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Mathematics Teachers' Electronic Readiness towards Information and Communication Technology Integration into the Teaching and Learning of Mathematics

Christopher Yarkwah[1*], Rosemary Twum[2] & John Erebakyere[3]

1. Department of Mathematics and ICT Education, University of Cape Coast, Ghana
*Email: cyarkwah@ucc.edu.gh
2. Department of Mathematics and ICT Education, University of Cape Coast, Ghana
Email: rtwum@ucc.edu.gh
3. Department of Mathematics & Computer Studies, Dambai College of Education, Ghana
Email: erebakyere@gmail.com

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Abstract

This study explored the electronic readiness of mathematics teachers towards the integration of ICT in the teaching of mathematics. Three research questions guided the study. Using descriptive research design, data were collected from 118 senior high school mathematics teachers sampled from six senior high schools in the Cape Coast Metropolis. The data were obtained using closed ended questionnaires. The study findings revealed that the mathematics teachers had the perceived knowledge to support mathematics learning activities with electronic devices. The teachers expressed positive perceptions towards the use of electronic devices and ready to integrate electronic devices in their mathematics teaching practices.

It is recommended that stakeholders of Ghanaian senior high schools ensure that mathematics teachers have technology-based in-service trainings that will continuously enrich their digital knowledge for effective pedagogical practices. The implications of the findings are discussed.

Key words: *Digital Knowledge, Electronic Readiness, Electronic Devices, Digital Literacy, ICT Integration, Mathematics Teachers*

Introduction

The importance of technology in recent times in the educational sector cannot be overemphasised. Governments around the world are investing extensively in ICT integration in education to increase the acquisition of knowledge and skills to meet the demands of modern knowledge-based economies (Gyaase & Takyi, 2014). The use of ICT in the classroom is very important for providing opportunities for students to learn to operate in an information age (Bingimlas, 2009). In Ghana, the integration of technology into the teaching and learning processes seems to be making strides in the tertiary education. However, the case appears not to be the same at the pre-tertiary education levels (Mensah, Poku, & Quashigah, 2022). The low level of technology integration into the teaching-learning processes at the Ghanaian pre-tertiary level raise concerns about teacher readiness, requisite ICT skills, resource availability, and the teachers' Technological Pedagogical and Content Knowledge (TPACK) (Mensah, Poku, & Quashigah, 2022).

The understanding and application of ICT has become an unavoidable necessity due to its widespread adaption and application in industries, businesses, engineering, and general organisations. Consequently, the readiness of teachers to use electronic devices in the classroom for teaching and learning is critical. The role of digital technologies such as laptops, mobile phones, projectors, and digital televisions to foster development has an increasing relevance, which could explain government efforts and demands on teachers to integrate technology into their classroom practices to enable students experience and realise the potentials of these devices. Effective adoption of technology into the mathematics classroom may depend on multiple factors including training, self-efficacy, perceptions, skills, resources availability, preparedness, TPACK, and readiness.

Research suggests that mathematics teachers demonstrate positive perceptions about integrating technology into their instructional practices (Boni, 2018; Hudson & Porter, 2010). Boni (2018) revealed that teachers' use of technology-based teaching approaches improves their pedagogical practices and skills. It is reported that 114 mathematics teachers expressed how the affordance of electronic devices positively transformed their teaching methods (Hudson & Porter, 2010). Onyia and Onyia (2011) discovered that correlations exist between perception of self-efficacy and technology adoption among teachers. The self-efficacy of the mathematics teacher positively correlates to their intention to adopt technology integration as an alternative instructional strategy. Broni (2018) established that the kind perception of teachers about technological devices determines how effective these electronic devices would be adapted and employed. This launches the premise that, the perception teachers have about electronic devices matter in the quest to integrate ICT into mathematics teaching and learning.

At the higher teacher education institutions in Ghana, pre-service teachers are trained and motivated to integrate ICT into the teaching of mathematics (Mensah, Poku, & Quashigah, 2022). Despite the requisite training and positive interest of teachers to integrate ICT into the learning environments, many are constrained by lack of confidence, in-service training, continuous professional skills development, technical support, resources as well as technological infrastructure to carry it out effectively (Krause, Pietzner, Dori, & Eilks, 2017). Negative perception about the use of electronic devices could also diminish the interest and willingness of teachers to integrate ICT into their teaching. Therefore, teachers' digital knowledge on electronic devices, their perception about the usage of electronic devices and their readiness to integrate electronic devices into teaching cannot be ignored when considering the integration of ICT into teaching. It is noted that Ghanaian mathematics teachers graduate from well-established institutions with sufficient ICT resources (Gyaase, Gyamfi & Kuranchie, 2019). Thus, the teachers are well equipped with the necessary skills to use electronic devices to teach. However, few embrace the use of electronic devices in the classroom in the senior high schools. The ICT literacy of teachers in the pre-university schools in Ghana is high, but their utility of ICT to design and deliver technology-based subject contents to improve the learning experiences of the students is low (Gyaase, Gyamfi & Kuranchie, 2019).

It is replete in the literature about some factors hindering mathematics teachers' ability to consistently and appropriately employ technology in their teaching processes. Kirkok and Karanja (2018) outlined low availability of infrastructure (computer laboratories, computer hardware and software programmes) as hindering factors. Keong, Horani and Daniel (2005) reported lack of knowledge about ways to use ICT to enhance the curriculum, difficulty in integrating and using different ICT in a single lesson, and teachers not fully utilising the facilities available. They emphasised that the lack of knowledge about the electronic devices and the skills to use them are major setbacks to teachers in technology integration. It is conceptualised that the knowledge level of a teacher about electronic devices correlates and affects the extent to which a teacher can adapt and employ them into instructional activities (Agyei & Voogt, 2010).

Several in-service trainings have been organised by the Ghana Education Service (GES) for teachers to equip them with TPAC knowledge, with greater emphasis on technology integration into instructional practices. The higher teacher education institutions (University of Cape Coast (UCC) and University of Education, Winneba (UEW)) have rolled out teacher education programmes designed to train pre-service teachers to effectively design and implement technology-based lessons. These efforts by GES, UCC, and UEW suggest the need for teachers to be equipped with digital knowledge and skills for the integration of ICT into teaching. Mensah, Poku, and Quashigah (2022) posits that effective technology integration as an instructional practice depends on the teachers' digital knowledge on electronic devices, their perceptions and readiness to integrate electronic devices into the teaching process. The electronic readiness and digital literacy of teachers to integrate ICT using electronic devices is the focus of this study.

This study is therefore structured to determine the electronic readiness of mathematics teachers use ICT for instruction, in terms of their perceived level of digital knowledge, perception about electronic devices and their readiness to integrate the electronic devices into the teaching of mathematics. Hence, three research questions were proposed and answered in the study which include: 1) What is the perceived digital knowledge level of senior high school mathematics teachers? 2) How do senior high school mathematics teachers perceive their use of electronic devices in the teaching of mathematics? 3)

What is the perceived electronic readiness level of senior high school mathematics teachers?

Literature Review

Digital knowledge of mathematics teachers

Technology can serve as an asset as well as obstacle within a classroom setting. On one hand, it can help reinforce curriculum for students with different learning styles. Students and teachers alike can use electronic devices to access information or photos more quickly than with a textbook. On the other hand, electronic devices can also serve as a distraction when constantly within arm's reach (Van Braak et al, 2004). Understanding both sides of the debate is essential for teachers to maximise the benefits of technology in education for the next generation of students. Electronic devices are devices used for audio, video or text communications. This includes the use of computers, smartphones, calculators, projectors, electronic watches, tablets, or virtual reality devices (Chege, 2014). The effective use of electronic devices in mathematics education requires computer competence, digital knowledge and skills of the teacher to be brought to bear. Thus, the level of digital knowledge of the mathematics teacher determines the extent of success of technology integration into instructional practices (Agyei & Voogt, 2010).

According to Peralta and Costa (2007), teachers' confidence to integrate technology into their teaching practices depends largely on their level of digital knowledge. Teachers' confidence refers to their perceived likelihood of success on using ICT for educational purpose (Peralta & Costa, 2007). This shows that mathematics teachers should be knowledgeable and skilful to competently involve ICT in their teaching. As argued, if the mathematics teacher lacks knowledge about the various electronic devices, then there will be difficulties to confidently integrate them into teaching and learning. Tezci (2010) has it that irrespective of the technological knowledge level of teachers, their attitude about using electronic devices to support instruction has been positive.

Research that investigated the factors influencing mathematics teachers' readiness to use ICT in teaching revealed that computer training and availability of infrastructure are determiners of teacher readiness (Chege, 2014). The findings of Amuko (2015) suggest that low self-training towards development of digital skills is a hindrance to technology adoption in the

mathematics classroom. Other research indicate that the prerequisite digital knowledge of teachers based on their professional training is limited. Sheila (2016) reported that mathematics teachers are not well prepared to integrate ICT in teaching mathematics. Available statistics suggest 73.9% of teachers in 298 South African schools do not support their lesson activities with electronic devices, 64.8% have not attended any ICT based professional development, and some 55.5% expressed the need for technical support to integrate technology into their lessons processes (Saal, 2017). Saal (2017) recommended that the digital knowledge level of the mathematics teacher be determined in order to profile their needs for professional development.

In Ghana, Agyei & Voogt (2010) conducted research on ICT use in the teaching of mathematics which revealed that teachers' competency is affected by lack of knowledge about ways to integrate ICT into lessons and lack of training opportunities for ICT integration. Also, Mensah (2017) investigated the extent of ICT use among Ghanaian mathematics teachers in their instructional delivery. The findings revealed that mathematics teachers with extensive technology professional training were competent in the use of ICTs such as MS Word, MS PowerPoint, Excel and Calculator. Thus, professional training to develop the technical requisite knowledge of teachers can translate into higher competencies for technology integration.

Perception of mathematics teachers on the use of electronic devices

Electronic teaching is using electronic equipment/devices either directly or indirectly to support classroom learning activities. Electronic teaching methods do not have any boundary for the teacher or student (Nielit & Thaunuskodi, 2020). Teachers are still faced with the perplexing decision of whether to disallow or promote students' usage of technology in the classroom due to its double edge merits and demerits within the same context (Lam & Tong, 2012). Nevertheless, the perception of the mathematics teachers about the impact of technology potentially determines the likelihood of its usage in the classroom. Literature has stated several benefits when the learning activities of students are supported with technology. According to Keong, Horani and Daniel (2005), supporting mathematics lessons with technology encourages interaction among students to share their knowledge and skills; it causes educators to act as facilitators and the learning process becomes student-centred; fosters students' self-exploration, improves students' interest,

motivation and perceptions towards mathematics is enhanced; generates higher-level thinking skills among students; and encourages students to think about alternative strategies in solving mathematics problems.

The merits and demerits of technology on the teaching practices of teachers and learning experiences of students are potential factors that can influence the perception of teachers towards technology adoption into their teaching activities (Adedokun-Shittu & Shittu, 2015). A report on 114 Australian mathematics teachers indicates their positive perception towards technology-oriented lessons (Hudson & Porter, 2010). A logistic regression model on the beliefs, perceptions and knowledge of the teachers about technology integration confirmed perception and knowledge as significant predictor variables of technology integration.

Almekhlafi and Almeqdadi (2010) investigated on technology integration at United Arab Emirates (UAE) model schools using a mixed-method data collection process, consisting of focused group interviews and questionnaires. The results showed that teachers at both schools had positive perceptions towards ICT integration into their classroom activities. The study by Onyia and Onyia (2011) which sought to discover any significant correlation between perception of self-efficacy and technology adoption among teachers in Nigeria revealed similar results. The findings pointed out a positive correlation between teachers' self-efficacy and their integration of technology into instructional activities.

The perception about the electronic devices one may need in his/her work contributes to how effective he/she would be in the use of that technology. For this reason, the perception teachers have about electronic devices matter in the quest to integrate ICT into teaching of mathematics. Baya'a (2012) conducted a study on mathematics teachers' readiness to integrate ICT in the classroom, using 475 Arab elementary school teachers. The results suggest that about 70% of the participating teachers demonstrated positive perceptions of their competence in technology and technology integration, and positive self-esteem about the presence of technology in their mathematics classrooms. The research concluded that teachers are ready to integrate ICT into their teaching and learning practices and the learning processes of students.

Contextually, research on Ghanaian mathematics teachers' technology integration pointed out that the teachers demonstrated positive perceptions

about the use of electronic devices in teaching and learning of mathematics (Boni, 2018). The teachers also disclosed that using technology-based teaching improved their pedagogical skills even though they practice more of the traditional approach of teaching than the use of ICT. The foregoing discussion presents the notion that mathematics teachers have positive perceptions about the use of electronic devices to support their teaching practices as well as the learning processes of their students.

Teachers' electronic readiness

The electronic readiness of the mathematics teacher determines how successful ICT can be integrated into the teaching and learning of mathematics. Baya'a and Daher (2013) confirmed that, the positive perceptions of Arab teachers could stem from their readiness to use electronic devices to augment their teaching practices. It is also highlighted that the use of ICT to support learning has proven to be an effective pedagogical approach, and therefore, the readiness of the mathematics teacher and students need to be explored to determine their readiness for using these tools to support teaching and learning (Mazana, Montero & Oyelere, 2019). Within the Ghanaian context, Mensah (2017) concluded that, the high usage of scientific calculators in the mathematics classroom is a glimpse of evidence that teachers and students might be ready to support learning with electronic devices.

Research Methods

Research design

Descriptive research design was employed to obtain quantitative data that was analysed to describe the electronic readiness of the Ghanaian senior high school mathematics teachers. The descriptive design was adopted on the premise that the characteristics of the mathematics teachers were examined based on their willingness to use electronic devices in the teaching and learning of mathematics. The dependent variables of this study are the mathematics teachers perceived digital knowledge level, their electronic devices readiness level in teaching mathematics, and the teachers' perceptions about the use of electronic devices in teaching mathematics.

Respondents

The study was conducted in the Cape Coast Metropolis in the Central Region of Ghana. The Cape Coast Metropolis forms part of the 22 Metropolitan,

Municipal and District Assemblies (MMDAs) in Central Region. The study was conducted in the Cape Coast Metropolis, the largest city in Ghana`s central region and abounds in the number of senior high schools. Figure 1 shows the geographical map of Cape Coast.

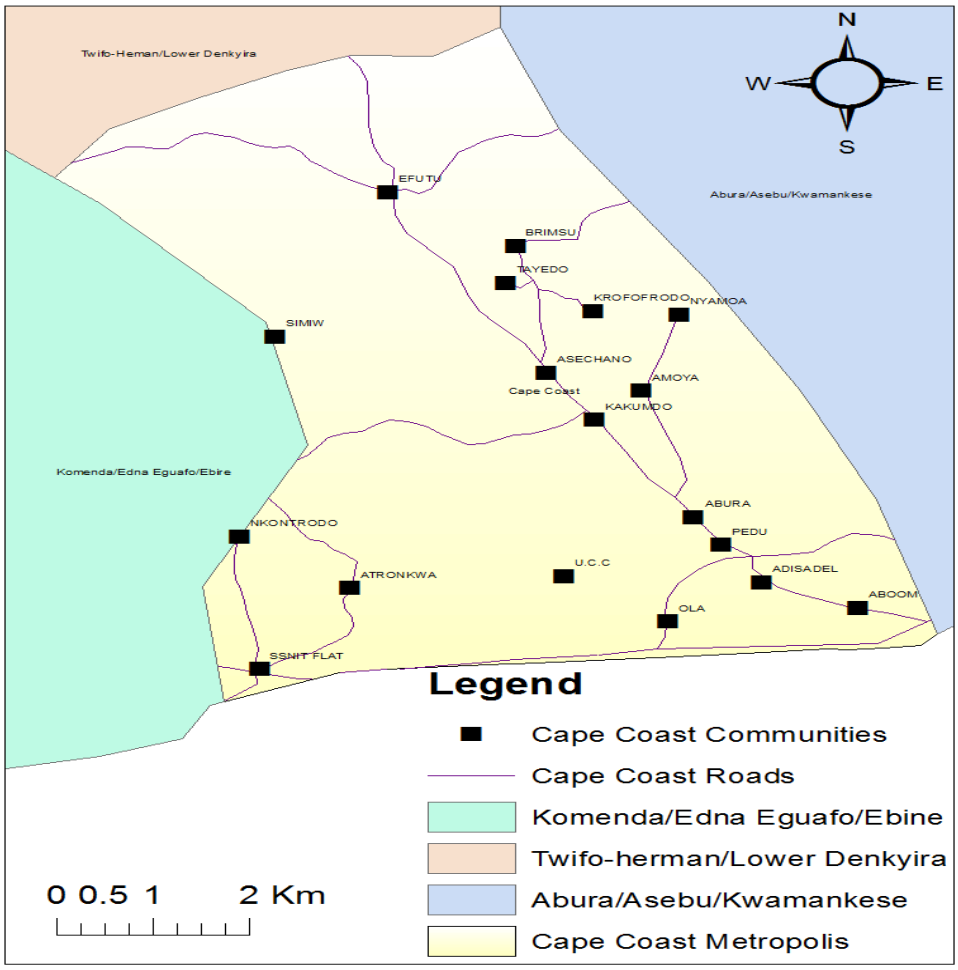

Figure 3: Map of Cape Coast Metropolis
Source:https://www.researchgate.net/figure/A-Map-of-Cape-Coast-Metropolis

The targeted population for the study was mathematics teachers from six selected schools (55%) in the Cape Coast Metropolis, out of the total of eleven senior high schools in the metropolis. A simple random technique (using the Excel random number generator) was used to select six schools from the total of eleven for this study. The total number of mathematics teachers in the six

selected schools were 170. Out of the 170 mathematics teachers, 118 (70%) responded to the research questionnaire based on their willingness and availability at the point of data collection. Hence, 118 mathematics teachers formed the sample size of this study. The distribution of sampled teachers across the elected schools is displayed in Figure 2, showing the number, and percentage of mathematics teachers selected from each school. For ethical reasons, the six selected schools are confidentially coded A, B, C, D, E, and F.

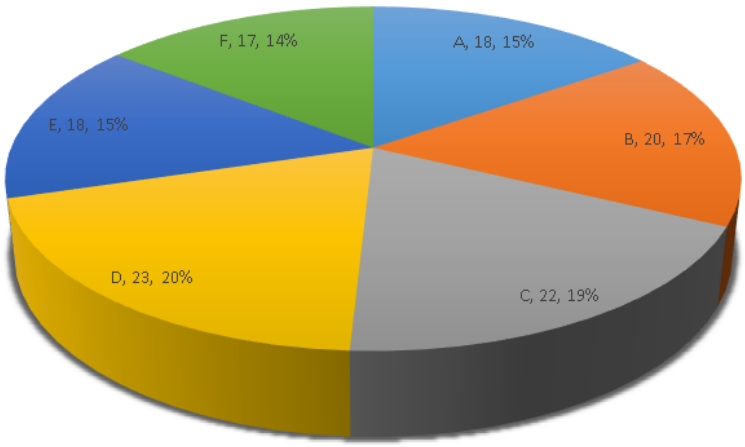

Figure 2: Distribution of sampled teachers from six selected schools

Instrument

The main instrument of measure of the research was questionnaire. The perception of digital knowledge, perception of ability to use, and perception of electronic readiness questionnaire of Alshehri (2012) was adapted for this study. While maintaining the meaning, questionnaire items were reworded to reflect electronic devices used in the Ghanaian SHS context. Two items were deleted from items on the electronic knowledge level of teachers because the items related to advanced application of python. The questionnaire was structured in four major sections: (A) required participants' demographic information, (B) consist of questions based on the perception of their knowledge level of electronic devices in teaching mathematics, (C) provided questions on mathematics teachers' perceptions of using electronic devices for

teaching and (D) contained items on the teachers perceived electronic devices readiness. The Cronbach Alpha reliability coefficient of the questionnaire was determined. The reliability of the teachers' perception of their knowledge level in electronic devices, their perceived electronic devices to teach, and their perceived readiness to use electronic devices were 0.82, 0.87, and 0.85 respectively. The mathematics teachers were to indicate the extent of their agreement to each statement on the perception items on a five-point Likert scale coded as strongly disagree (1), disagree (2), undecided (3), agree (4), and strongly agree (5).

Data analyses

Frequency counts and percentages were used to present results of the respective research questions. The teachers' perception of their knowledge level in electronic devices was analysed and results presented using frequencies and percentages. Also, the perception of the teachers about their use of electronic devices and their readiness to use them in teaching mathematics was also presented using frequencies and percentages. The five-point Likert scale responses of the mathematics teachers was recategorized into three-point Likert scale, where strongly agree and agree was collapsed into agree, and strongly disagree and disagree also collapsed into disagree. Hence, the results are presented for the combined agree as agree, neutral, and the combined disagree as disagree.

Results

The results are presented based on the research questions. The purpose of the study was to determine the electronic readiness of SHS mathematics teachers to integrate ICT into the teaching of mathematics. Results are presented using frequencies and percentages.

Digital knowledge level of senior high school mathematics teachers

This research objective sought to determine mathematics teachers perceived digital knowledge level. Frequency counts and percentages were generated for each item and the results are presented in Table 1.

Table 1: Perception of mathematics teachers' knowledge level of electronic devices usage

Perceived Digital Knowledge level	Agree		Neutral		Disagree	
	f	%	f	%	f	%
Overall perceived digital knowledge level	**78**	**65.8**	**14**	**11.7**	**26**	**22.5**
I know how to connect projector and use printer	74	77.9	10	10.5	11	11.6
I frequently play around electronic devices	68	71.6	21	22.1	6	6.3
I am able to use electronic devices to explore mathematical ideas	66	69.5	17	17.9	12	12.6
I know how to use different electronic devices	63	66.3	23	24.2	9	9.5
I am able to select certain electronic devices to communicate mathematics processes	62	65.3	26	27.4	7	7.4
I am able to use electronic devices to solve mathematics problems	62	65.3	23	24.2	10	10.5
I know how to use electronic devices to represent mathematical ideas	57	60.0	27	28.4	11	11.6
I know how to fix electronic devices when I encounter challenge(s) when using them	48	50.5	24	25.3	23	24.2

Source: Fieldwork (2022)

Table 1 shows that 65.8% of the mathematics teachers perceived having the requisite digital knowledge for using electronic devices to support the teaching and learning of mathematics as against 22.5 % who perceived not possessing the needed digital knowledge for mathematics instructional. A relatively low percentage of the teachers remained indecisive of their perceived digital knowledge level. The frequency counts of the respective items show that 11.7 % of the teachers averagely judges their digital knowledge level in using electronic devices to teach mathematics. Specifically, 65.8% of teachers agreed to having the knowledge to; use different electronic devices like

projectors, communicate with these devices, use electronic devices to explore mathematic concepts, use them to represent mathematics ideas and solve problems. Also, 22.5% of the mathematics teachers disagreed to possessing the digital knowledge for using electronic devices to support the teaching of mathematics whiles 11.7% revealed an average digital knowledge level. From Table 1, the frequency counts of the items show that SHS mathematics teachers perceived their knowledge level to be high in using electronic devices to teach mathematics. The percentage of teachers who agreed to possessing the repertoire digital knowledge was greater than those who disagree to the items. Therefore, majority of mathematics teachers from the sampled schools perceived to have high digital knowledge for teaching mathematics.

Mathematics teachers' perception on the use of electronic devices in teaching mathematics

This research objective sought to determine the perception of the mathematics teachers on the use of electronic devices for teaching mathematics. Frequency counts and percentages were generated for each item and shown in Table 2.

Table 2: Mathematics teachers' perception on using electronic devices

Teachers' perception on digital devices	Agree		Neutral		Disagree	
	f	%	f	%	f	%
Overall perception of use of electronic device	**81**	**68.8**	**26**	**22.4**	**11**	**8.8**
Engaging with electronic devices is not difficult.	71	74.7	14	14.7	10	10.5
Teaching with electronic devices can help me organise tasks well and in simple forms.	69	72.6	18	18.9	8	8.4
Use of electronic devices as instructional tools can increase the interest of students toward learning mathematics	69	72.6	16	16.8	10	10.5
Teaching with electronic devices makes students understand the concepts well.	67	70.5	27	28.4	1	1.1

Using electronic devices make teachers more productive	66	69.5	22	23.2	7	7.4
Teaching with electronic devices does not delay the instruction process.	63	66.3	20	21.1	12	12.6
Usage of electronic devices makes it easier to prepare course materials (assignments, handout)	62	65.3	21	22.1	12	12.6
Using electronic devices for instructional purposes is important rather than printed materials only	54	56.8	34	35.8	7	7.4

Source: Fieldwork (2022)

Based on the item-by-item analyses, the percentages of Table 2 show that the teachers have positive perception about the use of digital devices in the teaching and learning of mathematics. This is reflected on the 68.8% of teachers expressing confidence in their ability to use various digital tools for supporting the teaching and learning of mathematics. Also, 22.4% of the teachers expressed average perceptions of their abilities in using different electronic devices in supporting students learning. However, a relatively low percentage (8.8%) of the teachers indicated low perceptions in their potentials of supporting mathematics teaching with electronic devices. The general view of the results suggests that 68.8% of the teachers demonstrated positive perceptions of supporting mathematics teaching with electronic devices and thereby agreed that: using electronic devices to support learning is not difficult and makes preparing course materials easier; electronic devices help organise learning activities; students learning interests increases; teachers' instructional practices improve and makes them more productive; and make students understand concepts better. About 8.8% of the teachers disagreed to the affordances of electronic devices in supporting students learning of mathematics and 22.4% of the teachers showed average perceptions about the use of electronic devices in the teaching and learning of mathematics. The results of Table 2 indicate that Ghanaian SHS mathematics teachers have positive perceptions regarding supporting learning processes and activities with electronic devices.

The electronic readiness of mathematics teachers

The third research objective was to determine the readiness of mathematics teachers in using electronic devices to support the teaching and learning of mathematics. The frequency counts and percentages of teachers' electronic readiness is reported in Table 3.

Table 3: Mathematics teachers' electronic readiness

Teachers' electronic readiness	Agree		Neutral		Disagree	
	f	%	f	%	f	%
Overall perceived readiness to use electronic devices	**80**	**67.8**	**25**	**21.4**	**13**	**10.8**
I can download files from the Internet using electronic devices	74	77.9	15	15.8	6	6.3
I am competent in using presentation software such as PowerPoint	68	71.6	18	18.9	9	9.5
I am confident when using electronic devices	68	71.6	15	15.8	12	12.6
I possess basic skills to operate electronic devices.	67	70.5	21	22.1	7	7.4
I am willing to integrate electronic devices in teaching mathematics (computers, mobile phones, projectors, printers etc)	65	68.4	18	18.9	12	12.6
I can use electronic devices to support my teaching methods	64	67.4	25	26.3	6	6.3
I can develop electronic learning activities that urge my students to become critical thinkers	60	63.2	24	25.3	11	11.6
I can design online quizzes and use them in teaching my classes.	49	51.6	27	28.4	19	20.0

Source: Fieldwork (2022)

From Table 3, it is revealed that 67.8% of the mathematics teachers expressed readiness to support their instructions with electronic devices. On the other hand, 10.8% of the teachers suggested they were not ready to use electronic devices during their mathematics lessons. A relatively moderate percentage of

the teachers, 21.4% expressed average readiness to use electronic devices during their mathematics instruction. The total frequency counts show that 67.8% of the mathematics teachers have expressed their readiness to use electronic devices to augment teaching and learning activities of mathematics in Ghanaian senior high schools. The responses revealed that teachers can download instructional materials from internet, they have high presentation competencies when using PowerPoint, they are willing and are confident when using electronic devices, they have the skills to operate and integrate digital tools into lessons, they can use electronic devices to develop and design learning activities, conduct online quizzes, and integrate electronic devices into various teaching approaches. These results suggest that the readiness of mathematics teachers to support teaching and learning processes with electronic devices is relatively high, and hence Ghanaian mathematics teachers are ready to adapt and employ these devices into curricula activities.

Discussion

This study aimed to investigate the electronic readiness of senior high school mathematics teachers. The study is pivoted on the perceived digital knowledge level, teachers' perception about electronic devices usage and the electronic readiness of mathematics teachers.

The results on the perceived digital knowledge level of the senior high school mathematics teachers showed that generally, mathematics teachers believe they have the requisite digital knowledge to integrate electronic devices into the teaching and learning of mathematics. The teachers' responses revealed their perceived capability to use devices such as printers, projectors, computers, mobile devices and mathematical software to support mathematics instruction. Thus, the knowledge of available electronic devices for teaching mathematics is reportedly high among the teachers. This finding aligns with literature that, high knowledge of classroom technological resources translates into effective technology adaptation into teaching practices (Chege, 2014). Hence, the Ghanaian mathematics teacher is perceived to have the requisite knowledge of electronic devices that can be employed as teaching-learning resources for teaching different mathematics concepts.

The results also suggest that the mathematics teachers know how to use different electronic devices to support learning activities. This indicates that they can employ appropriately different electronic tools into the teaching

processes of various mathematics concepts. The ability of teachers to use different or multiple electronic devices to support learning is an expression of the extent of their high digital knowledge.

It was also reported that the teachers had perceived themselves to attain proficiency of choosing specific electronic devices that are suitable for teaching some specific mathematics contents. The ability of teachers to specify which device can be used to communicate what mathematical concept exemplifies their competencies in technology integration. Agyei and Voogt (2010) agree with this conclusion that technology integration competencies is defined by the teachers' ability to know the ways through which a technology should be used to communicate mathematics ideas to the student. Therefore, teachers' ability to select certain electronic devices to communicate mathematical content and represent mathematical ideas suggest that the teachers possess the necessary digital knowledge which helps them to select the appropriate electronic devices to support in communicating and representing mathematical ideas appropriately.

The results on the perception of the mathematics teachers on the usage of electronic devices revealed that the teachers had positive perceptions about supporting mathematics classroom learning activities with electronic devices. It is revealed that about 68.8% of the mathematics teachers expressed positive perceptions to supporting mathematics learning with electronic devices. This result agrees with the research of Boni (2018) which pointed out that teachers demonstrated positive perception about the use of ICT in teaching and learning. Boni (2018) concluded that, teachers who used technology-based teaching improved in their pedagogical skills and practices.

It is reported that the teachers did not perceive to experience difficulties in using the electronic devices for instruction. The teachers also indicated that the use of technology did not delay the progress of lesson delivery. Thus, the positive perception of teachers could be explained by the minimal challenges they experienced when using electronic devices. It could also be attributed to the success of achieving their teaching-learning objectives within stipulated time frames. The positive impact of technology in mathematics learning expressed by the teachers could explain their positive perception regarding using electronic devices in learning mathematics. Baya'a (2010) posited that

the perception one may have about electronic devices extends to the success of using it to support work activities.

Again, the teachers indicated that the usage of electronic devices as instructional tools can increase the interest of students towards the learning of mathematics. The responses suggest that students engage or participate actively when they are being taught through the use of electronic devices. The opinion that electronic devices can serve as mediating tools to enhance mathematics learning could also explain the positive perception of the teachers.

Results on the perceived digital readiness of the mathematics teachers revealed that about 67.8% of them felt digitally ready to use electronic devices to support the teaching and learning of mathematics. The results showed that the teachers were confident using electronic devices, possessed basic skills to operate electronic devices, and were willing to integrate electronic devices in teaching mathematics.

The willingness of the teachers to integrate electronic devices into the teaching of mathematic means that the mathematics teachers are purposeful, passionate and committed to integrate the electronic devices into the teaching of mathematics. The perceived electronic readiness of Ghanaian mathematics teachers in the present study is consistent with the results of Mazana, Montero and Oyelere (2019) that, mathematics teachers and their students of the 21st century are always electronically ready in terms of perception, knowledge, skills and psychology. This implies that the Ghanaian mathematics classroom is ready to undergo a technological transformation from the old face-to-face traditional approach to a technological interactive platform for effective mathematical discourse.

Implications and Recommendations

The intention to use technology to support classroom learning activities could be a result of positive perceptions about the usefulness of the technology. Based on the concepts of Technology Acceptance Model (TAM) by Ma and Liu (2014), teachers' behavioural intentions of using technology can be defined by their attitudes, ease of use and usefulness of the technology system. Results of this study informed that the mathematics teachers reported high

positive perceptions regarding augmenting learning activities with technological tools. Thus, the Ghanaian mathematics teacher has the behavioural intention of supporting mathematics learning with technology. Authorities in tertiary and second cycle institutions could harness this positive behaviour of teachers towards school development through providing digital resources for instructional activities.

The readiness of the mathematics teachers to use digital resources for teaching-learning activities informs the need for curriculum restructure, offering an opportunity to extensively integrate the application of technology into learning considerable concepts of the mathematics curriculum. The teachers reported perceived high digital proficiencies, thus integration of new technology into the mathematics curriculum would be readily accepted and adapted by teachers for teaching and learning. This is a gateway to motivate teachers undergo a paradigm shift of conventional teaching practices to using 21st century digital tools that enhances learning and support problem-solving of real situations.

Based on the high perceived digital knowledge level of the teachers, their digital proficiencies and readiness reported, it is recommended that institutions endeavour to provide the necessary digital resources for the teachers to use to support learning activities. Curriculum development and design institutions such as Transforming Teacher Education and Learning (T-TEL) could considerably integrate technology into classroom textbook learning activities. The Ministry of Education, Ghana, is encouraged to intensify trainings involving teaching with technology during professional development programmes among teachers.

Conclusion

The senior high school mathematics teachers indicated they had the necessary knowledge to use electronic devices in teaching mathematics. They know how to connect projector and use printer, they frequently play around electronic devices, they know how to use different electronic devices, and they are able to use electronic devices to explore mathematical ideas during instructional process.

The teachers do not have difficulties in using electronic devices. They believe that teaching with electronic devices do not delay the instruction process, and the devices help them organise tasks well and in simple forms. It is also noted that using electronic devices as instructional tools enhances understanding and increases the interest of students towards learning mathematics. The Ghanaian mathematics teacher has a positive orientation about supporting lessons with electronic devices. Thus, teachers reported their willingness, confidence and competencies in using electronic devices such as GeoGebra, Autograph, mobile devices, calculators, projectors and printers.

Therefore, senior high school mathematics teachers in the Cape Coast Metropolis perceived digital knowledge levels are high. The teachers reported positive perceptions about using electronic devices to support the teaching of mathematics and are electronically ready to adopt technology-based instructions as a pedagogical approach.

Ethical Statement
A signed consent was obtained from each participant prior to the commencement of data collection, ensuring voluntary participation and ethical adherence.

Conflict of Interest
The authors affirm that there is no conflict of interest with regards to the publication of this article.

Author Contributions
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