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Basic School Teachers' Attitude and Confidence Level in Teaching the Computing Common-Core Programme Curriculum in Ghana

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ABSTRACT

This study investigates the attitudes and confidence levels of Basic 7-9 teachers in Ghana regarding the implementation of the Computing Common Core Programme (CCP) curriculum. Utilizing Rogers' Diffusion of Innovations Theory as a framework, the research explores factors influencing teacher confidence, including access to ICT resources and professional development opportunities. A descriptive survey design was employed, involving 287 teachers from public schools across Ghana. The findings reveal a high level of teacher confidence in teaching the CCP curriculum, despite limited access to ICT tools and resources. A positive, albeit insignificant, correlation was found between ICT resource availability and teacher confidence. However, professional development avenues significantly impact teacher confidence, aligning with Rogers' theory on the role of communication channels and social systems in the diffusion of innovation. The study recommends prioritizing the provision of ICT tools in schools and expanding professional development opportunities for teachers to ensure the successful implementation of the CCP curriculum.

Keywords: Teacher Attitudes, Teacher Confidence, Computing Common Core Programme, ICT resources, Diffusion of Innovations Theory

Introduction

The integration of Information and Communications Technology (ICT) into school curricula has been a global trend in recent decades, driven by the recognition that digital literacy is a crucial skill for success in the 21st-century workforce. The Computing Common Core Programme which aims to equip students with fundamental computing knowledge and skills, has been adopted by many education systems around the world, including Ghana. However, the effective implementation of such ICT-focused curricula largely depends on the attitudes and confidence levels of the teachers tasked with delivering this content. Globally, studies have shown that teachers' perceptions and self-efficacy in teaching ICT subjects can vary significantly. Some educators exhibit high levels of enthusiasm and confidence, readily embracing the integration of technology in their classrooms (Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2017). Others, however, may feel apprehensive or underprepared, which can hamper their ability to effectively teach ICT-related topics (Teo, 2008; Voogt, 2010).

In the Ghanaian context, the integration of ICT into the national curriculum has been a gradual process, with varying levels of success. While the government has made efforts to improve ICT infrastructure and teacher training, challenges remain in ensuring that all teachers feel confident and equipped to deliver the Computing Common Core Programme effectively. Existing research suggests that some Ghanaian teachers may lack the necessary digital skills, pedagogical knowledge, or access to resources, leading to uncertainties and hesitance in teaching ICT subjects (Buabeng-Andoh, 2012; Boakye & Banini, 2008; Agyei & Voogt, 2011).

This paper aims to explore the attitudes and confidence levels of basic school teachers in Ghana as they navigate the implementation of the Computing Common Core Programme. By understanding the perspectives and experiences of these educators, policymakers and educational stakeholders we can identify areas for improvement and develop targeted interventions to support teachers in effectively delivering ICT-focused curricula.

ICT as a Tool in the Classroom

The integration of Information and Communications Technology (ICT) into classroom instruction has become increasingly prevalent in recent years. ICT can serve as a powerful tool to enhance the teaching and learning process, providing teachers and students with a wide range of opportunities and capabilities. At its core, ICT can be utilized as a versatile instructional tool in the classroom. Digital technologies, such as computers, tablets, interactive whiteboards, and educational software, can be leveraged to present content, facilitate interactive learning activities, and enable more personalized and engaging learning experiences (Tondeur et al., 2017; Hew & Brush, 2007). For instance, teachers can use presentation software to create dynamic, multimedia-rich lessons, or incorporate educational applications and simulations to help students better visualize and comprehend complex concepts.

Furthermore, ICT can facilitate more collaborative and student-centered learning. Collaborative tools, such as online document editors, discussion forums, and virtual learning environments, can enable students to work together on projects, share ideas, and receive feedback from their peers and teachers (Ertmer & Ottenbreit-Leftwich, 2010; Hermans et al., 2008). This can foster the development of essential 21st-century skills, such as communication, critical thinking, and problem-solving. The use of ICT in the classroom also has the potential to provide teachers with valuable data and insights to inform their instructional practices. Learning management systems, assessment tools, and data analytics can help teachers track student progress, identify areas of difficulty, and personalize learning experiences accordingly (Wastiau et al., 2013).

However, the effective integration of ICT in the classroom is not without its challenges. Factors such as teacher digital competence, access to technology, and institutional support can significantly influence the successful implementation of ICT-enabled teaching and learning (Buabeng-Andoh, 2012; Agyei & Voogt, 2011). Ongoing professional development and the provision of adequate resources are crucial to empowering teachers to leverage ICT as a transformative tool in the classroom.

ICT as a Subject in Basic Schools

Computing is studied as a subject in Ghanaian Basic Schools. At Early Grade (B1-B3) it is embedded in the "Our World, Our People" curriculum and it is a standalone subject in Upper Primary (B4-B6), B7-B9 (Junior High School) and B10-B12 (Senior High School). Assessment strategies including Assessment *for* Learning, Assessment *as* Learning and Assessment *of* Learning are expected to be adopted to help learners achieve learning outcomes. The following sub-strands are found in the B1-B3 (Our World Our People) curriculum: Introduction to Computing, Sources of Information and Technology in Communication (National Council for Curriculum and Assessment, 2021). At the Upper Primary, 21 different sub-strands are found under the following headings: Introduction to computing, presentation, word processing, desktop publishing, programming and databases, internet and social media and finally health and safety in using ICT tools. In the Computing Common Core Programme curriculum, 15 sub-strands are presented including the following: components of computers and computer systems, health and safety in using ICT tools, introduction to word processing, introduction to presentation, desktop publishing and electronic spreadsheets. In addition, computer networks, internet and social media, information security and web technologies are taught under communication networks. The final strand – computational thinking has these sub-strands: introduction to programming, algorithm, robotics and artificial intelligence (National Council for Curriculum and Assessment, 2021). The Computing curriculum aims at helping learners to acquire basic ICT literacy and communicate effectively using ICT tools. It is also aimed at developing learners' interest and skills in the use of the internet, develop their ethics in using ICT tools and finally acquiring programming and database skills. It is expected that, after learners have gone through a period of instruction, a body of skills known as, core competencies, are expected to be developed in learners. The core competencies include critical thinking and problem solving, creativity and innovation, communication and collaboration, cultural identity and global citizenship, personal development and leadership and digital literacy (NaCCA, 2020). The curriculum for the Senior High School has two stands. It is in the draft format and is now being trialed before final approval for deployment in 2024 academic year.

The need to Study ICT versus the Acquisition of 21st Century Skills

Learning computing provides the opportunity for learners to develop essential skills and competencies and motivates them to become flexible problem solvers and lifelong learners. In the 21st century, the possession of problem-solving and decision-making skills is an essential pre-requisite and these are acquired in the learning of computing. In an increasingly technological age, the possession of problem-solving and decision-making skills is an essential pre-requisite and these are acquired in the learning of computing. This makes the study of ICT as a subject essential if the slogan *"Our dream Ghanaian Child"* is to be attained. The core competencies envisaged by the 2019/2020 curriculum reforms in Ghana include global citizenship, innovation, critical thinking, problem solving, teamwork, good communication etc. The core competencies enshrined in the Basic School curriculum are carefully selected, to among other things, ensure learners' acquisition of 21st Century skills which comprise skills, abilities, and learning dispositions that have been identified as being required for success in 21st century society. These include critical thinking and problem solving, creativity and innovation, communication and collaboration, digital literacy etc. (National Council for Curriculum and Assessment, 2021). To achieve this, teachers must use multimodal content, hands-on training, interactive, collaborative and nonlinear methods of teaching (Murugesan, 2021). A 21st century teacher's role includes planning, instructing, delivering lessons and assessing student learning. Teachers will require a positive attitude towards teaching to be able to meet this expectation.

Teachers' Attitude and Confidence in Teaching Computing

Thura and Khaing (2020) believe that the attitude of teachers is an important aspect which determines the perception, and realization of the objectives and goals of a curriculum. Thura and Khaing observed that most teachers have positive attitudes with respect to new curriculum. Ponte et al. (1994) also found that teachers wanted to have a much greater level of participation in the processes of implementing new curriculum. In evaluating teachers' attitude towards curriculum reforms, Jeder (2013) found *criticism, negative attitudes* towards certain components such as: the lack of a real dialogue with the practitioners in the dynamic of the curriculum reform and of the proposed changes. Other issues identified included "unjustified disappearance" of some disciplines of study, the lack of agreement between some disciplines and manuals with high levels of abstraction. Again, students' cognitive level, the mismatch of some programs and the volume of the proposed contents with the number of hours allocated to their study were some of the issues raised.

Areekkuzhiyil (2014), in a study on attitude of teachers towards curriculum reform at undergraduate level, found that teachers have a positive attitude towards the restructured curriculum at under graduate level. The study further noted that while comparing different sub-samples, it shows that the male teachers have a higher positive attitude than the female teachers. Again, teachers with average experience demonstrated a higher level of positive attitude towards the restructured curriculum than the more experienced.

In research conducted to find the attitude and confidence level of KG to B6 teachers in teaching the standards-based computing curriculum Ayebi-Arthur, Abdulai, and Korsah (2020) found that most KG – B6 teachers in Ghana were confident in handling the sub-strands of the standards-based computing curriculum. The researchers found out that the teachers exhibited high confidence level to teach the various sub-strands. They also found that basic school teachers have positive attitude towards the use of ICT and this was positively correlated with their confidence level. Jamieson-Proctor and Finger (2006) think that the quantity and quality of student use of ICT for learning is related to the teacher's gender, confidence, years of experience and school type. They further found that male teachers reported significantly higher levels of confidence in using ICT with students for teaching and learning and the students of male teachers or confident teachers use ICT more frequently to both enhance and transform the curriculum. They thus concluded that teacher confidence is a major factor in determining teachers' and students' engagement with ICT. Teaching is a profession which requires the impartation of knowledge and skills to students. The ability of the teacher to impart knowledge and skills determines the level of confidence of mastery of the subject matter and pedagogy possessed by the teacher.

Confidence is a crucial attribute that teachers need in the teaching profession for effective delivery of instruction (Nolan & Molla, 2017). McBer's model of teacher effectiveness defined confidence as "the belief in one's ability to be effective and to take on challenges" (McBer, 2001, p, 38). This implies that the teacher's optimism in his or her ability in the teaching process can influence classroom practices. Again, the confidence level of teachers makes them embrace new teaching methods, strategies and challenge their creativity in the teaching profession. The confidence level of teachers in teaching content in any academic program cannot be underestimated. Lim-Teo, Low, Wong & Chong (2008) found a correlation between teacher preparation and quality teaching. Other researchers have found a correlation between school resources and confidence Lim-Teo, et al. (2008) content knowledge (CK) and confidence (Norton, 2017).

In integrating ICT into teaching, many studies have highlighted teachers' mixed feelings showing their low confidence levels (Hajara & Bukari, 2017; Mwila, 2018). However, a study done by Nikolopoulou and Gialamas, (2015) on teachers' beliefs and confidence established that teachers' have higher confidence in using ICT in the classroom which promotes positive engagement with learners. In another study on the influence of teachers' self-efficacy on perceptions, Miller, Ramirez, and Murdock (2017) suggested that teachers with strong confidence build good classroom interaction. It can be said that the confidence level of the teachers determines effective classroom management, which will influence learners' performance. Teacher confidence serves as an antidote for successful ICT usage in the classroom (Singhavi & Basargekar, 2019). Buabeng-Andoh and Yidana (2015) concluded that the availability of needed ICT resources with support can motivate teachers' ICT use in the classroom. This makes the teacher's role essential in teaching ICT-infused lessons.

ICT Policies in Ghana

The quest of the Government of Ghana to use ICT to develop the country's human resource led to the development of the Information Communication Technology for Accelerated Development (ICT4AD) framework (Ministry of Education, 2003). The Policy sought to empower the citizenry with ICT knowledge and skills needed to make the nation a knowledge and information-rich economy. In 2009, the policy was updated after considerable stakeholder engagement. In 2015, it was further reviewed to reflect the enormous changes that the ICT industry had experienced to reflect the state of the times (Ministry of Education, 2015). The ICT4AD policy sought to utilize ICT as a cross-cutting tool in the teaching and learning process. That is, the policy outlines how ICT should be used in transforming classroom activities. It further proposed ICT as an elective and general course to be taught at pre-tertiary and tertiary institutions. The beliefs and attitudes of teachers towards change as well as the confidence level of teachers to teach new and emerging content in their subject areas are important especially, when implementing a new curriculum. In 2020, the National Council for Curriculum and Assessment (NaCCA) of the Ministry of Education, Ghana introduced the Common Core Programme (CCP). The CCP, which was originally intended to be a 4-year programme (JHS1-SHS1) comprised nine subjects including Mathematics, English, Career Technology, Computing, Creative Arts and Design, Social Studies, Physical and Health Education, Ghanaian language and RME (NaCCA, 2020). The CCP is now a 3-year programme beginning from B7 and ending B9.

This study investigates the critical factors that influence the successful implementation of the Common Core Programme (CCP) in Junior High Schools. Specifically, it examines the attitudes and confidence levels of B7-B9 teachers in teaching the CCP computing curriculum, as well as other key factors that shape teacher confidence and competence in utilizing ICT tools for instruction. The study holds significant importance for several reasons:

1. The CCP represents a crucial initiative to enhance students' computing and programming skills, essential for their future success in the digital age. Understanding teachers' attitudes and confidence levels is vital to ensuring the effective delivery of this curriculum.
2. Identifying the factors that influence teacher confidence, such as access to ICT resources and teacher skills, can inform targeted professional development programs. Empowering teachers with the necessary knowledge, skills, and resources can lead to more effective integration of technology in the classroom.
3. The CCP curriculum, when effectively delivered with the support of ICT tools, can foster the development of critical 21st-century skills, including computational thinking, problem-solving, and digital literacy. Understanding the factors that facilitate this process is crucial for preparing students for the demands of the modern workforce.
4. The findings of this study can inform policymakers and educational authorities in developing comprehensive strategies

and policies to support the successful implementation of technology-enhanced curriculum initiatives, such as the CCP, across the junior high school system.

The research was guided by the following research questions and hypotheses:

Research Questions

1. What is the confidence level of teachers in teaching the sub-strands in the Common Core Computing Curriculum?
2. What resources are available for teaching Computing at the JHS schools?
3. To what extent are teachers ready to use available facilities like Professional Learning Communities and top-up courses to prepare them to confidently teach the CCP Computing Curriculum?

Research Hypotheses

H_1: There is a relationship between the availability of ICT tools and teachers' confidence level in teaching the new common core computing curriculum.

H_2: There is a relationship between professional development avenue and teachers' confidence level in teaching the new common core computing curriculum.

Literature review

Theoretical framework

The study is underpinned by Rogers' Diffusion of Innovations Theory (Rogers, 2003). Diffusion of Innovations Theory explains, how, why and to what extent new ideas and technologies quickly spread in a given society. The theory remains relevant to evaluating technology adopters in the educational environment (Sutton & DeSantis, 2016). Rogers explained diffusion as the process by which innovation disseminates with time among people in a society. He proposed four key elements that affect how a new idea, concept or innovation is spread quickly. They are the "innovation, communication channels, time, and the social system" (Rogers, 2003). These four elements express the extent to which new ideas are adopted in society. He further explained the innovation-decision process as the stages an individual goes through in adopting new ideas or innovations. Five major stages were identified in the innovation-decision process. These five stages determine how an individual adopts ideas or innovations. They are; Knowledge (the concept of understanding how an idea or innovation works), *Persuasion* (positive and negative attitude formation towards the idea or the innovation.) *Decision* (formation of choices leading to adoption or rejection of new ideas or innovations), *Implementation* (new ideas or innovation is put into practice) and *Confirmation* (confirmation of an already-made innovative decision).

In determining how quickly an individual adopts new ideas compared to other group members, Rogers (2003) classified the "degree" of people's adoption into adopter categories. He explained adopter categories as "the classifications of members of a social system based on innovativeness" (p. 22). As a result, he came out with five categories of adopters which are; innovators, early adopters, early majority, late adopters and laggards.

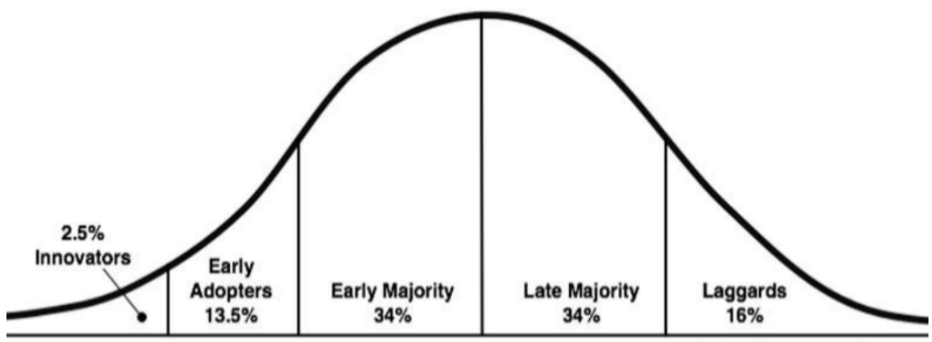

Figure 1*: Diffusion of Innovations Theory. Source: (*Rogers, 2003)

Rogers (2003) described the innovators as "active seekers" and eager for knowledge of novel concepts. They are internally motivated to drive change in society. Their willpower makes them adventurers, which makes them tolerate uncertainty. Even though innovators are not regarded in the social system, they are crucial in the diffusion process. Rogers added that innovators are people who are initiators of change in society. Early Adopters are most respected in the social system. They are the best source of advice and knowledge to others as they act like "role models" to other members of the social system. That is are influencers who convey a novel concept to others in society. They are also best described as the catalyst to speed up the diffusion process. The Early Adopters as described by Rogers as people who deliberately adopt new inventions before the “average” members of the society. He further described them as not the first nor last to adopt innovation. They wait till innovation has been successfully implemented before they adopt it. Though they are not in a position in society but have good interaction with members. Their attitude helps to reach mass appeal which is important in the diffusion process. The Late Majority are people who adopt innovation when they see mass adoption. They adopt new ideas out of necessity not by choice. They are skeptical towards innovations. The Late Majority can be persuaded to embrace innovation when the “system norm” favors the innovation, as well as there, is a peer influence in the adoption process. Rogers (2003) described Laggards as the last group of people in the system to adopt an innovation after the Late Majority. They engage mostly with people who have conventional views like them and often feel resistant to change. Their resistance to change may be a result of their limited resources, they need to be certain of the success of innovation before they adopt. They wait till they are forced to adopt innovation as this slows their innovation-decision process.

From Rogers' theory of Diffusion of Innovation, one can conclude that teachers in the classroom can also be classified into the five groups of adopters with affordance to ICT tools for teaching. They can be Innovators, Early Adaptors, Early Majority, Late Majority or Laggards depending on how they have embraced ICT in the classroom instruction. Teachers' adaptability to the new computing curriculum will determine their self-efficacy in implementing the curriculum in the classroom.

Research Methods

The descriptive survey design was used for the study. Creswell (2012) noted that a descriptive research design helps to determine and report things naturally and attempts to present issues as feasible behavior, attitudes, ideals and characteristics. This study sought to describe the current situation on teachers' confidence and attitude teaching computing in B7-B9. This design was suitable for this study because it elucidates facts regarding teachers' opinions on teaching the common core curriculum as it occurs at the present time. The target population for the study comprises B7- B9 public school teachers in all 16 regions in Ghana, numbering 94,027 (Danso & Gadugah, 2022). The choice of B7-B9 teachers stems from the Computing Common Core

Programme Curriculum focusing on B7-B9. Besides, B7-B9 teachers may have pedagogical content knowledge in Computing necessary for this study.

The target sample size is 287 teachers, which was determined by an online sample size calculator. To ensure each region is proportionally represented, the sample size for each region was determined based on the total number of basic school teachers in that region. This proportional allocation ensured that larger regions with more teachers are adequately represented. Within each selected region, individual teachers were randomly selected to participate in the study. This was achieved using systematic sampling techniques to ensure unbiased selection. Below is the regional distribution of the respondents for the study: Greater Accra (51), Ashanti (51), Eastern (27), Central (27), Northern (22), Western (19), Volta (15), Upper East (12), Bono (11), Bono East (11), Upper West (8), Western North (8), Oti (7), North East (6), Savanah (6), Ahafo (5). In all, 287 teachers comprising 224 males and 63 females participated in the study. Basic school (B7-B9) teachers in Ghana exhibit diverse educational backgrounds, teaching experiences, and technological proficiencies, with significant variations influenced by geographic, gender, and resource availability factors. Understanding these characteristics is essential for addressing their attitudes and confidence levels in teaching the Computing Common-Core Programme Curriculum, highlighting the need for tailored professional development and resource support.

A self-developed structured questionnaire used for data collection was made up of five sections: Section A consisted of seven items and it focused on demographic information of the teachers. Section B focused on the confidence level of teachers to teach the various indicators in the Computing Curriculum. The section contained 39 items which was sub-divided into indicators in B7, B8 and B9 each having 13 items respectively. The questionnaire items were on a five-point Likert scale. Section C contained 7 items and was designed to enquire about the availability of ICT resources and Section D (seven items) enquired about the professional development avenue of teachers. The researchers followed a comprehensive process to develop and validate the research instrument for the study on "Basic School Teachers' Attitude and Confidence Level in teaching the Computing Common-Core Programme Curriculum in Ghana." This process involved a literature review, instrument development, content validity assessment, pilot testing, reliability evaluation, and adherence to ethical considerations to ensure the instrument's credibility, reliability, and validity. The data collected was analyzed using means, standard deviation and correlation.

Results and Discussions

This section presents the findings as derived from the data analysis and discussions thereof. The researchers essentially presented the findings in line with the study objectives. The study sought to find out the confidence level of teachers to teach the indicators in B7-B9 computing curriculum. The analysis delved into the confidence of teachers, the availability of ICT tools for teaching and learning, and professional development avenues available to teachers. Again, the relationship between availability of ICT tools and teachers' confidence level as well as teachers' professional development avenues were analyzed.

The data collected to answer research questions 1 to 3 is presented below:

B7-B9 teachers' confidence in teaching the indicators of the common core computing curriculum

The research question sought to find out the confidence level of the teachers in relation to the new common core curriculum and. towards the various indicators under the study. Their level of agreement or disagreement was assessed through a Likert scale of 1 to 5 ranging from Strongly Disagree to Strongly Agree. The responses were analyzed using means and standard deviations. The result of this research question is displayed in Table 1 to 4.

Table 1: Teachers' confidence in teaching the B7 indicators (N = 287)

S/N	I can confidently teach the following Indicators in the CCP Computing Curriculum	Mean	Std. Deviation
1	B7.1.1.1.1 Discuss the second and third generation of computers	4.26	1.005
2	B7.1.1.1.2 Demonstrate understanding of the use of input devices (wireless keyboard, wireless mouse, light pen, touchscreen).	4.26	1.072

3	B7.1.1.2.1 Describe storage devices: full-sized external hard drives, hard drive speed, disk caching	4.34	1.055
4	B7.1.1.2.2 Discover the latest Windows Operating System (Start screen, Use of tiles, Taskbar buttons, Preview thumbnails)	3.84	1.255
5	B7.1.1.2.3 Practise file management techniques (file and folder management)	4.30	1.014
6	B7.2.1.1.1. Explain the importance of word-processing software	4.17	1.127
7	B7.2.2.1.1. Explain the importance of presentation software Exemplar(s):	4.38	1.048
8	B7.2.3.1.1. Explain the importance of electronic spreadsheet	4.30	1.018
9	B7.3.1.1.1 Draw diagrams to illustrate features of the network topologies (Bus, Star, Ring, Mesh)	4.36	1.017
10	B7.3.1.1.2 Describe types of networks [Personal Area Network (PAN), Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN)]	4.34	1.025
11	B7.3.2.1.1 Identify the various types and uses of Social Media sites such as those for Social Networking (Facebook, LinkedIn, WhatsApp) and Microblogging (Twitter, Tumblr)	4.18	1.083
12	B7.4.1.1.1 Demonstrate the correct use of programming terminologies	4.28	1.073
13	B7.4.1.1.2 Demonstrate understanding in the use of data types (e.g. float, integer, string, char, etc.)	4.41	1.017
	Mean of Means	**4.2627**	**.94369**

From Table 1, the indicator with the highest mean (4.41) is indicator (B7.4.1.1.2 Demonstrate understanding in the use of data types (e.g. float, integer, string, char, etc.) followed by (B7.2.2.1.1. Explain the importance of presentation software.) and (B7.3.1.1.1 Draw diagrams to illustrate features of the network topologies (Bus, Star, Ring, Mesh) with a mean of 4.38 and 4.36 respectively. The mid value means is 3.84 for indicator B7.1.1.2.2 Discover the latest Windows Operating System (Start screen, Use of tiles, Taskbar buttons, Preview thumbnails.

Table 2: Teachers' confidence in teaching the B8 indicators (N = 287)

S/N	I can confidently teach the following Indicators in the CCP Computing Curriculum	Mean	Std. Deviation
14	B8.1.1.1.1. Discuss the fourth-generation computers	4.43	1.024
15	B8.1.1.1.2. Demonstrate understanding in the use of input devices (barcode, scanner, etc.)	4.35	1.023
16	B8.1.1.1.4 Examine Storage portable hard drives, Optical Discs and Drives.	4.41	.988
17	B8.1.2.1.3. Create a component from disposed computer parts.	4.16	1.039
18	B8.2.2.1.1. Demonstrate how to change text case, text size, text colour and decorate text	4.37	1.040
19	B8.2.2.1.3. Demonstrate the use of the Slide Master, design template, and be able to give a 5-slide presentation in MS-PowerPoint using the tools of the ribbons studied	4.05	1.149
20	B8.2.3.1.3. Demonstrate the use of the Autofill function in MS-Excel worksheet	4.38	1.010
21	B8.3.2.1. Demonstrate how to create formulas	4.32	1.041

22	B8.3.1.1.1 Describe the data communication models for networks.	4.39	1.004
23	B8.3.1.1.2 Describe the Internet, World Wide Web (www) and Internet Protocol (IP) addresses	4.02	1.209
24	B8.4.2.1.1 Apply variables, expressions, assignment statements and operator precedence order (BODMAS rule) to process and store numbers and text in a programme	4.05	1.127
25	B8.4.3.1.1 Describe the principles underlying the operation of the components of a robot (Controller Mechanical, Sensors)	3.83	1.231
26	B8.4.4.1.1 Discuss Artificial Neural Networks (ANN) and compare intelligence in humans, animals and machines	4.05	1.132
	Mean of Means	**4.2147**	**.94978**

From Table 2, the indicator with the highest mean (4.43) is indicator (B8.1.1.1.1. Discuss the fourth-generation computers) followed by (B8.1.1.1.4 Examine Storage portable hard drives, Optical Discs and Drives.) and (B8.3.1.1.1 Describe the data communication models for networks.) with a mean of 4.41 and 4.39 respectively. The mid value means is 3.83 for indicator B8.4.3.1.1 Describe the principles underlying the operation of the components of a robot (Controller Mechanical, Sensors).

Table 3: Teachers' confidence in teaching the B9 indicators (N = 287)

S/N	I can confidently teach the following Indicators in the Computing CCP Curriculum	Mean	Std. Deviation
27	B9.1.1.1.1. Discuss the fifth generation of computers with emphasis on quantum computing	3.85	1.225

28	B9.1.1.2.1 Explore the use of the Charms bar	4.13	1.056
29	B9.1.1.2.2. Practise file management techniques (Drive Management)	4.31	1.023
30	B9.2.1.1.1. Demonstrate how to create a table and hyperlinks	3.91	1.230
31	B9.2.3.1.1. Explain the importance of desktop publishing software (DTP)	3.80	1.190
32	B9.3.1.1.1 Discuss types of e-commerce and the cashless society (Bitcoin, Transaction cards, Quick Response code (QR) payment system)	3.94	1.160
33	B9.3.1.1.2 Justify eLearning potentials	3.67	1.268
34	B9.3.3.1.1 Discuss cyberbullying, cyberstalking, digital footprint and digital shadow on the Internet	3.65	1.278
35	B9.3.3.1.2 Explain ten (10) information hacking techniques on the Internet environment.	3.67	1.311
36	B9.4.1.1.1 Describe the conversion of decimal into binary data type for a computer to recognize the meaning, process and store	3.57	1.271
37	B9.4.2.1.1 Write a programme using a flowchart and Pseudocode algorithm that includes sequence, selection and iteration choices in problem-solving	3.37	1.365
38	B9.4.3.1.1 Construct a robot artefact using available lab components and tools or emulator/simulator software pack.	3.30	1.385
39	[B9.4.4.1.1. Describe the knowledge-based systems (Expert	3.14	1.346

systems) as the classical Artificial intelligence]		
Means	3.7156	1.04283
Mean of means	**4.05**	**0.926**

From Table 3, the indicator with the highest mean (4.31) is indicator (B9.1.1.2.1 Explore the use of the Charms Bar) with a mean of 4.13. The mid value means are 3.67 for indicator B9.3.1.1.2 Justify eLearning potentials and indicator [B9.3.3.1.2 Explain 10 information hacking techniques on the Internet environment]. Another mid-value mean, 3.65 was for indicator B9.3.3.1.1 Discuss cyberbullying, cyberstalking, digital footprint and digital shadow on the Internet. The indicators with low mean values (B9.4.4.1.1. Describe the knowledge-based systems (Expert systems) as the classical Artificial intelligence), (B9.4.3.1.1 Construct a robot artefact using available lab components and tools or emulator/simulator software pack.] and [B9.4.2.1.1 Write a programme using flowchart and Pseudocode algorithm that includes sequence, selection and iteration choices in problem-solving.] with a mean of 3.14, 3.30 and 3.37 respectively.

Table 4: Summary of Teachers' confidence in teaching the B7-B9

Level	Mean	Std
BS7	4.2627	.94369
BS8	4.2147	.94978
BS9	3.7156	1.04283
Overall Means	**4.05**	**0.926**

The overall mean score for teachers' confidence level in teaching the indicators of the CCP curriculum is 4.05 which is high. This result is in line with an earlier study by Ayebi-Arthur, Abdulai and Korsah (2020) which shows that teachers in the basic schools have high confident level in teaching the new standard-based curriculum. This is very good for the implementation of the CCP curriculum since it is the continuation of the standard-based curriculum in the country. The high confidence level indicates most basic school teachers fit into the description of early adopters of the innovation diffusion theory.

ICT tools available for teaching and learning the Computing Curriculum

The research question sought to ascertain teachers' responses on the availability of ICT resources for teaching and learning computing in B7-B9. Their level of agreement or disagreement was assessed through a Likert scale of 1 to 5 ranging from Strongly Disagree to Strongly Agree. The responses were analyzed using frequencies and standard percentages. The result of this research question is displayed in Table 5.

Table 5: Availability of ICT tools (N = 287)

S/N	ICT tools available in my school	SD	D	U	A	SA
1	Desktop Computers	88 (30.7%)	32 (11.1%)	18 (6.3%)	93 (32.4%)	56 (19.5%)
2	Laptops	108 (37.6%)	54 (18.8%)	12 (4.2%)	76 (26.5%)	37 (12.9%)
3	Tablets	156 (54.4%)	67 (23.3%)	17 (5.9%)	29 (10.1%)	18 (6.3%)
4	Programming Textbooks	170 (55.7%)	66 (23%)	22 (7.7%)	25 (8.7%)	14 (4.9%)
5	English Dictionary Software	26 (9.1%)	23 (8%)	19 (6.6%)	110 (38.3%)	109 (38%)
6	Internet Source	98 (34.1%)	55 (19.2%)	25 (8.7%)	59 (20.6%)	50 (17.4%)
7	Algorithm Worksheets and Posters	152 (53%)	70 (24.4%)	27 (9.4%)	23 (8%)	15 (5.2%)

The data in Table 5 indicates that most of the resources listed are not available in the schools. Out of the seven ICT tools and resources listed, dictionary software and desktop computers had a high availability rate of 68.3% and 51.9% respectively. The rest of the tools listed had low ICT tools and resource availability rate. This suggests that most of the ICT tools and resources are not available for use by basic school teachers to teach the common core computing curriculum. This result confirms earlier research by Ayebi-Arthur, Abdulai and Korsah (2020) which produced a similar outcome of unavailability of ICT resources for teaching and learning. This should be a source of worry for stakeholders since this tends to affect the implementation of the new CCP Computing curriculum. This result also resonates with research by Opoku (2016) which suggests that the majority of basic schools in the northern part of Ghana lack ICT tools. Again, Ampofo and Abrefi (2020) also give credence to the results by indicating that only a small number of basic schools have ICT facilities which affect its availability to teachers. Even though the confidence level and attitude of teachers are high, the unavailability of ICT tools may affect the teaching and learning of the Computing curriculum negatively. NGOs and other stakeholders who support education in basic schools are encouraged to increase their support in providing ICT tools to improve teaching and learning.

Professional Development Avenues

Research question 3 sought to find out the readiness of basic school teachers to use professional development avenues to prepare them to confidently teach the Computing Curriculum in B7-B9. Their level of agreement or disagreement was assessed through a Likert scale of 1 to 5 ranging from Strongly Disagree to Strongly Agree. The responses were analyzed using frequencies and standard percentages. The result of this research question is displayed in Table 6.

Research question 3 sought to find out the readiness of basic school teachers to use professional development avenues including Professional Learning Communities (PLCs) to prepare them to confidently teach the CCP Computing Curriculum. The result is displayed in Table 6.

Table 6: Professional Development Avenue

	Professional development avenues	**SD**	**D**	**U**	**A**	**SA**
1	PLCs and workshops will help to increase my knowledge	4(1.4%)	5(1.7%)	6(2.1%)	97(33.8%)	175(61%)

	teaching methods for Computing					
2	I believe my teaching approaches for teaching the CCP computing curriculum will improve with a few seminars	5(1.7%)	7(2.4%)	3(1%)	111(38.7%)	161(56.1%)
3	I am prepared to take advantage of school-based and cluster-based PLC sections to prepare me to teach the content of the CCP Computing Curriculum	5(1.7%)	3(1%)	2(0.7%)	101(35.2%)	176(61.3%)
4	I think a special Certificate Course should be organized for computing teachers to address their gaps in knowledge of the CCP Computing Curriculum	3(1%)	6(2.1%)	3(1%)	77(26.8%)	198(69%)
5	I believe PLCs can help teachers to reflect critically on their teaching practice	3(1%)	7(2.4%)	4(1.4%)	90(31.4%)	183(63.8%)
6	I think teachers can learn best practices in assessing and monitoring students' performance through PLCs	3(1%)	9(3.1%)	4(1.4%)	116(40.4%)	155(54%)
7	I think teachers can learn best practices in	3(1%)	10(3.5%)	6(2.1%)	116(40.4%)	152(53%)

assessing and monitoring students' performance through Workshops	

Table 6 shows that almost 95% of the respondents indicated that PLCs and workshops will help to increase their knowledge of teaching methods for Computing. Also, another 95% of the teachers agreed or strongly believed that their teaching approaches for teaching the CCP Computing curriculum would improve with a few seminars. The data in Table 6 also indicate that 96.5% of teachers are prepared to take advantage of school-based and cluster-based PLC sections to prepare to teach the content of the CCP Computing curriculum. Again, 95.8% of the teachers think that a special Certificate course should be organized for Computing teachers to address their gaps in knowledge of the Computing CCP curriculum.

In addition, 95.2% of the respondents believed that PLCs can help teachers reflect critically on their teaching practice. Further analysis of the result shows that 94.4% of the teachers think that teachers can learn best practices in assessing and monitoring students' performance through PLCs. Table 6 also shows that 93.4% of the teachers think they can learn best practices in assessing and monitoring students' performance through workshops. All the results show that most of the teachers are prepared to use PLC and other top-up courses to boost their confidence in teaching the CCP Computing curriculum which is a good sign for the curriculum implementation.

Relationship between the availability of ICT tools and teachers' confidence level in teaching the new common core computing curriculum

This hypothesis sought to find out the relation between the availability of ICT tools and teachers' confidence level in teaching the new common core computing curriculum. Pearson correlation was used to analyze the data and displayed in Table 7.

Table 7: Correlation between Availability of ICT tool and confidence level

		Availability of ICT Tools	**Confidence level**
Availability of ICT Tools	Pearson Correlation	1	.101
	Sig. (2-tailed)		.088
	N	287	287
Confidence level	Pearson Correlation	.101	1
	Sig. (2-tailed)	.088	
	N	287	287

The results in Table 7 indicate a positive correlation between the availability of ICT tools and the confidence of teachers to teach the new common core computing curriculum with a correlation value r = 0.101. Using the general guidelines provided by Cohen (1988), the value of 0.101 suggests a low positive correlation. With the p-value of 0.088 which is more than 0.05 shows that the relationship is not statistically significant. Nevertheless, this result corroborates several research findings which suggest a positive correlation between access to ICT tools and confidence level of teachers (Tasir, Mohammed, Halim, & Harun, 2012; Bingimlas, 2009; Fidelis & Daniel Oduor Onyango, 2021) Again the results match a similar study by Ayebi-Arthur, Abdulai and Korsah (2020) which shows that there is positive insignificant relationship between availability of ICT and the confidence of teachers. However, whereas that study produces a moderate relationship this one shows a low relationship between availability of ICT and the confidence of teachers. Even though teachers reported low availability of ICT resources, it seems they still have a high confidence level in teaching the indicators without the tools. This may be because the teachers are used to teaching without these ICT tools for a very long time and with time they have grown confidence in teaching without these tools. This situation is worrying because it may cause teachers not to use the ICT tools when available since they have grown confident without them. This tends to affect the students negatively.

Relationship between Professional Development Avenue and teachers' confidence level in teaching the new Common Core computing curriculum

This hypothesis sought to find out the relationship between professional development avenue and the confidence level of teachers in teaching the new computing curriculum. Pearson correlation was use to analyze the data and displayed in Table 8.

Table 8: Correlation between professional development avenue and teachers' confidence

Correlation		Professional Development Avenue	Confidence Level
Professional Development Avenue	Pearson Correlation	1	.414**
	Sig. (2-tailed)		.000
	N	287	287
Confidence Level	Pearson Correlation	.414**	1
	Sig. (2-tailed)	.000	
	N	287	287

**. Correlation is significant at the 0.01 level (2-tailed).

The result in Table 8 shows that there is a positive correlation between professional development avenue and confidence level of teachers in teaching the new common core computing curriculum. According to a general guideline provided by Cohen (1992) the correlation value $r = 0.414$ indicates a moderate positive correlation but the p-value of 0.000 is greater than 0.05. This suggests that the relationship is statistically significant. The result shows that there is a statistically significant relationship between professional development avenue and teachers' confidence level in teaching the new common core computing curriculum effectively. This result contradicts Rokhyati (2015) who found no relationship between the two variables in English teachers in Indonesia.

Conclusion and Recommendations

The findings of this study have important practical implications for improving the implementation of the Computing Common-Core Programme curriculum in Ghana's basic schools. The key insights revealed by the study are:

Teachers' Confidence Level: The study found that teachers have a high level of confidence in teaching the indicators of the CCP Computing curriculum. This suggests that teachers are generally receptive and well-equipped to deliver the new curriculum, which aligns with the early adopter and early majority stages of the Diffusion of Innovation theory. This high confidence level is a positive foundation that can be leveraged to further enhance the successful implementation of the CCP.

Availability of ICT Tools: However, the study also revealed a major challenge - the lack of availability of ICT tools and resources for teachers to effectively teach the CCP Computing curriculum. Despite their high confidence levels, teachers are hindered by the lack of necessary technological resources in the classroom.

These findings point to critical areas that policymakers, teacher educators, and school administrators should address to support the successful implementation of the CCP curriculum.

Recommendations for Policymakers:

Increase Funding and Prioritize ICT Infrastructure: The government should significantly increase investment in providing ICT tools, equipment, and digital resources for basic schools. This should be a top priority to ensure teachers have the necessary technological infrastructure to effectively deliver the CCP curriculum.

Establish ICT Resource Centers: Considering the cost barriers, the government should establish centralized ICT resource centers that can serve clusters of nearby schools. This shared access to ICT resources can help overcome the challenges of individual schools acquiring these tools.

Recommendation for Teacher Educators:

Enhance Pre-Service and In-Service Training: Teacher education programs and professional development initiatives should place a stronger emphasis on preparing teachers to integrate technology and digital resources into their teaching practices. This will help build teachers' pedagogical skills and confidence in utilizing ICT tools to teach the CCP curriculum.

Recommendations for School Administrators:

Facilitate Access to ICT Resources: School leaders should work closely with the government and other stakeholders to ensure their schools have reliable access to the necessary ICT tools and resources. This may involve exploring innovative partnerships or community-based initiatives to supplement any gaps in government provision.

Promote Collaborative Learning: Administrators should encourage and facilitate collaborative learning opportunities among teachers to share best practices, troubleshoot challenges, and collectively find solutions for effectively incorporating technology into CCP curriculum delivery.

By addressing these key areas through coordinated efforts, policymakers, teacher educators, and school administrators can create an enabling environment that supports teachers' confidence and equips them with the necessary resources to successfully implement the Computing Common-Core Programme curriculum in Ghana's basic schools.

Limitations of the Study

This study is limited to basic schools (Junior High Schools) within Ghana. The findings may not be fully generalizable to other educational contexts or countries, as the sociocultural, economic, and policy environments can vary significantly. Also, the study may be limited by the sample size of participating teachers and the extent to which the sample is representative of the overall population of basic school teachers in Ghana. Factors such as teacher demographics, school locations, and resource availability may not be fully captured. Finally, the study relied on self-reported data from teachers regarding their attitudes, confidence levels, and perceptions. Self-reported data can be subject to bias, including social desirability bias or inaccurate self-assessment. Despite these limitations, the study provides valuable insights into the attitudes and confidence levels of basic school teachers in Ghana towards teaching the Computing Common-Core Programme Curriculum. Future research could address these limitations by expanding the sample size, including a more diverse range of schools and teachers, and incorporating objective measures of teacher attitudes and confidence levels, such as classroom observations and performance assessments. By doing so, a more comprehensive understanding of the factors influencing teachers' effectiveness in teaching computing education in Ghana can be achieved.

Ethical Standards and Guidelines

The research on basic school teachers' attitudes and confidence levels in teaching the Computing Common-Core Programme curriculum in Ghana adhered to ethical standards that prioritized informed consent, confidentiality, respect for autonomy, promotion of beneficence and social value, researcher integrity and accountability, and responsible dissemination of findings to ensure the study's ethical conduct and positive impact on educational practices and policies.

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