UNIVERSITY OF CAPE COAST

PRE-SERVICE MATHEMATICS TEACHERS' READINESS TO INTEGRATE TECHNOLOGY IN THE TEACHING OF MATHEMATICS

JONADAB DARKOH

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BY

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Thesis submitted to the Department of Mathematics and ICT Education of the Faculty of Science and Technology Education, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy degree in Mathematics Education

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree at this university or any other institution.

Candidate's Signature: ……..……..…….. Date: ……

Name: Jonadab Darkoh

Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on thesis supervision laid down by the University of Cape Coast.

Supervisor's Signature: …… Date: ……..…

Name: Prof. Kofi Ayebi-Arthur

ABSTRACT

If educators wish to use technology to teach mathematics, they must be open to incorporating it into their lesson plans. The study examined the degree to which pre-service maths instructors in Ghana's Central Region were equipped to accept and integrate technology into mathematical classes. A cross-sectional descriptive survey design was used to investigate the technological readiness of pre-service teachers. Multi-stage sampling was used to determine the study's sample size. For the study, 134 pre-service maths teachers contributed quantitative data. The findings demonstrated that neither sex nor school type had a statistically significant effect on pre-service teachers' opinions about the usefulness and use of technology. However, depending on their age and prior technological experience, pre-service teachers' opinions of the benefits and usability of employing technology to teach mathematics differed statistically significantly. Additionally, the sex of pre-service maths instructors affected their readiness to use technology in the classroom. Finally, perceived usefulness and usability had a favourable effect on instructors' desire to use technology to teach arithmetic. It was proposed that teacher training programs incorporate lectures or modules designed specifically to address the technical requirements of pre-service teachers.

KEYWORDS

Readiness

Technology

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DEDICATION

To my immediate family

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CHAPTER ONE

INTRODUCTION

Background of the Study

Over the past 20 years, instructors and students have had access to a vast array of technology tools, and mathematical classrooms are no exception (Snyder, de Brey, & Dillow, 2018). Technology has a favourable correlation with student engagement and self-directed learning, both of which improve students' mathematical proficiency (Rashid and Asghar, 2016). However, simply having access to technology is not enough. The instructor has a big impact on how this technology is used. Effective teachers employ technology to enhance students' comprehension, pique their interest, and develop their mathematical skills (NCTM, 2015).

Many teachers around the world have not included instructional technology into their regular courses, despite the quick growth of gadgets and software (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014). Teachers' readiness to use instructional technology is influenced by their perceptions of their own skills and opinions (Petko, Prasse, & Cantieni, 2018). In practically every nation, including Ghana, maths is taught as a core subject (Keith, 2000). Students' performance and future are significantly impacted by mathematics (Fadlelmula, 2022). It has become a vital component of the development of our contemporary world and is pervasive in our daily lives (Collins & Halverson, 2018; Kumar, 2021). Thinking and reasoning are organised, and the mind is trained by mathematics. Once more, Yadav (2019) claimed that mathematics has essential connections to a number of fields, such as the social sciences, engineering, medicine, and the natural sciences.

Technology has been crucial to human civilisation since the beginning of time (Scherer & Teo, 2019). In the 21st century, children are constantly encircled by digital devices. Children are growing increasingly comfortable with and using digital technology in a more casual manner (Bayaga et al., 2021). Many kids utilise computers and software to learn reading, math, and music. Students can learn challenging mathematical concepts and topics with the help of ICT. Verschaffel, Schukajlow, Star, and Van Dooren (2020), for example, there is a greater demand for technology interventions and strategies in the domains of word problems and multi-step mathematics. According to Engelbrecht, Llinares, and Borba (2020), the use of technology will make the curriculum easier to understand, even for students who are having difficulty with mathematics or are only beginning to understand the subject. If pre-service instructors are ready to incorporate technology into their lesson plans, pupils' performance and enthusiasm for learning mathematics will both improve (Gurer & Akkaya, 2022). According to Thorvaldsen and Madsen (2021), when teachers neglect to take into account their pupils' technology settings, learning gaps may result. Technology-enhanced learning settings are ideal for stimulating students' curiosity and performance. The use of ICTs in maths education has evolved in the twenty-first century. Problem-solving abilities are given precedence over complex computational capabilities in the current reform-oriented approach to mathematics education (Armah & Apeanti, 2012). ICT has the potential to transform mathematics instruction in all contexts, according to prominent African educators (Agyei & Voogt, 2015; Armah & Apeanti, 2012). ICT improves classroom engagement, sharpens focus, and maximises student learning in maths lessons (Bhattacharjee & Deb, 2016; Netsianda & Ramaila,

2021). When ICT is utilised in the classroom, teachers may develop captivating classes that will hold students' interest and help them learn (Ratheeswari, 2018). ICT helps students become self-directed by encouraging critical thinking, creativity, cooperative learning, and distance learning (Netsianda & Ramaila, 2021). In today's scientific and technical culture, educators need to be more knowledgeable about ICT and be able to use it successfully in the teaching and learning process. To effectively incorporate technology into their courses during their training, pre-service teachers must possess a deeper knowledge of ICT (Bhattacharjee & Deb, 2016). Advanced technology proficiency is correlated with advanced teaching expertise.

ICTs are transforming classrooms and schools in this digital age by providing new curricula that are focused on projects and concerns from the real world. Additionally, ICT provides educators and learners with additional resources, feedback opportunities, and learning-enhancing technologies. According to Hong, Zhang, and Liu (2021), the attitudes of instructors towards technology use have a significant impact on its acceptability. However, instructors' desire to use technology in the classroom is influenced by their knowledge of it (Jamrus & Razali, 2021).

Additionally, how instructors use ICT is influenced by their perceptions of the value and usability of technical tools (Perienen, 2020; Pittalis, 2021; Scherer, & Teo, 2019). Perienen (2020) observed that using technology was generally simple for teachers. Once more, educators reported feeling at ease using computers, selecting the right software for a task, and moving data between devices (Perienen, 2020). Teachers' readiness to adopt technology in the classroom is significantly predicted by perceived utility and perceived ease

of use (Pittalis, 2021). Teachers' opinions on the general usage of technology for teaching and learning are influenced by perceived ease of use (Scherer & Teo, 2019). Technology integration can be facilitated by a school culture that encourages creativity, teamwork, and continuous professional growth. However, a school culture that opposes change, discourages experimentation, or favours traditional teaching techniques may make it difficult to incorporate technology into the classroom (Thurm & Barzel, 2020). However, when there is a sufficient infrastructure for technology, educators may readily access, utilise, and integrate it into their instructional strategies (Matthew, 2021).

Statement of the Problem

Regardless of their subject of study, all junior and senior high school students in Ghana are required to attend mathematics classes. For students to be admitted to secondary and postsecondary educational institutions, they must also pass mathematics. Teachers usually prioritise a quick review of each subject over in-depth student learning in their haste to finish the curriculum in time for exams (Agyei, 2012). NCTM (2000) states that "those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their future" (p. 5). In mathematics education, emphasis must be placed on mathematical processes such as mathematical thinking, reasoning, communication, connections, and problem-solving (NCTM, 2000). Information technology utilisation in the classroom is one of the primary components of Ghana's Education Strategic Plan (ESP, 2018–2030) reforms. By providing students with technology-based training, ICT skills, and the integration of ICTs into educational management, ICT in education reforms seek to revolutionise postsecondary education and teacher preparation

programs. Therefore, throughout their training, pre-service teachers must comprehend ICT (Bhattacharjee & Deb, 2016).

According to Smith, Kim, and McIntyre (2016), Ghanaian educational institutions do not have the resources required to properly train instructors. Yalley (2022) and Soma, Nantomah, and Adusei (2021) corroborate the assertion made by Soma et al. (2021) that pre-service teachers do not appear to incorporate technology into their work at the elementary school level because of a lack of training resources. Many academics have questioned how competent teachers are to teach mathematical topics using instructional technology. For example, teachers are not ready to use technology in the classroom, claim Botane and Ngwako (2017). It was also determined by Appavoo (2019) that instructors were hesitant to employ technology in the classroom.

According to Nodira, Umida, and Najibahon (2020), teachers also saw the use of ICT as a tool rather than a necessary component of the instruction process. However, many teachers are still reluctant and unprepared to integrate ICT tools and resources into their teaching methods, even if they are readily available for use in mathematics instruction (Jamrus & Razali, 2021). According to research, teachers' demographic traits may have an impact on their capacity to use technology to teach mathematics (Awofala, Olabiyi, Awofala, Arigbabu, Fatade, & Udeani, 2019; Gebhardt, Thomson, Ainley & Hillman, 2019). According to Awofala, Akinoso, and Fatade (2017), pre-service teachers' views on internet use are significantly influenced by their sex. According to Awofala et al. (2019), there are notable differences in attitudes towards computers by sex. According to Chung, Park, Wang, Fulk, and McLaughlin

(2010), age affected readiness and acceptance of ICT in both direct and moderating ways.

In a similar vein, Koh, Chai, and Tsai (2014) discovered a correlation between instructors' age and their proficiency using computers as a teaching tool. Furthermore, it was discovered that instructors' intentions to employ technology were significantly influenced by extrinsic factors such as age and sex (Pittalis, 2021).The location of educational institutions has an impact on how well teachers use technology (Kaleli-Yilmaz, 2015). The readiness of educators to integrate technology is influenced by professional development initiatives (Thurm & Barzel, 2020). In addition, Kaleli-Yilmaz (2015) concluded that technological issues, resource availability, and content management all have an impact on technology integration.

Purpose of the Study

The purpose of the study was to explore how pre-service maths teachers are to embrace and use technology in the classroom.

Research Objectives

The study was directed by the following research goals:

1. Analyse the difference between the demographic traits of maths teachers and their perceptions of their own utility.
2. Find out how math teachers' demographic traits and their opinions of usability relate to each other.
3. Find out how the sex of maths teachers affects their preparedness to use technology in the classroom.
4. Find out whether teachers' readiness to employ technology in math instruction is statistically impacted by their opinions about its utility.

5. Find out if teachers' readiness to employ technology in maths classes is significantly impacted by their opinions of how easy it is to use.

6. Examine whether contextual factors and pre-service maths instructors' perceptions of their effectiveness are statistically correlated.

Research Questions

The research was executed with the following questions and hypotheses in focus:

1. What is the statistically significant difference between pre-service math instructors' demographic characteristics and their assessed utility?
2. What statistically significant differences exist between pre-service math teachers' demographic characteristics and their perceptions of usability?
3. What is the sex-based statistically significant difference in pre-service maths teachers' readiness to use technology in the classroom?

Research Hypotheses

H^1_0: The perceived value of technology among pre-service teachers has no statistically significant impact on their preparedness to use it in math instruction.

H^2_0: Pre-service teachers' perceived ease of use of technology in mathematics instruction has no statistically significant impact on their preparedness.

H^3_0: The perceived usefulness of pre-service maths teachers is not statistically impacted by their environmental attributes.

Significance of the Study

Findings from research on the effects of environmental factors on pre-service Teachers' preparedness should help college professors develop creative

ways to teach student teachers how to become more prepared and tech-savvy. Once more, the study's conclusions and suggestions might be useful to curriculum designers creating courses that raise students' technological competency.

Delimitations

The study's conclusions only apply to educational institutions in Ghana's Central Region; they do not apply to institutions in other regions. A cross-sectional descriptive design, which provides a brief overview of the situation at a certain point in time, was used in the study. For the purpose of investigating causal links, the layout might not be suitable.

Limitations

One of the study's shortcomings is the use of questionnaires. Questionnaire responses from teachers are probably going to be few, and it's probable that their readiness for incorporating technology hasn't been fully assessed. High-reliability questionnaires were used to overcome this limitation. Finally, because the analysis approaches utilised to look at how the variables affected each other did not include the relationships between and among the variables, only cause-and-effect correlations were established.

Definition of Terms

"Readiness" describes how pre-service maths instructors feel about and want to include technology in their classes. The degree to which pre-service math teachers think that utilising technology to teach math will be easy is known as perceived ease of usage. The degree to which pre-service maths instructors think utilising technology would improve their teaching is known as perceived utility. The external elements and conditions within the school that affect the

preparedness of aspiring maths teachers are known as environmental characteristics.

In this study, "technology" refers to the digital tools, software, and platforms used in mathematics training.

Organisation of the Study

This study is structured into five chapters. Chapter one delineates the research, outlining objectives, questions, hypotheses, and limitations. Chapter two reviews the current literature and formulates a conceptual framework. Chapter three covers the approach, target demographics, sample tactics, data collection tools, and protocols. Chapter Four offers the study's findings, and Chapter Five summarises the research methodology, highlighting major findings, conclusions, recommendations, and future research.

CHAPTER TWO

LITERATURE REVIEW

This chapter examines studies that explore how prepared pre-service mathematics instructors are to integrate technology into their teaching. The theoretical framework and the empirical review are covered in this chapter. The chapter ends with a summary of the literature review.

Theoretical Framework

Technology Acceptance Model

The Technology Acceptance Model (TAM) served as the foundation for this investigation. A theoretical framework that explains and forecasts users' acceptance and adoption of new technologies is called the Technology Acceptance Model (Davis, 1989). According to the Technology Acceptance Model, people's opinions on technology are impacted by how practical and simple they think it is. Classrooms are among the many organisational contexts where the idea has been extensively used and assessed (Teo, 2009). According to Davis (1989), perceived usefulness reflects a user's belief that using a specific technology will boost their job performance or make their responsibilities less demanding. The degree to which a user believes that using the technology will be simple is known as perceived ease of use.

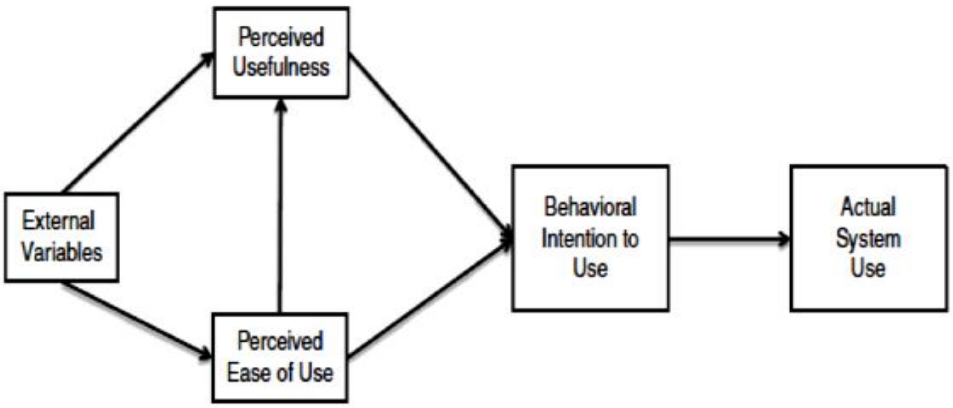

Figure 1: Technology Acceptance Model (Venkatesh & Davis, 1996)

External Factors

As predictor factors, a number of external characteristics such as computer anxiety, individual inventiveness, computer self-efficacy, age and experience, and supportive environments have been introduced. (Marangunić & Granić, 2015). The effects of extrinsic factors like age, enabling circumstances, computer phobia, and personal inventiveness were examined by Patilis (2021) using TAM. This was due to the fact that these traits encompass a large spectrum of external factors and have been demonstrated to have significant effects in earlier studies (Burton-Jones & Hubona, 2006). Organisations may offer instructional training and administrative support in enhancing the usage of these technologies (Teo & Noyes, 2014). According to the meta-analysis conducted by Scherer and Teo (2019), enabling factors showed a positive association with perceived usefulness and ease of use, exerting a particularly stronger effect on the latter.

Perceived Usefulness

Ma identified three core features present in classrooms led by teachers with PUFM: interconnectedness, multiple representations, and longitudinal coherence. Such teachers deliberately draw links between mathematical ideas and skills to support pupils' understanding of mathematics as a unified discipline. They encourage flexibility by weighing the strengths and limitations of various approaches, while demonstrating mastery of the mathematics curriculum. This enables them to identify the crucial knowledge that supports continuous learning and long-term development.

Liping Ma's PUFM framework has significantly shaped the way teacher expertise in mathematics is understood. It underscores the importance of

specialised knowledge that combines conceptual depth with pedagogical skill. Perceived usefulness in educational settings has a big impact on teachers' intentions to include technology into their lesson plans (Siyam, 2019). Teachers who have a positive attitude towards technology are more likely to see how it might enhance student learning, boost output, and simplify administrative tasks. Therefore, likely to embrace and incorporate technology into their lessons. Akkaya (2016) asserts that perceived utility has a favourable and significant influence on teachers' views on the adoption of technology. When teachers think technology could be useful, they adopt and use it in the classroom and to have positive opinions about it (Akkaya, 2016).

Perceived Ease of Use

Perceived Ease of Use, which gauges people's perceptions of how simple technology will be to use, is another crucial component of TAM (Davis, 1989). It covers topics including the technology's usability, learning and application ease, and interface usability. Teachers' attitudes and techniques for adopting technology into the classroom are highly influenced by perceived ease of use (Tran, Nguyen, & Tang, 2023). When educators perceive technology as user-friendly, they are more likely to accept it and be inspired to integrate it into their classroom instruction. Teachers may be hesitant to adopt and incorporate technology into their daily routines if they believe it will be difficult to use.

According to research, teachers' opinions regarding the use of technology are directly impacted by how easy they believe it to be to use (Aljaloud, Billingsley & Kwan, 2019). Gyamfi (2016) asserts that teachers who think the use of ICT is not complicated to use will employ it in the classroom.

Critique and Evaluation of the Technology Acceptance Model

Because of its many benefits, TAM is frequently utilised in research on technology acceptance and application. A simple yet useful theoretical framework for understanding and predicting technology uptake is provided by the Technology Acceptance Model. Its emphasis on two important dimensions—perceived utility and perceived ease of use—allows for a straightforward and succinct assessment of people's readiness and intentions about the adoption of technology. TAM's simplicity makes it applicable to a variety of sectors and areas.

Furthermore, TAM can be used in a variety of situations and cultural contexts due to its significant emphasis on PEU and PU. Numerous industries, including consumer technology, business, healthcare, and education, have successfully employed the strategy. Studies carried out in a range of cultural contexts have shown its cross-cultural validity, emphasising its adaptability and endurance.

Limitations and Challenges

Despite TAM's many advantages, a thorough assessment of the Model requires an understanding of its drawbacks and difficulties. The main drawbacks and difficulties of TAM are listed below:

Individual-centric focus

Model of Technology Acceptance, One disadvantage of the individual-centric approach is that it may overlook contextual and organisational situations that affect the adoption and usage of digital tools. The TAM highlights the people's attitudes and notions, including perceived utility and ease of use, while largely ignoring the wider social, cultural, and organisational repercussions.

This limitation, according to Legris, Ingham, and Collerette (2003), reduces TAM's ability to capture the complex relationships between social, environmental, and personal factors that affect technology adoption and use.

Contextual considerations

Another problem with the TAM is its disdain for contextual factors, which have a significant impact on how technology is used in the classroom. Institutional support, resource accessibility, cultural norms, and other contextual elements that impact technology acceptance and use in educational contexts may not be adequately considered, despite TAM's emphasis on individual viewpoints (Akkaya, 2016). These contextual considerations play a major role in determining whether technology integration initiatives succeed or fail. TAM should be extended to incorporate more models that particularly address these contextual elements to offer a comprehensive thought of technology adoption and use in education.

Conceptual Framework

The study's conceptual framework is depicted in Figure 2. The two main TAM constructs used for the study are embodied in it. The perceived utility and usability of technology influence both actual use and behavioural intentions. Perceived ease of use is also regarded as having an impact on how beneficial people think technology is. A modified version of the Technology Acceptance Model (TAM), this model illustrates how demographics and environmental factors influence people's perceptions of how easy and beneficial technology is.

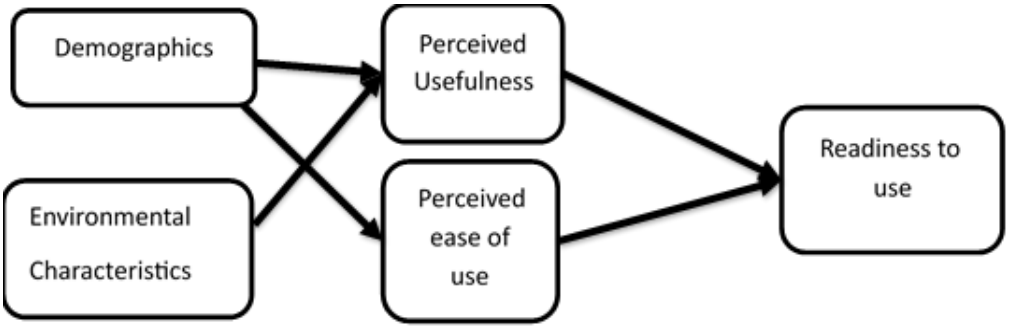

Figure 2: The Technology Acceptance Model modified (Jayaweera et al., 2015)

In order to deepen insights into how technology is integrated within classrooms, researchers have proposed conceptual frameworks that also take external consequences into account (Thurm & Barzel, 2020; Jayaweera et al., 2015; Marangunić & Granić, 2015; Legris et al., 2003). These external elements include institutional support, teacher preparation, technical infrastructure, and other environmental influences in addition to individual attitudes and beliefs. The study's framework considers the following demographics: age, sex, type of school, and prior familiarity with technology. Research by Norton (2019), indicates that sex significantly affects the degree to which technology is embraced. This is due to the possibility that men and women are exposed to technology at varying degrees. Men are more prone to believe that technology is helpful when they are exposed to it more frequently. In a similar vein, women who use technology more frequently are more likely to think it beneficial. Accordingly, pre-service teachers' views of usability and utility may be influenced by sex (Huffman, Whetten, & Huffman, 2013). Technology proficiency does not provide an easier integration of technology into instructional methods (Siyam, 2019). Teachers who have worked with technology in the past may be aware of its benefits and ease of use. Pre-service teachers' past experiences with technology will impact how they view and use it. Due to their inexperience and lack of confidence, instructors find it

challenging to incorporate ICT into their lesson plans (Han, Shin, & Ko, 2017). The challenges pre-service instructors have had in the past may negatively impact their views of the usefulness and usability of technology (Farjon, Smits, & Voogt, 2019).

According to research, age influences how useful and simple a product is perceived (Szymkowiak et al. 2021; Pittalis, 2021). The goal of the study is to evaluate how perceived utility and usability relate to age. The sort of school an individual attends is likely to have an impact on perceived utility and perceived ease of usage. Single-sex schools' perceptions of technology use are likely to shift when they choose a different curriculum than coeducational schools. The student body may have influenced how pre-service instructors from single-sex schools assess ease of usage.

Perceived utility and readiness to integrate ICT are positively connected, according Davis's (1986) Technology Acceptance Model. Teachers are more likely to feel confident and encouraged to investigate the potential use of ICT in the classroom if they believe it is beneficial or easy to apply (Walan, 2020). They now have more confidence in their capacity to use technology in their teaching practices. As a result, instructors are more ready to use technology in the classroom if they believe it will improve their teaching methods. Teachers will be willing to use technology in their lessons if they believe it is user-friendly. Teachers' readiness to include ICT into the classroom is influenced by a variety of environmental factors, such as school culture, technological infrastructure, and legislative backing. These elements influence the experiences and viewpoints of educators as well as the broader framework within which technology integration projects are implemented.

Another issue is school culture. The culture of a school can have an impact on how much technology is embraced and incorporated into teaching and learning procedures. ICT integration can be facilitated by a school culture that encourages creativity, teamwork, and continuous professional growth. However, a school culture that opposes change, discourages experimentation, or favours traditional teaching techniques makes it problematic to incorporate ICT into the classroom lessons (Thurm & Barzel, 2020).

Technology-related infrastructure is another. Hardware, software, internet connectivity, and technical assistance are just a few of the elements that make up a successful technology infrastructure. Their quality and availability are additional crucial factors. Inadequate or unsafe infrastructure may affect the use of ICT in the classroom. Teachers can easily access, use, and incorporate technology into their teaching methods when there is a sufficient infrastructure in place (Matthew et al. 2021). Policy support is another aspect. The way that technology is incorporated into education can be greatly influenced by policies at the institutional, district, or national levels. Teachers may be encouraged to embrace technology and integrate it into their teaching strategies by supportive policies that offer rewards, resources, and guidance for doing so. On the other hand, rules that are incompatible or unsupportive could create obstacles and hinder attempts to integrate technology. It is essential to comprehend and pay consideration to these environmental factors while creating effective strategies and interventions to promote technology integration in the classroom. Consequently, it is likely that environmental factors may have an indirect impact on how instructors view technology (Soma, Nantomah, & Adusei, 2021). In addition to providing a more comprehensive understanding of the complex

dynamics involved in technology integration, conceptual frameworks that consider these factors aid in the development of evidence-based practices and policies (Agyei, 2012; Agyei & Voogt, 2015).

Empirical Review

Association between Pre-Service Mathematics Teachers' Perceived Usefulness and their Demographic Characteristics

In 2021, Pittalis explored "the relations between the role of external variables and the parameters of TAM." Pittalis (2021) enhanced the TAM by incorporating the idea of "perceived pedagogical-learning fit" (PLF) into the Model. Perceived pedagogical learning, which is founded on a cognitive learning paradigm, is the assessment of the pedagogical learning suitability of employing dynamic geometry software in geometry training. The study used a cross-sectional survey design. A convenience sample technique was employed to recruit 146 pre- and in-service maths teachers from secondary schools. The data was collected using questionnaires. The researchers discovered that the perceived benefit had no influence on the propensity to use technology. Personal inventiveness, enabling settings, and computer fear had only a moderate effect on perceived utility and pedagogical learning fit. The suggested approach demonstrated how important instructors' perceptions of pedagogical fit are in determining how they use technology. Although the study's integration of TAM with the view of perceived pedagogical-learning is one of its strong points, a more thorough examination of how these two frameworks work together to improve our understanding of instructors' technology adoption would be helpful. The study noted that the

sample might not be entirely typical of maths teachers in general. The study's geographic and demographic focus was not made public. This restriction limits the findings' applicability to a larger group of teachers in various learning environments.

Chung, Park, Wang, Fulk, and McLaughlin (2010) investigated the effects of age on people's perceptions of their participation in online communities. The study, which took a cross-sectional approach, was structured around the TAM. The Media Research Lab at the University of Texas in Austin offered 20,000 online panels from which data for this study was collected. 989 panellists were randomly selected from the panel database as part of the sample method.

The findings offered some support for the TAM hypothesis, age differences in external influences, and the moderating effect of age. The study, which looked at how attitudes towards joining online groups varied by age, was significant and pertinent. Online panels might not adequately reflect the population's variety, which could introduce bias into the sample and restrict how broadly the results can be applied. The study was to explore how age impacted the correlations between variables, but the results showed no moderating effect of age. This highlights the need for more research and raises questions about how age influences opinions about joining online organisations.

Ngwako and Botane (2017) studied "pre-service teachers' use of technology during teaching practice." The study made use of the UTAUT. Stratified sampling was used to select 52 samples from a total of 95 teaching practice students. Semi-structured observation and a checklist were used to evaluate how the learning environment and technology were used. Interviews

were conducted to find out more about the people's technology usage. Although the majority of participants (90%) expressed high levels of skill in using electronic resources, the inquiry's findings revealed that 90% of them did not use technology when teaching their courses. Furthermore, 89% of participants said that technology was beneficial for learning and might have improved students' comprehension in a variety of ways, including capturing their interest, simplifying difficult topics, saving time, and providing material not available in textbooks.

If the qualitative design, and more specifically the case study, had been employed, the study might have yielded reliable results. The observations and interviews may help to explain the people's heavy reliance on technology. However, the study did not explain the PEU of ICT or its relationship to technology use. Participants did not use technology since schools might not have adequate resources for it.

Association between Pre-Service Mathematics Teachers' Perceived Ease of Use and their Demographic Characteristics

Using perceived ease of use as a mediator, Addison (2021) explored how user expectations, competitive pressure, and technology improvements affect continuing digital disruption. To identify the important components of the multiple variables, this study developed a conceptual framework for critically evaluating relevant theoretical models, literature reviews, and empirical tests. The recommended conceptual framework was used with 292 of 1,200 respondents in Kuala Lumpur, Malaysia, aged 18 and up, who worked in the digital technology sector. Convenience sampling was used to choose the responders. An explanatory mixed-methods approach was adopted for the

study. The information was collected using an online survey. The data were analysed using AMOS 22 software, which comprised structural equation modelling, confirmatory factor analysis, and exploratory factor analysis. Perceived ease of use was found to be a moderately effective mediator of user expectations and competitive pressure. The study's explanatory mixed-methods research approach looks to lend credibility to the conclusions. Furthermore, the study concentrated on the mediating effect of perceived ease of use, leaving out other characteristics that potentially influence digital disruption. The study's findings may have been impacted by the non-probability sampling even though a convenience sample technique was used. The conceptual framework, however, illustrates how the variables are related. Consequently, the research contributes to the understanding of digital disruption in the business world.

Cuhadar (2018) looked into how sex influences pre-service teachers' ability to integrate technology. The Synthesis of Qualitative Evidence Model offered the theoretical foundation for developing the scale to assess pre-service teachers' readiness to incorporate technology into the classroom. The study used a purposive sample with a cross-sectional survey approach. The sample included 832 pre-service teachers from four Turkish educational faculties. Data was gathered via questionnaires. The findings demonstrated that pre-service teachers' attitudes about receiving training and assistance with ICT integration differed significantly according to gender. To ensure the measurement tool's dependability, the scale underwent stringent validation procedures, such as confirmatory factor analysis, construct validity testing, and translation. A large and diversified sample improved the generalisability of the findings and

provided a more comprehensive understanding of the technological integration readiness of pre-service teachers.

Papadakis (2018) explored how pre-service teachers used technology based on gender and age. The survey study was designed using a quantitative research methodology. 125 pre-service teachers engaged in a one-year pedagogical training program at the School of Pedagogical and Technological Education in Heraklion, Crete, were chosen using convenience sampling. Descriptive statistics were used to assess the acquired data, resulting in mean scores, standard deviations, skewness, and kurtosis for several Technology Acceptance Model components.

This study looked at the variables that affect how technology is incorporated into programs for preparing teachers and underlined how crucial it is to comprehend how teachers feel about technology in order to use it in the classroom. With mean scores for each item exceeding 50% of the total score, the results showed that people's attitudes regarding the acceptance of technology were largely positive. The gender distribution within the participation group was highlighted by the results, which showed that female students made up 66% of the sample. However, when it came to utilising smart mobile devices in their teaching activities, pre-service teachers of various ages did not discover any statistically significant differences in how easy they were to use.

The mean perceived ease of use scores, which indicated positive attitudes towards technology, showed pre-service teachers' desire to use technology into their teaching practices. Because the population was divided into year groups, a simple selection method with 125 students was sufficient. However, the study's demographics were not revealed, but the participants' year

groups were.

Eraslan, Yalcin, and Kutlu (2019) conducted a thorough empirical investigation of students' perceptions of learning management systems (LMS) in classrooms. The study employed an updated Technology Acceptability Model to identify the elements that influence students' acceptability and intention to use learning management systems. 282 students from two Turkish colleges who have used or are considering using learning management systems (LMS) for their academic endeavours were chosen for the study using a convenience selection technique and a cross-sectional survey methodology. The data was gathered via questionnaires.

According to the report, 93% of students use LMS for two hours or fewer per day, whereas 87% of students regularly use computers and the Internet. The bulk of respondents (76%) were under the age of twenty-four. The respondents' student demographics were quite well divided, with 43.3% girls and 56.7% males. The study broadened the widely used Technology Acceptance Model (TAM) to include computer self-efficacy, user interface design, and social norms. This improvement enabled a more in-depth examination of students' consent and intention to use learning management systems. Although the poll did not particularly address this issue, demographic factors such as age, gender, educational background, and past technological proficiency can all influence people's impressions of how simple it is to utilise an LMS.

The study's population was not specified, despite the sample size appearing to be suitable. The researchers found that sending the questionnaire link by email was pointless and a waste of time. Due to time constraints,

physical copies of the questionnaires were filled out. It's possible that the time-consuming data collection process was pointless.

Influence of Pre-Service Mathematics Teachers' sex on their Readiness to use Technology in teaching mathematics

Ma identified three core features present in classrooms led by teachers with PUFM: interconnectedness, multiple representations, and longitudinal coherence. Such teachers deliberately draw links between mathematical ideas and skills to support pupils' understanding of mathematics as a unified discipline. They encourage flexibility by weighing the strengths and limitations of various approaches, while demonstrating mastery of the mathematics curriculum. This enables them to identify the crucial knowledge that supports continuous learning and long-term development. Liping Ma's PUFM framework has significantly shaped the way teacher expertise in mathematics is understood. It underscores the importance of specialised knowledge that combines conceptual depth with pedagogical skill.

It seemed appropriate to select 163 members of the mathematics department using a simple selection procedure, since the population was composed of pre-service mathematics students. However, the total number of maths pre-service instructors at the school was not made public. Although the results were significant, the study did not include third-year students. The results might have been impacted by the lack of courses that introduced them to the real-world applications of ICT during their first year. Additionally, the third-year students were excluded because they were off campus for teaching practice. Additionally, the data gathering method left out other crucial aspects

like perceived utility and usability, which limited how far the findings could be applied.

Alonso-Castaño et al. (2021) examined the capacity of future educators to understand and complete a probability assignment, revealing that despite demonstrating strong general and domain-specific mathematical knowledge, nearly half of the participants exhibited significant deficiencies in these areas. These findings underscore the multifaceted association between teachers' mathematical proficiency and their ability to convey probability ideas to pupils successfully. The inconsistencies in findings suggest that the correlation between instructor expertise and student learning is neither uniform nor straightforward. The outcome may depend on the specific field of mathematics, the depth and clarity of instructors' understanding, and the degree to which their expertise aligns with curriculum standards. Although the study takes sex into account as a demographic variable, it did not completely evaluate other factors that might have an impact on computer self-efficacy, such as past computer experience, access to technology, and training methodologies. The study's use of a slightly modified Computer Self-Efficacy Scale raises questions regarding the measure's validity and reliability in this particular environment, but it's unclear how the scale was modified and validated in the Nigerian context.

Influence of Pre-Service Teachers' Perceptions of the Usefulness of Technology on their Readiness to use Technology in teaching mathematics

In a recent study, Al-Abdullatif, Al-Dokhny, and Drwish (2022) investigated the factors that influence pre-service teachers' decisions to use the Internet of Things (IoT) as a digital tool to enhance classroom teaching and learning. The Technology Acceptance Model was used to assess how the

Internet of Things (IoT) impacted an online learning environment. The study investigated pre-service teachers' impressions of the use of IoT, how practical and simple they thought it was, and how these perspectives influenced their students' behaviour. The study employed a descriptive research method. Purposive sampling was used to choose the 47 final-year pre-service computer teachers in the program.

The study discovered that pre-service teachers' preparedness to implement IoT in their classrooms was strongly influenced by the technology's perceived usefulness and usability, both of which are related to TAM. Their views on the matter have no bearing on their use of the Internet of Things (IoT). Furthermore, pre-service customers' impressions of the Internet of Things' utility had a significant impact on their decision to use or continue using it. The study found that pre-service teachers' perceptions towards the feasibility and application of technology influenced their willingness to adopt the Internet of Things. However, the study's selection process could have been biassed towards pre-service computer students.

This is because the sampling procedure did not ensure that every student had an equal opportunity of participating in the study. Furthermore, the study population was not identified. Furthermore, pre-service teachers' willingness to employ technology in the classroom may have been influenced by their training program and environment. The relationship between TAM variables such as perceived utility and perceived ease of use was not investigated, despite the fact that the TAM was employed to assess IoT use. Appavoo (2021) investigated the factors that significantly influence maths instructors' usage of technology. This

study used both the Technology Acceptance Model and the Unified Theory of Acceptance Model.

155 teachers from 44 senior high schools were consulted in the study using quota and deliberate sample techniques in a contemporaneous mixed method design. The study found that the teachers' frequent computer use showed that they valued technology as a teaching tool and thought it could improve maths instruction. Nonetheless, 16.6% of educators used technology into their instructional plans. Teachers emphasised how important it is to have proper training while integrating ICTs in the classroom. The respondents also emphasised the need for better computer services, especially Internet access, at universities. The employment of new computer-mediated teaching methods and the departure from traditional methods were nevertheless seen with trepidation, hesitancy, and anxiety, despite the fact that the majority of teachers demonstrated skill with technology.

The concurrent mixed-method methodology developed by Appavoo (2021) increases the validity of the outcomes. This is due to the fact that the mixed-method approach provides more in-depth explanations of the topic being studied. Additionally, by confirming and supplementing the answers given in the questionnaires, the triangulation method of data gathering helped to guarantee the validity of the procedure. However, the study is susceptible to academic biases because the respondents were selected by a deliberate selection procedure. Furthermore, Appavoo (2021) did not thoroughly examine how maths professors incorporate technology into their lectures or what specific pedagogical techniques they employ to improve student learning outcomes. After receiving training on integrating technology into mathematics classroom,

Akkaya (2016) examined how instructors' opinions towards its use changed. A curriculum for pre-service teachers was created and put into use that included topic knowledge, pedagogy, and technology. An exploratory sequential mixed technique was used in the investigation. A pretest-posttest experimental design was used in the investigation, and there was no control group.

Pre-service teachers' written thoughts were also gathered as part of the study's qualitative component. Using a convenience selection approach, 34 participants were chosen for the entire academic year from among the three pre-service maths teachers at the State University in Turkey. Perception of Scale in Technology Utilisation and interview forms were used as tools for gathering data. Descriptive statistical techniques and t-tests were used to evaluate quantitative data, and content analysis was used to analyse qualitative data. The study's findings demonstrated that pre-service middle school maths teachers' opinions towards the use of technology in the classroom underwent a significant shift following training on its integration.

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Influence of Pre-Service Teachers' Perceptions on the Ease of Use of Technology on their Readiness to Use Technology in Teaching Mathematics

Gyamfi (2016) assessed Ghanaian pre-service maths teachers' computer readiness using the Technology Acceptance Model. The investigation was conducted using a cross-sectional survey design. From two public pre-service teacher education schools in Ghana, 380 pre-service teachers were selected as a sample. To ensure that the sample from the two universities was fairly represented, the stratified random sampling approach was employed. Teo (2009) and other researchers utilised a questionnaire that was modified to create the current one. Both descriptive and inferential analyses of the collected data were performed using IBM SPSS (version 21), a statistical program.

Gyamfi (2016) showed that attitudes towards computer use, perceived usefulness, and simplicity of use had a substantial impact on pre-service teachers' actual computer use. Perceived utility and perceived ease of use were significantly influenced by pre-service teachers' educational viewpoints, according to multiple stepwise regression analyses. Furthermore, pre-service teachers' perceptions of the usefulness and usability of computers have a big impact on their attitudes towards using them, which in turn has a big impact on how they actually utilise computers.

It's possible that the 380-person sample size was too small to be typical of Ghana's two pre-service teacher training institutions. Furthermore, the study relied on self-reported data from pre-service teachers, which might have been influenced by social desirability. This study does not take into account how external factors, including institutional support or the availability of technology, affect teachers' adoption of technology. Apeanti (2016) investigated how

prepared aspiring maths teachers were to use ICT. 155 teachers from 44 senior high schools were consulted in the study using quota and deliberate sample techniques in a contemporaneous mixed method design. The study found that the teachers' frequent computer use showed that they valued technology as a teaching tool and thought it could improve maths instruction. Nonetheless, 16.6% of educators used technology into their instructional plans. Teachers emphasised how important it is to have proper training while integrating ICTs in the classroom. The respondents also emphasised the need for better computer services, especially Internet access, at universities. The employment of new computer-mediated teaching methods and the departure from traditional methods were nevertheless seen with trepidation, hesitancy, and anxiety, despite the fact that the majority of teachers demonstrated skill with technology. The concurrent mixed-method methodology developed by Appavoo (2021) increases the validity of the outcomes. This is due to the fact that the mixed-method approach provides more in-depth explanations of the topic being studied. Additionally, by confirming and supplementing the answers given in the questionnaires, the triangulation method of data gathering helped to guarantee the validity of the procedure. However, the study is susceptible to academic biases because the respondents were selected by a deliberate selection procedure. Furthermore, Appavoo (2021) did not thoroughly examine how maths professors incorporate technology into their lectures or what specific pedagogical techniques they employ to improve student learning outcomes. After receiving training on integrating technology into mathematics classroom, Akkaya (2016) examined how instructors' opinions towards its use changed. A curriculum for pre-service teachers was created and put into use that included

topic knowledge, pedagogy, and technology. An exploratory sequential mixed technique was used in the investigation.

Association between Environmental Characteristics and Pre-Service Mathematics Teachers' Perceived Usefulness

Thurm and Barzel (2020) investigated the "efficacy of a half-year professional development program for teaching mathematics with technology in three sites including the North, Rhine and Westphalia, in Germany." Thurm and Barzel (2020) employed a quasi-experimental methodology for their study. It was discovered that the majority of the experimental group's participants (n=39) had never used technology in maths lessons before. The control group (n=88) was paired with teachers who were not participating in the professional development program using propensity score matching. Teachers' views towards technology were most influenced by the professional development program.

Thurm and Barzel (2020) found that teachers' perceptions of the use of technology in maths lessons were much enhanced by the professional development program. Additionally, the professional development program raised instructors' self-efficacy in using multi-representational tools and the frequency with which they used technology in math classes. These effects began immediately after the intervention and continued for six months. However, there was no discernible difference in the comprehension of mathematical ideas or teaching methods between the treatment and control groups.

In their conclusion, Thurm and Barzel (2020) offered suggestions for creating professional development programs in technology-assisted teaching. Lesson plans and interviews, for example, could provide insight into how other

elements, such organisational support and school culture, may have affected the professional development program's results. The study's capacity to prove causation is constrained because it was carried out utilising a quasi-experimental methodology as opposed to a randomised controlled trial. Furthermore, the self-reported frequency of technology usage may not be as accurate as it may be because observation and classroom implementation were not triangulated.

Kaleli-Yilmaz (2015) explored mathematics teachers' views on the factors that affect their use of technology in teaching mathematics. A qualitative case study design involved ten professors who were postgraduate students at a Turkish university. The study's sample was selected through the use of purposeful sampling. The three components of the study were teacher-led activities, software and learning materials, and teachers delivering a technology-assisted course in an authentic classroom environment. A semi-structured interview was employed by Kaleli-Yilmaz (2015) to gather data regarding the participants' experiences. The interview took place following the completion of each procedure. The interviews' content analysis showed that a variety of factors, including those pertaining to teachers, students, content, methods, resources, time management, and technology, affected the incorporation of technology.

The results of the interviews showed that teachers were not prepared to incorporate technology into their lessons, even if the program created for their training did. This is because they blamed their incapacity to integrate technology for a number of other issues. Furthermore, because the factors influencing teachers' use of technology in the classroom are subjective, it could

be difficult for the researcher to extrapolate the findings to other educators who also utilise technology.

Purposeful sampling may have been biassed towards the 10 participants, even though qualitative research provides a thorough response to the discussion topic, improving the validity and reliability of the results. 155 teachers from 44 senior high schools were consulted in the study using quota and deliberate sample techniques in a contemporaneous mixed method design. The study found that the teachers' frequent computer use showed that they valued technology as a teaching tool and thought it could improve maths instruction. Nonetheless, 16.6% of educators used technology into their instructional plans. Teachers emphasised how important it is to have proper training while integrating ICTs in the classroom. The respondents also emphasised the need for better computer services, especially Internet access, at universities. The employment of new computer-mediated teaching methods and the departure from traditional methods were nevertheless seen with trepidation, hesitancy, and anxiety, despite the fact that the majority of teachers demonstrated skill with technology.

The concurrent mixed-method methodology developed by Appavoo (2021) increases the validity of the outcomes. This is due to the fact that the mixed-method approach provides more in-depth explanations of the topic being studied. Additionally, by confirming and supplementing the answers given in the questionnaires, the triangulation method of data gathering helped to guarantee the validity of the procedure. However, the study is susceptible to academic biases because the respondents were selected by a deliberate selection procedure. Furthermore, Appavoo (2021) did not thoroughly examine how

maths professors incorporate technology into their lectures or what specific pedagogical techniques they employ to improve student learning outcomes. After receiving training on integrating technology into mathematics classroom, Akkaya (2016) examined how instructors' opinions towards its use changed. A curriculum for pre-service teachers was created and put into use that included topic knowledge, pedagogy, and technology. An exploratory sequential mixed technique was used in the investigation. According to the study's findings, maths teachers hardly ever use ICT in the classroom. Respondents had little opportunity to explain how much ICT they utilised because they had to select pre-formatted answers to fill out the questionnaire. The results could have been affected by the sampling strategy. Even if the sample size would have been adequate for the study, the sampling procedure might have been biassed in favour of particular public schools. This is due to the fact that several public schools in the Volta region might not have the tools and support needed to enable teachers to use ICT in the classroom. The survey method does away with changes to the way data is gathered.

Furthermore, only a limited number of responses may be gathered, and a of the research is excluded. In order to gather data, the participants also responded to structured questionnaires. Because the participants may have inflated their ICT skills in their responses, the results might not fairly represent their competencies. A study on the "relevance of the integration of modern digital technologies in teaching mathematics" was carried out by Nodira, Parpieva, Yakubova, and Mirkhodjaeva (2020). The study examined the attitudes and usage of digital technology among 50 maths professors in

universities. The TPCK framework served as the study's compass. Questionnaires, observations, and interviews were used to collect data.

The results of the study showed that both internal and external barriers affected teachers' strategies for incorporating modern digital technology into mathematics instruction. The outcome of the poll revealed that teachers were quite confident in their technical proficiency, subject-matter expertise, and instructional strategies. However, most people did not view digital technologies as an essential part of education, but rather as merely an instrument. The study's scientific approach was not disclosed by the authors. The study used a mixed-method approach, according to the data gathering method. It was challenging to comprehend how the qualitative data complimented the quantitative data, though, because the precise mixed-method research design was not stated.

Furthermore, despite stating that the sample size was 50, the report did not specify which group the sample size was taken from. It is therefore challenging to argue that the results are suitable for generalisation. The obstacles to integrating technology were recognised by the respondents. Despite having a high level of content competence and believing that technology was helpful, maths teachers did not integrate it into their classes. This is due to the fact that different schools have different environmental conditions, such as differing access to resources and technological support.
A study on the use of technology in maths instruction in a few Ghanaian senior high schools was carried out by Larbi (2019). The study recruited 105 maths instructors from nine senior high schools in the West and East Sunyani Municipality using a purposive sample approach and a descriptive survey

design. The results showed that the schools where the poll was conducted had a moderate amount of computers available. Additionally, in order to successfully integrate computers into their classes, senior high school maths teachers need to have a basic understanding of the technology. The results of the study showed that only a tiny percentage of maths teachers in the research region used technology to teach arithmetic in the classroom. Larbi (2019) proposed expanding the quantity of computers in classrooms.

Additionally, one of the main goals of teacher preparation programs at universities and schools of education should be to train and support teacher candidates in applying their technological skills for the planning, carrying out, and evaluating of mathematics instruction. Despite the academics' belief in the benefits of technology and their fundamental knowledge of its use, less than 10% of the participants showed any indications of integrating it. Furthermore, 105 residents from the West and East Sunyani Municipality made up the study's sample size, which was enough; yet, the sampling procedure was not fully described. Furthermore, the theoretical and conceptual foundations of the research were not explained by Larbi (2019).

Chapter Summary

By examining the Technology Acceptance Model as the theoretical underpinning for evaluating how equipped pre-service maths teachers are to integrate technology, this chapter set the study's backdrop. An outline of the main concepts and their connections to the conceptual framework employed in this study was given in this chapter. The chapter's conclusion included a detailed analysis of the study on the variables affecting their usage of technology, including environmental factors and demography.

From the reviews described above, it can be concluded that teachers who have previously worked with technology have improved their teaching methods compared to those who have not. Additionally, it was shown that the schools where the research was conducted had a reasonable level of technological infrastructure. Nevertheless, the teachers did not make use of the limited technological facilities in the classrooms. The use of digital tools by maths teachers and students has been the subject of numerous research. It's crucial to remember, however, that the studies mentioned above do not examine how prepared teachers are to use these resources when teaching maths.

There are still gaps in the external factors, especially the training curriculum and school culture, that affect teachers' readiness to utilise technology.

CHAPTER THREE

RESEARCH METHODS

The study's goal was to determine how prepared maths teachers are to embrace and use technology in the classroom. This chapter primarily focuses on the research design, study setting, population, sampling method, research instruments, procedures for data collection, and approaches to data analysis.

Research Design

A cross-sectional descriptive survey design was used to investigate the technological readiness of pre-service teachers. A cross-sectional research approach was deemed appropriate for this study considering its ability to quickly gather and summarise participant characteristics and present a picture of the findings (Creswell, 2012). For this study, information on pre-service math teachers' readiness to use technology in math classes was gathered. Furthermore, because it makes it possible to get current information on a large number of participants during the study period, this approach is economical (Creswell, 2012). Additionally, cross-sectional surveys offer reliable and consistent processes, and participants are not impacted by the researcher's presence or opinions (Sarantakos, 2013). There are benefits and drawbacks to this study design. Sarantakos (2013) identifies one of the survey technique's drawbacks as its inability to generate meaningful questions or a response from the respondent. The study's design would not allow it to account for any potential changes in participants' knowledge that might occur after the study because data was only collected once. Additionally, cross-sectional surveys offer reliable and

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Study Area

There are sixteen administrative regions in Ghana, including the Central Region. The Greater Accra region borders it on the east, the Ashanti and Eastern regions border it on the north, the Gulf of Guinea borders it on the south, and the Western region borders it on the west. The three schools in the area are dispersed among multiple districts. Two coeducational and one single-sex college are among the chosen establishments.

Population

All final-year maths students from Ghana's Central Region's educational institutions made up the target audience. Table 1 displays the approximate number of pre-service maths instructors in their final year at each of the three universities chosen for the study.

Table 1: Population Size

Institution	**Pre-service Teachers' Population**
College A	50
College B	74
College C	55

Total	**179**

Source: Schools' Administration (2024)

Sampling Procedure

Multi-stage sampling was used to determine the study's sample size. First, the census was used to choose all of the educational institutions in Ghana's Central Region. Krejcie and Morgan (1970) suggested that an average sample size of 123 pre-service teachers is required for a population of 179, even though a sample size of 134 was used for the study. A census was used to choose the College A participants since they were all suitably representative for the research. A proportionate sample approach was also used to choose pre-service maths teachers from Colleges B and C in order to guarantee equitable representation. Participants in the study were chosen from Colleges B and C using the standard random selection process. The responses from Colleges B and C were selected using random numbers produced by MS-Excel.

Data Collection Instrument

The data was collected using a closed-ended questionnaire on a five-point Likert scale. To meet the study's objectives, the Teo (2009) questionnaire was updated. According to Frankel, Wallen, and Hyun (2006), a questionnaire saves time while protecting respondents' anonymity. The questionnaire was broken into five parts. Section A's items were designed to elicit demographic information from prospective teachers. Section B included eleven additional questions about pre-service teachers' attitudes towards technological use in math instruction. The nine questions in Section C were designed to measure pre-service teachers' views on the use of technology in mathematics classes.

Pre-Testing of Instrument

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Validity and Reliability of the Instrument

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 2: Reliability of Constructs

Construct	Number of Items	Cronbach Alpha
Environmental Characteristics	11	0.927

Perceived Usefulness	9	0.721
Perceived ease of use	9	0.839
Readiness to use	7	0.818

Each question's Cronbach Alpha was more than 0.65, meaning that every item assessed the constructs for which it was intended (Table 2). According to Vaske (2008), this made the device dependable.

Data Collection Procedure

Regular communication with the department head and school administration was planned in order to establish rapport. Following supervisor approval, the University of Cape Coast's Department of Mathematics and ICT Education issued an introductory letter to each of the three Colleges of Education asking for their permission to gather data. Additionally, an ethical permission request was sent to the Institutional Review Board of the University of Cape Coast. It was given to the educational institutions after receiving ethical clearance. I gave the study participants an explanation of the instrument's purpose before they self-administered it. Each participant was given guarantees that any information they submitted would be kept secret and entirely anonymous. Additionally, since participation was completely optional, they might end at any moment. Respondents were given a maximum of one day to finish the questionnaire in order to ensure effective data collection.

Data Processing and Analysis

To highlight and encourage data quality and provide outcomes that are helpful for decision-making, data processing procedures such as coding, cleaning, converting, and modelling are employed (Ader, 2008). According to Saunders et al. (2013), research ethics include all the actions necessary to carry out

research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 3: Research hypotheses/question and statistical tools used

SNo	Research question/ hypothesis	Data Collection Instrument	Statistical Tools
1.	What is the statistical significant difference between pre-service mathematics teachers' perceived usefulness and their demographic characteristics?	Questionnaire	Independent T-test and ANOVA
2.	What is the statistical significant difference between pre-service mathematics teachers' perceived ease of use and their demographic characteristics?	Questionnaire	Independent T-test and ANOVA
3.	What is the statistical significant difference between the sex of pre-service mathematics teachers and their readiness to use technology in teaching mathematics?	Questionnaire	Independent T-test
4.	There is no statistical significant influence of pre-service teachers' perceived usefulness of technology on their readiness to use technology in teaching mathematics.	Questionnaire	Simple linear regression

5.	There is no statistical significant influence of pre-service teachers' perceived ease of use on their readiness to use technology in teaching mathematics.	Questionnaire	Simple linear regression
6.	There is no statistical significant influence of pre-service teachers' environmental characteristics on their perceived usefulness.	Questionnaire	Simple linear regression

Ethical Considerations

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Chapter Summary

The methodology for evaluating pre-service teachers' technology preparedness was described in this chapter. Every educational institution in Ghana's central area was the subject of the study. Participants were sampled using a multi-stage sampling procedure and a cross-sectional descriptive survey methodology. ANOVA, simple linear regression, and the independent sample t-test were used to analyse the survey data. Chapter 4 offered the findings along with a review of the research participants and hypotheses.

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CHAPTER FOUR

RESULTS AND DISCUSSION

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Results

According to Table 1, 86 (64.2%) of the pre-service maths teachers attended a coeducational college, whereas 48 (35.7%) attended a single-sex institution. Of the pre-service maths teachers, 83 (61.9%) were between the ages of 20 and 24, 47 (35.1%) were older than 25, and 44 (3.0%) were younger than 20.

Table 4: Demographic Characteristics of Pre-service Mathematics Teachers

Demographics	Frequency	Percentage
School Type		
Single Sex	48	35.8
Co-educational	86	64.2
Age		
Below 20 years	4	3.0
20 – 24 years	83	61.9
25 + years	47	35.1
Sex		
Male	44	32.8
Female	90	67.2
Have you used technology to teach before?		
Yes	95	70.9
No	39	29.1

Additionally, there were 90 (67.2%) women and 44 (32.8%) men in the sample. Lastly, out of the 134 participants in the sample, 95 (70.9%) said they had previously used technology for instruction, while the remaining 39 (20.1%) said they had never used any technology at all.

What is the statistical significant difference between pre-service mathematics teachers' perceived usefulness and their demographic characteristics?

The primary objective of study question one is to ascertain how the demographic characteristics of pre-service maths instructors differ from their opinions regarding the benefits of using technology to teach maths. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

The pre-service teachers' school type ($F=0.226$, $p=0.635$) and their prior experience with technology use ($F=18.787$, p0.001), with the male and female pre-service maths teachers ($F=5.611$, $p=0.019$), were assumed to have equal variances, according to Levene's test of equality of variances. Tables 5, 6, and 7 display the responses to the initial study question.

Table 5: Group Statistics of Demographic Characteristics (School Type, Sex and Prior Experience with Technology) and Perceived Usefulness

		N	Mean	Std. Dev	T	Df	p-value
Type of School	Single Sex	46	3.768	.877	-1.065	126	.289
	Co-educational	82	3.943	. 901			
Sex	Female	87	3.825	.771	-.898	58.906	.373
	Male	41	3.997	1.108			
Prior experience with Technology	Yes	90	3.799	1.011	-2.094	124.812	.038
	No	38	4.073	.469			

The opinions of pre-service teachers about the use of technology in math instruction did not differ statistically between coeducational schools (M=3.943, SD=0.901), t(126) = -1.065, p = 0.289, and single-sex schools (M=3.768, SD=0.877), as shown in Table 5. Despite this, the means and standard deviations showed that pre-service maths teachers in coeducational schools (M=3.943, SD=0.901) thought technology was better than those in single-sex schools (M=3.768, SD=0.877). According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 6: ANOVA Test Results of Ages

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.248	2	3.624	4.825	.010
Within Groups	93.878	125	.751		
Total	101.126	127			

The one-way ANOVA results in Table 6 ($F(4.825)$, $p < 0.05$) revealed a statistically significant difference among the ages of pre-service mathematics teachers regarding their perceived usefulness of technology in teaching mathematics. To identify the specific differences between the age groups, a Tukey post-hoc test was performed, as presented in Table 7.

Table 7: Tukey Post Hoc Test of Age Difference between Groups

	(J) Age	Mean	Std. Deviation	Mean Difference (I-J)	Std. Error	Sig.
Below 20 years	20 to 24 years	3.926	.708	-1.37083*	.44401	.007
	25 + years	3.917	1.107	-1.36111*	.45258	.009
20 to 24 years	Below 20 years	2.556	.709	1.37083*	.44401	.007
	25 + years	3.917	1.107	.00972	.16265	.998
25 + years	Below 20 years	2.556	.709	1.36111*	.45258	.009
	20 to 24 years	3.926	.708	-.00972	.16265	.998

The outcomes of the analysis, as shown in Table 7, showed that According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. Pre-service maths teachers between the ages of 20 and 24 reported that technology was more helpful than those under 20 (M = 3.926). On the other hand, pre-service math teachers over 25 (M = 3.917) believe that technology is more beneficial than those under 20 (M = 2.556), indicating statistically significant (p0.05) differences between their views on the use of technology in math instruction. Nevertheless, there was no statistically significant difference (p > 0.05) in the perceived utility of pre-service maths teachers who were 25 years of age or older compared to those who were 20 to 24 years old.

What is the statistical significant difference between pre-service mathematics teachers' perceived ease of use and their demographic characteristics?

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the

study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Pre-service math teachers' sex (F=.144, p=.705) and prior technological experience (F=2.007, p=.159) had equal variances, according to Levene's test of equality of variances, but their school type (F=13.578, p.001) did not. The outcomes of the research question are presented in Tables 8, 9 and 10.

Table 8: Group Statistics of Demographic Characteristics (School Type, Sex and Prior Experience with Technology) and Perceived Ease of Use

		N	Mean	Std. Dev	t	df	p-value
Type of School	Single Sex	46	3.894	1.079	.061	66.815	.952
	Co-educational	75	3.883	. 674			
Sex	Female	84	3.881	.882	-.119	119	.906
	Male	37	3.901	.771			
Used technology to teach before	Yes	85	3.745	.775	-2.922	119	.004
	No	36	4.222	.922			

Table 8 shows that pre-service teachers' assessments of how simple it was to utilise technology to teach mathematics did not differ substantially between coeducational schools (M=3.883, SD=.674) and single-sex schools (M=3.894, SD = 1.079) (t(66.815) = 0.061, p =.289). According to Saunders et al. (2013),

research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. Thus, pre-service teachers who had previously used technology in the classroom (M=3.745, SD=.775) thought it was more difficult to use than those who had never used it (M=4.22, SD=.922).

Table 9: ANOVA Test Results of Ages

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.528	2	2.264	3.280	.041
Within Groups	81.447	118	.690		
Total	85.975	120			

Table 9's one-way ANOVA results show that pre-service math teachers' opinions on how simple it is to teach arithmetic using technology varied statistically substantially by age (F = 3.280, p = 0.041). According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical

concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 10: Tukey Post Hoc Test of Age Difference between Groups

	(J) Age	Mean	Std. Deviation	Mean Difference (I-J)	Std. Error	Sig.
Below 20 years	20 to 24 years	3.983	.824	-1.16764*	.48904	.048
	25 + years	3.791	.835	-.97619	.49650	.125
20 to 24 years	Below 20 years	2.815	.996	1.16764*	.48904	.048
	25 + years	3.791	.835	.19145	.15974	.456
25 + years	Below 20 years	2.815	.996	.97619	.49650	.125
	20 to 24 years	3.983	.824	-.19145	.15974	.456

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

The perceived ease of using technology to teach arithmetic, however, did not differ statistically significantly ($p>0.05$) between pre-service math teachers

under 20 and those over 25. Once more, the findings showed that pre-service maths teachers who were 25 years of age or older and those who were between the ages of 20 and 24 did not think that using technology in the classroom was any harder than they already did.

What is the stastitical significant difference between sex of pre-service mathematics teachers and their readiness to use technology in teaching mathematics?

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 11: Sample t-test of sex of pre-service mathematics teachers on their readiness

	Sex	N	Mean	Std. Deviation	t	df	p-value	Cohen's *d*
readiness	Female	88	3.568	.691	-2.330	130	.021	-0.43
	Male	44	3.883	.808				

The readiness of male and female pre-service math instructors to employ technology in math instruction differs statistically significantly (t(130) = -2.33,

p =.021), as shown in Table 11. Compared to female pre-service teachers (M = 3.568, SD = 0.691), male pre-service teachers (M = 3.883, SD = 0.808) appear to be more tech-savvy. The effect magnitude, however, was determined using Cohen's d, which is the mean difference divided by the pooled standard deviation ($d = M_{(d)} / SDp$), in order to better comprehend the findings' practical importance.

There is no statistical significance influence of pre-service teachers' perceived usefulness of technology on their readiness to use technology in teaching mathematics

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 12: Model Summary (Perceived Usefulness on Readiness)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.556[a]	.309	.304	.63000

a. Predictors: (Constant), PU

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 13: ANOVA[a] (Perceived Usefulness on Readiness)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.212	1	22.212	55.964	<.001[b]
	Residual	49.613	125	.397		
	Total	71.825	126			

a. Dependent Variable: READINESS

b. Predictors: (Constant), PU

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order

to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

The results are shown in Table 14.

Table 14: Coefficients (Perceived Usefulness on Readiness)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.861	.249		7.463	.000
	PU	.469	.063	.556	7.481	.000

a. Dependent Variable: READINESS

There is no stastitical significance influence of pre-service teachers' perceived ease of use of technology on their readiness to use technology in teaching mathematics.

A linear regression was used to examine the research hypothesis, and the results are shown in Table 15. The analysis made it easier to find the coefficient of determination and determine whether the model is suitable for the study. Finding out if math teachers' perceptions of how easy ICT is to use had a statistically significant effect on their readiness to use it in the classroom was another objective.

Table 15: Model Summary (Perceived Ease of Use on Readiness)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.734[a]	.539	.535	.50318

a. Predictors: (Constant), PEU

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the

steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Table 16: ANOVA[a] (Perceived Ease of Use on Readiness)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	34.621	1	34.621	136.736	<.001[b]
	Residual	29.624	117	.253		
	Total	64.245	118			

a. Dependent Variable: READINESS

b. Predictors: (Constant), PEU

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. I also used the linear regression model to find out if pre-service maths teachers' opinions about how easy technology is to use affect how prepared they are to use it. Table 17 displays the findings.

Table 17: Coefficients (Perceived Ease of Use on Readiness)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.234	.216		5.713	.000
	PEU	.635	.054	.734	11.693	.000

a. Dependent Variable: READINESS

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

There is no statistically significant influence of pre-service mathematics teachers' environmental characteristics on their perceived usefulness.

A simple linear regression was used to examine this study hypothesis, and the results are shown in Table 18. The analysis made it easier to find the coefficient of determination and determine whether the model is suitable for the study. It was also utilised to determine whether the environmental factors of pre-service teachers had a statistically significant effect on their assessments of the advantages of utilising technology in the classroom.

Table 18: Model Summary (Environmental Characteristics on Perceived Usefulness)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.205[a]	.042	.034	.75905

a. Predictors: (Constant), ENVIRONMENTAL

4.2% of pre-service teachers' opinions about the usefulness of technology in the classroom are influenced by their environmental features, whereas 95.8% are explained by factors not covered in the study (Table 18's R-square value of.042).

Table 19: ANOVA[a] (Environmental Characteristics on Perceived Usefulness)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.857	1	2.857	4.958	.028[b]
	Residual	65.106	113	.576		
	Total	67.963	114			

a. Dependent Variable: PU

b. Predictors: (Constant), ENVIRONMENTAL

The model's fit for gauging how pre-service teachers' perceptions of the value of technology are influenced by contextual circumstances is evaluated using the ANOVA (F-test) based on Table 19. If the F-statistic's p-value is less than the significant value of.05, the model is considered appropriate for the sample. Similarly, if the F-statistic p-value above the significant value of.05., the model is deemed inappropriate for the sample. The p-value (Sig.) for the F-statistic ($F = 4.958$, $df = 1$, $p<.05$) is less than 0.028%. The environmental elements on pre-service teachers' views of the value of technology in the classroom can be adequately described by the linear regression model (PU =.149*Environmental + 3.439). The results are shown in Table 20.

Table 20: Coefficients (Environmental Characteristics on Perceived Usefulness)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.439	.214		16.102	<.001
	ENVIRONMENTAL	.149	.067	.205	2.227	.028

a. Dependent Variable: PU

Table 20 shows that pre-service math teachers' opinions on the use of technology in math instruction are positively impacted by environmental factors in a statistically significant way (β =.149, p <.05). Accordingly, pre-service math instructors' perceptions of the value of technology in math classes are likely to rise by 14% as a function of their surroundings.

Discussion

This study was conducted to explore how pre-service mathematics teachers are ready to accept and use technology in teaching mathematics.

What is the stastitical significant difference between pre-service mathematics teachers' perceived usefulness and their demographic characteristics?

The results showed a patchwork of associations between the demographic traits of pre-service maths teachers and their perceptions of their own worth. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being

studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

Once more, the study found no difference in pre-service maths instructors' opinions about the advantages of utilising technology to teach maths between male and female participants. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

However, math teachers' sex affects how they see technology use. Sex do not have effect on perceived usefulness, but it may have an indirect effect on people's propensity to utilise technology generally, which may influence how valuable they think it is for math instruction. For example, people's expectations and attitudes about computer use may be influenced by cultural or societal conventions surrounding sexual orientation, which may lead to variations in their level of technological readiness.

The results of previous technological experience are in line with a research by Thurm and Barzel (2020), which demonstrates that despite the availability of ICT tools and resources, many teachers remain hesitant and unprepared to incorporate technology into their teaching approaches. Therefore, ensuring that digital resources are successfully incorporated into instructional approaches requires more than just making them accessible. Experienced pre-service teachers felt less important than those who had no prior experience. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. A 2017 study by Botane and Ngwako, which found that the majority of participants did not use technology when teaching, lends credence to this. Therefore, additional components like training and support are necessary to enable teachers to successfully and comfortably incorporate technology into their lectures. The poll also discovered that pre-service maths teachers' opinions on the usefulness of technology varied statistically significantly by age group. According to studies by Pittalis (2021) and Chung, Park, Wang, Fulk, and McLaughlin (2010), age has a direct and moderating impact on technology

acceptability. Their conclusions are supported by this outcome. Pre-service teachers under the age of 20 reported significantly lower perceived usefulness than those in the 20–24 and 25+ year groups. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

What is the stastitical significant difference between pre-service mathematics teachers' perceived ease of use and their demographic characteristics?

Pre-service teachers from coeducational and single-sex colleges did not significantly differ in their perceptions of how easy it was to use technology, according to the study. The Ghanaian government's extensive efforts to expand access to technological resources in schools, including computers, tablets, and internet connectivity, have led to this conclusion (Soma, Nantomah, & Adusei, 2021). In order to assist teachers in incorporating technology into their lesson plans, the Ghanaian Ministry of Education (MoE) has also put in place training programs and offered assistance in the form of computers and tablets.

Furthermore, whether they teach in coeducational or single-sex schools, Ghanaian teachers are likely familiar with similar pedagogical approaches for utilising technology in the classroom (Agyei, 2012). According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.According to this study, even if pre-service teachers have prior experience with technology, they could still struggle to incorporate it into their maths classes. It suggests that a more smooth integration of technology into teaching methods is not always correlated with familiarity alone (Siyam, 2019). This phenomena may be caused by a variety of reasons, including as the intricacy of the technology itself (Mouza, Karchmer-Klein, Nandakumar, Ozden, & Hu, 2014) and the particular abilities needed to use it for instruction (Brenner & Brill, 2016). The present outcome is in line with a 2019 research conducted by Farjon, Smits, and Voogt who found out that earlier exposure boosts technology use.

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering

data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

According to this study, pre-service teachers' age may have a big influence on how simple they think technology is to use. Specifically, there were notable differences between pre-service instructors under twenty and those between twenty and twenty-four. In support with their findings, Papadakis (2018) also found a statistically significant difference between these age groups. People between the ages of 20 and 24 have grown up with technology at their fingertips, claim Szymkowiak et al. (2021). A higher degree of comfort and familiarity with technology is likely the outcome of this ongoing exposure, and thus enhances the average perceived ease of use. From the newest wearables and smartphones to early-generation PCs, they might have used a wider range of technology (Matthew et al. 2021; Eraslan, Yalcin & Kutlu, 2019). This implies that pre-service teachers in this age group might possess a wider variety of technological experiences and perspectives.

What is the stastitical significant difference between sex of pre-service mathematics teachers and their readiness to use technology in teaching mathematics?

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

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According to Han, Shin, and Ko (2017), prior technological experience is recognised as a reliable indicator of future technological use. Nevertheless, it is

concerning that men pre-service teachers are more tech-savvy than their female counterparts. Men might have had greater opportunity to interact with technology outside of the classroom, for as by playing video games or fiddling with devices. According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. Because of this cumulative experience, people may feel more at ease and comfortable using technology in a variety of circumstances, including schooling.

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the

gathered data was safely kept on a password-protected hard drive. This assertion demonstrates that pre-service teachers, whether male and female, are eager to successfully incorporate technology into their class plans. According to Addison (2021), this willingness to embrace technology is positive and bodes well for the future of technology-enhanced learning in classroom settings.

There is no stastitical significance influence of pre-service teachers' perceived usefulness of technology on their readiness to use technology in teaching mathematics.

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

The study's findings align with previous research demonstrating a favourable correlation between technology adoption and perceived utility (Al-Abdullatif, Al-Dokhny & Drwish, 2022; Gyamfi, 2016). According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up

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Consistent with earlier findings in the field, this study demonstrated a positive association between technology readiness and views of its utilisation. When integrating technology into maths lessons, it also emphasises how crucial it is to give pre-service teachers enough help and direction (Agyei & Voogt, 2015; Pierce & Ball 2009). Additionally, this conclusion suggests that teachers and teacher preparation programs highlight how important it is to comprehend and value the use of technology in mathematics instruction.

There is no stastitical significance influence of pre-service teachers' perceived ease of use of technology on their readiness to use technology in teaching mathematics.

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There is no statistically significant influence of pre-service mathematics teachers' environmental characteristics on their perceived usefulness.

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. The study's findings align with those of Kaleli-Yilmaz (2015) and Thurm and Barzel (2020), who found a number of factors that influence technology integration.

These elements include time management, educators, technology, materials, processes, and resources. This demonstrates how integrating technology is a complicated process and how successful implementation requires addressing a number of factors. This claim is supported by research by Adams (2022) and Larbi (2019), which shows that teachers often struggle to integrate ICT into their core teaching methods due to a lack of training materials. The study also supports the conclusions of Nodira, Parpieva, Yakubova, and Mirkhodjaeva (2020), who looked at how technology increases student engagement and how they evaluate its value in the classroom.

Chapter Summary

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter outlines the study and presents the conclusions derived from analyzing the research questions and hypotheses, along with the key findings and recommendations for decision-making. The chapter finishes with recommendations for more study and application.

Summary

According to Saunders et al. (2013), research ethics include all the actions necessary to carry out research in a morally responsible manner. Identifying the research problem, creating a plan to address it, carrying out the study, gathering data, cleaning the data, interpreting the data, and recording the findings are the steps that make up the research process. Regardless of the demographic being studied, the ethical concerns of study participants should always come first. (Howe, Carr, Shaw, & Beazer, 2020). The researcher did not request respondents' names, email addresses, or other identifying information in order to protect their privacy. To guarantee participant identity and stop data leaks, the gathered data was safely kept on a password-protected hard drive. The results were presented in tables.

Key Findings

The following important conclusions were reached after the research questions and hypotheses were examined:

1. Pre-service teachers' perceptions of the value of technology were not substantially impacted by either sex or school type. Pre-service teachers' views on the advantages of using technology to teach

arithmetic varied statistically significantly depending on their age and level of prior familiarity with it.

2. Pre-service teachers' evaluations of how easy it was to use technology were not significantly impacted by either sex or school type. However, depending on their age and previous tech expertise, the pre-service teachers' opinions about how simple it was to use technology to teach arithmetic varied statistically significantly.
3. There was a statistically significant difference between female and male pre-service mathematics teachers' readiness to use technology in teaching mathematics.
4. Pre-service math teachers' preparedness to employ technology in the classroom was positively impacted by perceived usefulness in a statistically significant way.
5. Pre-service math instructors' readiness to use the technology to teach mathematics was positively impacted by their perceptions of its usefulness in a statistically significant way.
6. Pre-service maths students' opinions on the usefulness of technology are positively impacted by environmental elements in a statistically meaningful way.

Conclusion

This study looked at the variables influencing pre-service maths teachers' readiness to use technology into their lessons.

1. The findings suggest that pre-service teachers' perceptions of the usefulness of technology may be impacted by their age and prior technological experience.

2. The findings suggest that pre-service teachers' perceptions of technology usability can be impacted by their age and prior technological experience.
3. The findings indicated that pre-service female instructors may be deficient in confidence in their ability to utilise technology.
4. Perceived utility and pre-service teachers' preparedness to use technology are positively connected.
5. Pre-service teachers' preparedness to incorporate technology is positively correlated with perceived ease of use.
6. The study's findings suggest that school culture, infrastructure, and policies have an impact on pre-service teachers' opinions about the usefulness of technology.

Recommendations

The following suggestions for teacher education programs were derived from the study's findings:

1. Workshops or modules created especially to meet the technical demands of pre-service teachers should be included in teacher training programs.
2. Teachers should be encouraged to think about how they may incorporate technology into their maths classes in order to meet certain learning goals.
3. This will teach kids that technology can be used for more than simply "gadgets" in the classroom.When exposing teachers to technology, their sex should be taken into account.
4. Finding any possible sex biases in the curriculum and instructional strategies used in the teacher training program's usage of technology

could help achieve this. Teacher training programmes should prioritise educational technology tools with user-friendly interfaces and intuitive designs for pre-service mathematics teachers.

5. It is essential to conduct ongoing study on the advantages of integrating technology into instruction.
6. Adequate funding for software, technology infrastructure, and continuous professional development for educators in the field of technology integration should be provided by the government..

Suggestions for Further Research

Future studies could focus on two main areas to learn more about the technology proficiency of pre-service maths instructors. To ascertain how prepared pre-service maths instructors are to teach arithmetic using a certain technology, researchers can first carry out an experimental study. Comparing the preparedness of pre-service maths teachers in Ghana's various areas should be another goal of future studies.

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APPENDIX B: ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL:
E-MAIL:
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IORG #: IORG0011497

4TH APRIL, 2024

Mr. Jonadab Darkoh
Department of Math and ICT Education
University of Cape Coast

Dear Mr. Darkoh,

ETHICAL CLEARANCE – ID (UCCIRB/CES/2023/265)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your **Pre-Service Mathematics Teachers' Readiness to Integrate Technology in The Teaching of Mathematics.** This approval is valid from **4th April 2024 to 3rd April 2025.** You may apply for an extension of ethical approval if the study lasts for more than 12 months.

Please note that any modification to the project must first receive renewal clearance from the UCCIRB before its implementation. You are required to submit a periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us about this protocol.

Yours faithfully,

Koff F. Amuquandoh
Ag. Administrator