachers often struggle to apply the concepts they acquire throughout their training to real classroom situations (Cavanagh & Prescott, 2007; Hine, 2015). Pre-service teachers may initially encounter innovative pedagogical practices, but they often return to traditional teaching methods after they start their practicum and teaching careers (Marks, 2007). Meanwhile, these teachers had completed pre-service training. What is the reason behind their struggles in the classroom? This research study is essential to investigate pre-service mathematics teachers' perceptions of their preparedness and readiness for the classroom.

The same issue being discussed globally also exists in Africa. Alonge et al. (2014) discovered various obstacles that hinder pre-service teachers in Nigeria from effective teaching. Due to their lack of knowledge, information, talents, competence, and confidence needed for teaching, they are not only unprepared but also ill-equipped to instruct. Asante and Mereku (2012) found that pre-service instructors in Ghana lack pedagogical subject understanding and topic knowledge. They recommended that mathematics methodology training should be hands-on, and pre-service educators should have many opportunities to practise the subjects they would teach. The research results suggest that the training provided to pre-service mathematics teachers globally, including in Ghana, should be investigated. This research is essential to assess the readiness of prospective mathematics teachers to teach mathematics at the senior high school level. Furthermore, studies conducted by academics such as Pinamang (2016), Asantewaa (2020), and

Entsie (2021) in Ghana have shown research deficiencies. Pinamang (2016) and Entsie (2021) conducted studies on pre-service mathematics teachers, and Asantewaa (2020) focused on the perceptions of mathematics among SHS students in Ghana. None of them investigated pre-service mathematics teachers' view of their preparedness to teach mathematics at the senior high school level. It is essential to conduct a study to address these information gaps.

Research Questions

These are the research questions that guided this investigation:

1. What is the pre-service mathematics teachers' view of their preparedness to teach mathematics based on the mathematical subject they have learned?
2. What are pre-service mathematics teachers' views on their preparedness to teach mathematics after completing teaching methodology courses during their training?

Study Hypothesis

A research hypothesis was developed to direct the study.

H_{01}: There is no statistically significant relationship between pre-service mathematics teachers' training and their preparedness for teaching mathematics.

Methodology

The study is based on a positivist research perspective. Positivism is a philosophical viewpoint asserting that understanding a social phenomenon relies on observable, measurable, and documented evidence, similar to natural science. Positivism was established as a philosophical movement by French philosopher Auguste Comte (1798-1857). Positivism advocates for applying the scientific method to examine and critique society based on a defined set of social facts or laws. Positivist academics utilise quantitative methods in their research because they believe that human behaviour and society can be objectively assessed and studied scientifically. Quantitative approaches focus on objective judgements using numerical data. Positivists favoured primary research methods such as laboratory trials, sociological surveys, structured questionnaires, and polls.

This study utilised a descriptive survey strategy, which involves cross-sectional and longitudinal investigations using questionnaires or structured interviews to conclude a sample of the entire population (Fowler, 2008). Creswell (2014) defines survey design as the analysis of a sample from a population to identify relationships between variables and provide a quantitative description of the patterns, beliefs, or opinions of that population. The researchers employed a quantitative research approach to achieve the study's aims. The quantitative research approach originated from the positivist paradigm, serving as the primary guiding principle of this study. This approach aims to derive broad conclusions by gathering accurate, measurement-based scientific data, usually analysed using statistics. It highlights the importance of collecting numerical data and utilising it to analyse a specific event or make generalisations across multiple populations.

Tuckman (2011) states that academics should focus on studying a specific group of individuals to gain insights into the topic of enthusiasm before drawing any conclusions. The study focused on all fourth-year pre-service mathematics teachers in the Universities of Education in Ghana. The available population consisted of 149 fourth-year students studying to become mathematics instructors in the Faculty of Education at a selected public institution in the Central region of Ghana. The researchers found that the level 400 pre-service mathematics instructors were the only ones who possessed the needed features because they had completed most of the content courses and pedagogical training. The research effort utilised multi-stage sampling approaches to choose 149 pre-service mathematics teachers. Multi-stage sampling involves dividing the population into clusters for research purposes. The process involves selecting the sample in stages, specifically by extracting samples from existing samples. Multi-stage sampling was suitable for the study due to the extensive population size, making it unfeasible to research each individual. The researchers collected data on pre-service mathematics instructors' attitudes by surveying pre-service instructors from several universities nationwide who are taking mathematics education courses.

The study utilised a questionnaire as the research instrument. Mugenda and Mugenda (2003) suggested that questionnaires are the most suitable instruments to utilise in survey studies and are commonly employed in educational research to collect data. This is because of its effectiveness in gathering data on the attitudes and

opinions of several respondents and obtaining valuable information on practices and conditions (Yin, 2003). The questionnaire included a total of thirty-two (32) items divided into three sections: Section A for demographic information, Section B for subject content learned, and Section C for pedagogy courses learned. Both sections A and B were organised using a four-point Likert scale format.

Table 2: Sources of the Questionnaire

Sections	Sources
Section A (Personal Details)	
Section B (Subject Content Learnt)	Makamure, C. & Jita, L. C. (2019); Koech (2015); Hulya (2009); Elective Mathematics Syllabus (2010)
Section C (Pedagogy Courses Learnt)	Makamure, C. & Jita, L. C. (2019); Koech (2015); Hulya (2009)

By conducting a pilot study and personally handing out the questionnaires, including providing instructions to the participants, the researchers were able to address several challenges that could have been associated with the actual delivery of the questionnaires. The questionnaires were administered to 149 pre-service mathematics instructors.

The tool underwent rigorous examination to verify its validity and reliability. The researchers validated the questionnaire with the assistance of four more experts in mathematics education and other specialists in the study field to ensure that the instrument collected the correct information. Durrheim (1999) advises researchers to consult with other members of the academic community to verify the suitability of their measurement instruments. The Cronbach Alpha coefficient was calculated to assess the internal consistency of the items. Subsections B and C of the instruments demonstrated reliability values of 0.853 and 0.916, respectively. The coefficients indicate strong reliability, as highlighted by Ellis (2013), who stated that many writers recommend a minimum reliability coefficient of 0.70 for group research. Before commencing the data-gathering process, approval was obtained from the Institutional Review Board of C. K. Tedam University of Technology and Applied Sciences. The questionnaire was administered over seven days. The researchers visited the selected University to get to know the participants. After consulting with some prospective mathematics instructors, they decided to use Google Forms for the questionnaire to facilitate the data collection process. The researchers investigated by administering the instruments and collecting them for examination to get a high recovery rate.

Descriptive and inferential statistics were used to analyse the data in this inquiry due to the prevalence of ordinal and nominal data. The method commenced after collecting all the study materials from the respondents. Quantitative data analysis approaches were used. Frequency tables were generated after the data was counted. Some researchers argue that it is suitable to summarise Likert scale ratings using means and standard deviations and to use parametric techniques like Analysis of Variance for analysis. Consequently, the frequencies were transformed into means, percentages, and standard deviations to indicate readiness levels (Carifio & Perla, 2008, p. 1151). The association between the preparedness and readiness of pre-service mathematics instructors was assessed using Pearson's chi-square test.

The average of each statement was matched to the Likert scale interpretation guidelines established by Alston and Miller (2002) and Yidana and Asare (2021). The scale ranges from 1.00 to 5.00, with different ranges indicating varying levels of agreement. A mean score below 2.5 suggests that prospective maths teachers either do not agree with the concept or have a negative view of their preparedness to start teaching, and vice versa. This aligns with the criterion mean of 2.5 on a four-point Likert scale, where a mean equal to or above 2.5 shows support for the study topic or a positive perception of readiness to teach, while a mean below 2.5 indicates a negative perception of readiness to teach.

Results

Research Question 1: What is pre-service mathematics teachers' perception of their readiness to teach mathematics based on the mathematics content learnt?"

To answer the first research question, responses provided by respondents were analysed using means and standard deviations. A summary of their responses is showcased in Table 3.

Table 3: Pre-service mathematics teachers' perception of their readiness to teach mathematics based on the content learnt (n=110)

	Statement	Mean	Std. Deviation
1.	The mathematics contents I have learnt to help me teach at the Senior High School level are adequate	3.37	0.662
2.	I am ready to teach mathematics at the Senior High School level based on the mathematics content learnt	3.51	0.571
3.	The length of time allocated for me to learn the content courses is adequate	3.08	0.696
4.	I know what mathematics content to teach in each form of the Senior High School mathematics curriculum	3.30	0.599
5.	I know how mathematical concepts are related	3.37	0.539
6.	I have various ways and strategies for developing my understanding of the mathematics content learnt	3.35	0.568
7.	I know possible difficulties or misconceptions that students might have in mathematics content at the Senior High School level	3.31	0.555
8.	I am well-equipped to address and eliminate students' mathematical difficulties and misconceptions.	3.25	0.580
	Weighted / Overall	**3.32**	**0.596**

The data in Table 3 indicates that pre-service mathematics instructors had a favourable opinion of all eight criteria stated and unanimously felt prepared to teach mathematics based on the information they had learned. The comparison of the means of all eight items with the Likert scale interpretation standards by Alston and Miller (2002) and Yidana and Asare (2021) revealed that the mean of each statement, as well as the overall mean, exceeded 2.5, as shown in Table 2. The findings suggest that prospective mathematics instructors endorsed all the claims in the table, demonstrating their readiness to teach mathematics using the acquired information. The standard deviation of 0.596 indicates a high level of similarity and proximity among the perceptions of pre-service mathematics instructors.

Table 4: Number of pre-service mathematics teachers who are adequately prepared and or fully ready to teach SHS 1 topics

SHS 1 Topics	Preparation (N)	Preparation (%)	Readiness(N)	Readiness (%)
Sets	90	81.82	88	80.00
Surds	93	84.55	90	81.82
Binary Operations	88	80.00	89	80.91
Relations and Functions	90	81.82	86	78.18
Polynomial Functions	86	78.18	84	76.36
Rational Functions	85	77.27	83	75.45
Indices and Logarithmic Functions	85	77.27	81	73.64
Binomial Theorem	73	66.36	75	68.18
Inequalities and Linear Programming	78	70.91	76	69.09
Coordinate Geometry 1 (The Straight line)	86	78.18	83	75.45
Statistics	90	81.82	87	79.09
Probability	84	76.36	78	70.91
Total number of respondents = 110				

Upon close examination of Table 4, it is evident that the number of respondents in the "preparation" and "readiness" columns indicates that pre-service mathematics instructors were well-prepared during their training and are fully equipped to teach mathematics at the second-cycle school level. The number of pre-service mathematics instructors

for each of the SHS 1 topics is higher than normal. Upon reviewing Table 4 again, it was found that the Binomial theorem had the lowest number of respondents, with 73(66.36%) reporting on their preparation and 75(68.18%) on their readiness. This suggests that pre-service mathematics instructors viewed their preparation and readiness as relatively low compared to the other eleven topics. The category of Surds had the highest number of respondents, with 93(84.55%) in the "preparation" portion and 90(81.82%) in the "readiness" area. Respondents felt well-prepared and entirely ready to teach Surds.

Table 5: Number of pre-service mathematics teachers who are adequately prepared and or fully ready to teach SHS 2 mathematics topics

SHS 2 Topics	Preparation(N)	Preparation (%)	Readiness(N)	Readiness (%)
Coordinate Geometry 2 (The circle)	78	70.91	75	68.18
Sequences and series	96	87.27	91	82.73
Trigonometry	79	71.82	76	69.09
Differentiation	99	90.00	94	85.45
Application of Differentiation	85	77.27	75	68.18
Integration	89	80.91	84	76.36
Application of Integration	77	70.00	76	69.09
Vectors	91	82.73	85	77.27
Application of vectors in Geometry	69	62.73	71	64.55

Total number of respondents = 110

Upon careful examination of Table 5, it is evident that a significant number of respondents in the "preparation" and "readiness" columns indicated that pre-service mathematics instructors were well-prepared during their training and are fully equipped to teach mathematics at the second-cycle school level, as the number of pre-service mathematics teachers for each SHS 2 topic was above average. Upon reviewing Table 5, it is evident that the Application of vectors in Geometry had the lowest number of respondents, with 69(62.73%) indicating their preparation and 71(64.55%) indicating their readiness. This suggests that pre-service mathematics instructors felt their preparation and readiness for this topic were somewhat inadequate compared to the other eight topics. The category of Differentiation had the highest number of respondents, with 99(90.00%) in the "preparation" column and 94(85.45%) in the "readiness" part. Respondents felt well-prepared during their pre-service training to teach Differentiation at the second-cycle school level.

Table 6: Number of pre-service mathematics teachers who are adequately prepared and or fully ready to teach SHS 3 topics

	Preparation(N)	Preparation (%)	Readiness(N)	Readiness (%)
Mechanics (Statics)	67	60.91	58	52.73
Mechanics (Dynamics)	51	46.36	49	44.55
Matrices	90	81.82	86	78.18
Linear transformations	82	74.55	73	66.36
Logic	67	60.91	66	60.00
Correlation	71	64.55	74	67.27
Permutation and combination	80	72.73	83	75.45
Binomial Probability distribution	75	68.18	72	65.45

Upon further examination of Table 6, it is evident that many prospective mathematics instructors in the "preparation" and "readiness" categories are well-prepared and well-equipped to teach mathematics at the secondary

level. The number of pre-service mathematics teachers for each of the SHS 3 themes exceeded the average. This assumes that prospective mathematics teachers believe their training before entering the profession is sufficient and prepares them adequately to teach mathematics at the senior high school level. Upon detailed examination, it was shown that pre-service mathematics teachers hold a negative opinion towards certain areas in the SHS 3 curriculum. The item labelled Mechanics (Dynamics) received a score of 51(46.36%) in the "preparation" category and 49(44.55%) in the "readiness" category, both of which are below average. Pre-service mathematics educators felt they were not sufficiently trained in Dynamics and were unprepared to teach Dynamics at the second-cycle school level. Although Mechanics (Statics) scored 67(60.91%) and 58(60%) in the "preparation" and "readiness" areas, respectively, which are somewhat above average, the numbers are not very encouraging. Pre-service mathematics teachers may require further instruction in Mechanics to ensure they are well-prepared to properly teach it at the second-cycle school level.

Research Question 2: What is pre-service mathematics teachers' perception of their readiness to teach mathematics based on the teaching methodology courses learnt as part of their training?" To answer the second research question, responses provided by respondents were analysed using means and standard deviations. The results are shown in Table 7.

Table 7: Pre-service mathematics teachers' perception of their readiness to teach mathematics based on the teaching methodology courses learnt. (N=110)

	Statement	Mean	SD
1.	The number of methodology courses I have learnt is adequate for me to go and teach	3.37	0.588
2.	I am ready to teach mathematics at the senior high school level based on the methodology courses learnt	3.38	0.541
3.	The length of time allocated for me to learn the methodology courses is adequate to learn all the needed skills	3.10	0.757
4.	I know how to select effective teaching methods to guide students' thinking and learning in mathematics	3.32	0.506
5.	I can use a wide range of teaching methods in a classroom setting based on the training received so far	3.33	0.560
6.	I can adapt my teaching styles to suit different student's learning abilities	3.34	0.547
7.	I am well-resourced to select and design teaching aids that suit different teaching purposes.	3.21	0.597
8.	I am well-equipped to monitor my student's learning and progress using effective assessment criteria in multiple ways	3.38	0.574
9.	I have what it takes to provide students with constructive feedback on their learning	3.39	0.508
	Weighted / Overall	**3.31**	**0.575**

The primary results of this study were solely derived from the responses to the questionnaire by pre-service mathematics instructors. Pre-service mathematics instructors expressed a high level of confidence in their ability to teach mathematics, attributing it to the teaching methodology courses they completed throughout their training. Table 7 shows that each item had a mean score higher than 2.5, indicating that aspiring mathematics instructors have a positive perception of their readiness to teach mathematics based on the nine constructs outlined in Table 7, according to the Likert scale interpretation by Alston and Miller (2002) and Yidana and Asare (2021). The weighted mean for the second research question was 3.31, indicating a positive perception of pre-service mathematics instructors' readiness to teach mathematics based on teaching methodology courses. This value exceeds the threshold of 2.5 according to the Likert scale interpretation standards by Alston and Miller (2002) and Yidana and Asare (2021). The standard deviation score was 0.575, indicating that their perceptions were closely connected rather than widely varied

To enhance pre-service mathematics instructors' confidence in their ability to teach mathematics at the senior high school level, an additional question was proposed to the aspiring instructors based on the pedagogy courses they have completed. Were you well instructed in pedagogy courses? Their responses are displayed in Table 8.

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Table 8: Pre-service mathematics teachers' responses on whether they were adequately taught the pedagogy courses or not

Were you adequately taking through or taught the pedagogy courses?	Number of respondents	Percentage (%)
Yes	89	83.96
No	17	16.04
Total	106	100

Source: Researchers 's field data (2022)

It has been shown that pre-service mathematics instructors have a positive perception that they were taken through or taught well during their pedagogy training at the university level. This was because, a large number of the respondents, which was 89 (83.96%) were in affirmative to the item which states that "were you adequately taking through or taught the pedagogy courses?", while a lesser number, which was 17 (16.04%) opposed the statement.
The researchers again wanted to probe further to know why the respondents chose either Yes or No to the statement in Table 8. This made a further question to be asked for them to "Give reason(s) for your response in Table 8". The under-listed in Table 9 are some of the responses they gave.

Table 9: Reasons why pre-service mathematics teachers chose either "Yes" or "No"

Some of the responses for "Yes"	Some of the responses for "No"
We were taught in detail and we understood everything.	*There were fewer practices of what was taught*
We completed the course outline for every pedagogy course and most of them were used as presentations to enhance retention.	*Enough time was not devoted to some of the courses. The focus was on students passing exams so efforts were not made for students to understand very well.*
Lecturers were assigned to all the courses and they fully committed to the task.	*Some challenging topics were skipped*
I was taught how to use Geogebra, worksheet, workstation, and so forth, as part of teaching pedagogical content knowledge.	*Inadequate time*
Series of assignments to help practice the skills learnt	*Inadequate connection to various SHS topics.*
The reason is that I am now well-grounded in the use of the various pedagogical techniques	*Though we were taught, the time was limited so we couldn't delve deeper to have a comprehensive learning.*
I understood the contents and I applied them in my On-campus and Off-campus teaching practice	*Most of the courses were left to the students to do their research or reading for passing the exams and not for future use*
We were taken through most of the teaching methods and techniques very well	
A detailed course outline was given and it was systematically and completely taught.	
They guided us to go through step by step on how to handle things.	
The courses were handled through multiple teaching methods including presentations and discussions,	
I can now teach well with different methods to meet the needs of the individual learners.	
Experience lecturers guided us through the courses and they had enough time to handle the courses	

A careful observation of Table 9 brings to bear that the respondents were taken through the pedagogy courses effectively. A larger number of the participants, that was 89 (83.96%) chose "Yes" as an answer and justified why they chose "Yes", while a smaller number, that was 17 (16.04%) went in for "No", and they equally attached reasons as to why they took that stance.

Hypothesis

A null hypothesis (Ho) which states that "there is no statistically significant relationship between pre-service mathematics teachers' preparation and their readiness in teaching mathematics" was formulated to test the relationship existing between pre-service mathematics teachers' preparation and their readiness. The outcome of the research hypothesis has been showcased in Table 10.

Table 10: Association between Preservice Mathematics Teachers' preparation and their Readiness

	Value	Df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	53.669[a]	1	0.000
Number of Valid Cases	110		

a. 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 5.09.
b. Computed only for a 2x2 table

Source: Researchers 's field data (2022)

Upon conducting Pearson's chi-square test in Table 10, a highly statistically significant association ($x^2=53.669$, df=1, p=0.00) was observed between pre-service mathematics instructors' preparation and readiness at $\alpha=0.05$. The null hypothesis (Ho) stating that there is no statistically significant association between pre-service mathematics instructors' training and their readiness to teach mathematics was rejected. This indicates that the alternative hypothesis (H1) was confirmed, demonstrating a statistically significant association between pre-service mathematics instructors' training and their preparedness. The better the training and preparation of pre-service mathematics educators, the more equipped they are to teach at Senior High Schools. In Table 10, the footnote states that no cells had an expected count of less than 5, and the minimum predicted count was 5.09. This indicates that the sample size needed for Pearson's chi-square test was met.

Discussion

The data in Table 3 shows that the weighted mean for the first research question was 3.32, which exceeded 2.5. Based on the Likert scale interpretation standards established by Alston and Miller (2002) and Yidana and Asare (2021), it can be inferred that prospective mathematics teachers felt positively about their preparedness to teach senior high school mathematics, considering the mathematics content they had learned. This contrasts with the findings of Obeng, Opare, and Dzinyela (2003), Koech (2015), and Rosas and West (2011), who emphasised that pre-service teachers lack subject matter knowledge and that the mathematics curriculum in teacher education institutions is inadequate. Additionally, they noted that pre-service mathematics teachers at Ohio University start teaching without a comprehensive understanding of the subject matter. The finding aligns with the research conducted by Hine and Thai (2019), which indicated that most prospective teachers feel well-equipped to teach mathematics at the lower secondary school level.

Table 7 shows that the average for the second research question was 3.31, which exceeded 2.5. According to Alston and Miller (2002) and Yidana and Asare (2021), pre-service mathematics instructors perceived themselves as well-prepared to teach mathematics at the second-cycle school level based on the teaching methodology courses they completed during their training. This conflicts with the findings of other researchers such as Asante and Mereku (2012), Kildan, Ibret, Pektas, Aydinozu, Incikabi, and Recepoghis (2013) who suggested that prospective mathematics teachers have insufficient pedagogical subject understanding. They suggested that mathematics educational courses should be more hands-on. From Table 10, the Pearson Chi-square test was used to examine the research hypothesis. The null hypothesis, which suggests no statistically significant relationship between pre-service mathematics teachers' preparation and their readiness to teach mathematics, was rejected at a significance level of

α=0.05. This indicates a strong and statistically significant relationship (x^2=53.669, df=1, p=0.00) between pre-service mathematics teachers' preparation and their readiness to train future mathematics instructors.

Conclusion

The research findings indicated that pre-service mathematics instructors were prepared to teach mathematics at the Senior High School level in Ghana, based on their knowledge of mathematics subject. This suggests that the training provided to them is suitable and sufficient. However, pre-service Mathematics instructors felt that the training they received in Mechanics was insufficient. Therefore, it is essential to arrange in-service training for them to fully understand the ideas of Mechanics. The study revealed that pre-service mathematics instructors had a favourable impression of their preparedness to teach mathematics at the senior high school level due to the teaching technique courses they had completed. This suggests that they had received sufficient pedagogical preparation. The study's findings revealed a robust and statistically significant relationship between the training of aspiring mathematics educators and their level of readiness. Aspiring mathematics instructors need to be well-prepared throughout their pre-service training to become resourceful, efficient, and competent, enabling them to seamlessly transition into the teaching profession.

Study Constraints

The major study limitations were as follows:

1. The sample was collected from a tertiary institution in the Central region of Ghana; thus, the implications or results may reflect the situation in that University. The findings may not be representative of all pre-service mathematics teachers across different educational institutions in Ghana.
2. The investigation was constrained by restricted resources, specifically time and money. Due to constraints in time and finances, the inquiry could not be extended to other regions of the country. The research maximised the available resources.
3. The researchers were unable to include all 149 potential mathematics instructors as originally intended since they were occupied with their final examination and project work during the data-gathering period.

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