



Teachers' beliefs about technology integration in Ghana: a qualitative study of teachers', headteachers' and education officials' perceptions

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Abstract

With increasing policy interest in improving educational outcomes, technology integration has become a requirement in Ghana's education system, albeit with minimal impact on student learning. Several studies focus on identifying barriers to effective integration but pay scant consideration to the deeper reasons why teachers use technology. This qualitative study aimed to explore the underlying beliefs that shape teachers' decision-making and thinking regarding technology integration. The study used open-ended questions and interviews with five education officials, twenty teachers, and five headteachers, and an 'ICT Pedagogical Beliefs Classification Framework' as a lens for interpreting and categorising teacher beliefs. Thematic analysis of findings revealed four main beliefs: productivity tools for teaching and lesson preparation; developing students' ICT skills; meeting curriculum expectations, and engaging students in authentic teaching. Evidently, teachers are enthusiastic about using technology, but their beliefs indicate that they view technology primarily as a tool for productivity to supplement existing teaching practices, which they value. Findings indicate that most teachers espouse teacher-centred ICT beliefs, implying the need for transformative professional development that enables change in teachers' beliefs to embrace the view of technology as a pedagogical tool that can facilitate constructive pedagogy and deep student learning.

Keywords Pedagogical beliefs · Classification framework · Teachers · Technology integration · Ghana · Qualitative

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1 Introduction

In recent years, technology has become a dominant presence in modern educational reforms and schooling practices in many countries and is expected to facilitate the deep learning that is crucial for learners to thrive today and in the future (Fullan & Langworthy, 2014). Technology has evolved from being a mere option or possibility to becoming an integral part of several educational institutions (Miguel-Revilla et al., 2020). Among the prevalent motives for this transition is the want for pedagogical change (Albion & Tondeur, 2018). As schools seek to transform teachers' roles into activators of learning and pedagogies that capitalise on students' strengths and needs, policymakers the world over are increasing their investment in and demand for technology to better learning outcomes (Orlando, 2013; Vegas et al., 2019).

Teachers play a critical role in determining whether and how technology is used in the classroom (Ertmer & Ottenbreit-Leftwich, 2010). They are expected to integrate technology to promote constructivist instruction, whereby students have choice and control over their learning and play active roles in authentically learning 'with' technology to develop collaborative, creative, critical thinking, higher-order cognitive and problem-solving skills (Ertmer & Ottenbreit-Leftwich, 2013; Jonassen, 2003). Fullan and Langworthy (2014) discussed the potential of technologies for facilitating 'new pedagogies' built on learning partnerships among students and teachers for knowledge creation and deeper learning. Several studies, such as Orlando (2013), Willermark (2021), and Fullan and Langworthy (2014), indicate that despite increased investment and availability of technologies in schools, there has not been a substantial shift or change in teachers' pedagogical practices towards constructivist methods for promoting deeper student learning. Instead, most teachers still use technology in traditional ways as an add-on (Prestridge, 2012), or to reinforce established educational practices, a process Bigum (2012) referred to as 'domesticating the computer'. Prestridge (2017) noted that the technology use practices of most teachers often revolve around replicating traditional and/or administrative tasks, rather than bringing about considerable change in student learning. These claims cohere with Fullan and Langworthy's (2014, p.30) account that "technology investments have too often simply layered slightly more entertaining content delivery or basic skill practice on top of conventional teaching strategies that focus on the reproduction of existing content knowledge".

Several barriers to change, categorised as internal (second-order) and external (first-order) factors are found to hinder teachers' adoption of technology in ways that support 21st-century teaching and learning objectives (Ertmer, 2005; Hur et al., 2016). Historically, institutional 'first-order' factors, such as the availability of technological tools and technical support, were viewed as the primary barriers to technology integration. While still considered a big barrier, there is a belief that the significance of internal factors has diminished in recent years and is no longer a major obstacle in many countries (Ertmer et al., 2012). It is now widely conceded in the literature that teacher-related factors, referred to as 'second-order' barriers, play a crucial role in technology use. Teacher beliefs, including their attitudes and perceptions regarding the role and value of technology, are viewed as critical affective barriers to pedagogical change (Ertmer & Ottenbreit-Leftwich, 2013; Kim et al., 2013).

According to Orlando (2013), the question of why teachers actually use technology must be resolved if progress is to be made in effective technology use. Orlando added that more research is required to comprehend why teachers use the practices they do, as this information is essential to developing their practice. Shin (2015) concurs that despite many efforts by researchers to reveal the factors that influence teachers' decision to integrate technology, studies have reported limited findings about the value teachers assign to technology and the reasons why they integrate it into their teaching practice. Baek et al. (2008) note that many studies about technology integration have concentrated heavily on how to encourage teachers to integrate technology into the curriculum while ignoring the beliefs that influence teachers' decisions to adopt technology. Baek et al. deemed it prudent to first consider the beliefs behind teachers' decisions to use technology before discussing strategies that promote meaningful technology use. As Cheng et al. (2022, p. 5216) stated, the need "to revisit the significance of pedagogical beliefs about technology integration" is growing in research and demands attention, including in Ghana to improve technology integration practices.

To contribute to improving future integration practices in Ghana, this study includes multiple participant groups, including key district education officials, headteachers, and teachers to comprehensively identify and classify the beliefs that underlie teachers' reasoning and use of technology in classrooms, using an 'ICT Pedagogical Beliefs Classification Framework' derived from literature synthesis (Sect. 2.3) as an analytical lens for interpretation. This study distinguishes itself from previous research on ICT beliefs (e.g., Bice et al., 2022; Ertmer et al., 2012; Kim et al., 2013; Prestridge, 2012), which often relied solely on the views of teachers themselves. The question that guides the study is: *What are teachers' pedagogical beliefs about technology integration in Ghana?*

2 Literature review

The following sections present a brief review of technology integration in Ghana, literature on teacher ICT beliefs, and a framework for classifying ICT pedagogical beliefs.

2.1 Technology integration in Ghana

This study was conducted in Ghana, where educational reforms are ongoing to improve educational outcomes, with a greater emphasis on relevance and preparing learners to acquire 21st-century competencies. The government sees ICT as a crucial accelerator and partner in the country's socio-economic development and poverty alleviation efforts. As a result, the government has invested into the expansion of technological infrastructure in schools, enacted ICT policies, and implemented teacher professional development programs to promote technology integration. Following the country's ICT in education policies (Ministry of Education [MoE], 2015), the current standards-based curriculum requires teachers to utilise modern technologies as pedagogical tools to facilitate the transition from teacher-centred pedagogies

to student-centred or social constructivist teaching and learning approaches (MoE, 2018).

The rate of teachers' adoption of technology in instruction, however, remains slow, particularly at the primary school level (Agyei, 2013; Mangesi, 2007; Tsapali et al., 2021). Several studies (e.g., Buabeng-Andoh, 2019; Danso and Kesseh, 2016) have investigated barriers affecting meaningful integration, with teachers' capacity and nature of their technology integration practices among the prevalent factors often being called into question. To inform tailored interventions and preparation strategies that can improve teachers' use of technology to foster learning engagement, it is deemed essential to gain a deeper understanding of the nature of the common beliefs that drive teachers' decisions and thinking about technology use in Ghana's educational context; hence, the primary purpose and significance of this study.

2.2 Teacher ICT pedagogical beliefs

Beliefs, described as a complex construct (Hermans et al., 2008; Pajares, 1992) encompass psychological preconceptions, premises, or propositions that individuals hold as true (Richardson, 1996). Pedagogical beliefs are the educational beliefs about teaching and learning that teachers espouse. They serve as personal filters that predict, guide, and determine teachers' instructional tasks and curricular decisions in the classroom, including how they adopt and enact innovations and new instructional strategies (Levin, 2015; Ertmer et al., 2015; Pischetola, 2020). Pedagogical beliefs, a key internal factor, strongly predict teachers' teaching behaviours and can shed light on the variations in how they use technology and the impact on instructional practices (Ertmer et al., 2012; Kim et al., 2013; Liu, 2016).

The research literature presents various conceptualisations of teacher ICT pedagogical beliefs. Prestridge and de Aldama (2016) define these beliefs as the goals, purposes, or reasons for incorporating technology in teaching and learning. Taimalu and Luik (2019) consider beliefs to be associated with the value of using technology for teaching and student learning. Abbitt (2011), on the other hand, views teacher beliefs as self-efficacy related to technology use and the role of technology in instruction (Ertmer et al., 2012). In sum, ICT pedagogical beliefs could be described to comprise the educational goals and thoughts that influence how teachers plan and conduct activities regarding technology use in the classroom.

Pedagogical beliefs about technology can be classified on a spectrum, ranging from teacher-centred to student-centred beliefs (Tondeur et al., 2017). Teacher-centred beliefs are typically associated with behaviourism, which emphasises discipline, subject matter, and moral values. These beliefs are based on the transmission and reproduction of knowledge, with teachers believing that desired actions can be instilled through repeated practice (Liu, 2016). Ertmer et al. (2015) claimed that teachers with teacher-centred beliefs are more inclined to view technology as a tool for supporting basic and lower-level didactic instruction in highly structured learning environments. In behaviourist, traditional classrooms, technology is often used to supplement teacher-centred practices such as drill and practice, lecturing, and information presentation (Ertmer et al., 2015).

Student-centred beliefs are grounded in the constructivist approach, wherein teachers prioritise students' needs and interests and facilitate the construction of knowledge to foster higher-order thinking skills. Unlike behaviourism, which places prominence on the instructional designer, student-centred beliefs underscore student responsibility for learning (Dede, 2008). Technology is seen as a beneficial tool for supporting students in collaborative, authentic, and intellectually stimulating tasks that promote learning. Students actively participate in instruction and engage with technology as cognitive partners to solve real-world problems (Ertmer & Ottenbreit-Leftwich, 2013). Teachers who hold constructivist beliefs advocate for the recurrent and meaningful integration of technology to enhance high-level learning, encompassing critical thinking, problem-solving, communication, and collaboration skills (Ertmer et al., 2012; Hermans et al., 2008). There is a focus on fostering partnerships between teachers and students, as well as among students themselves, with a shared goal of co-constructing knowledge (Orlando, 2013). Fullan and Langworthy (2014) argued that these pedagogical strategies represent advanced uses of technology that are vital for enacting new teaching approaches, enabling student autonomy, collaboration, and deep learning.

2.3 Framework for classifying teacher ICT pedagogical beliefs

Beyond the dichotomy of traditional and constructivist beliefs, several researchers consider a multidimensional approach to classify teachers' ICT beliefs. Reasons such as the difficulty of categorising beliefs as either student-centred (constructivist) or teacher-centred (behaviourist) and the assertion that teachers may hold multiple beliefs are provided (Ertmer et al., 2012; Prestridge & de Aldama, 2016). Downes, Fluck, and others (2001) categorised teacher beliefs or goals for integrating technology as: (1) development of skills, (2) ICT as a learning tool, and (3) ICT as changing content and pedagogy, which involves the goal of using technology to transform existing curriculum practices. Mama and Hennessy (2013) classified ICT beliefs into four categories: (1) diversifying—teachers believe that using technology aids different methods of learning; (2) powerful—teachers believe that using technology is an exciting learning experience; (3) convenient—teachers' belief in the administrative utility of technology; and (4) subversive—teachers' fear of being replaced by technology forces them to avoid using it. Prestridge (2012) identified four types of ICT beliefs as: (1) foundational (using ICT in all subjects), (2) developing (curriculum implications of ICT), (3) skill-based (students need to acquire ICT skills), and (4) digital pedagogical practices (ICT promotes student-centred learning).

Law et al. (2008) categorised the role of technology in the curriculum into three groups: (1) learning about ICT as a school subject (computer literacy), (2) learning with ICT or knowledge deepening (using ICT as a tool to improve learning and existing instructional practices), and (3) learning through ICT or knowledge creation (full integration of ICT as a medium for curriculum and pedagogical change to promote learners' acquisition of 21st-century skills). Ertmer et al. (2012) found three types of beliefs associated with the use of technology: (1) supplementing the required curriculum where teachers believe that technology can deliver content and present information learned, motivate, reinforce and practice skills; (2) supporting/enriching the

existing curriculum where teachers believe that technology is an educational tool for student engagement, collaboration, and higher-order thinking; and (3) facilitating an emerging curriculum where teachers believe technology is a pedagogical tool for 21st-century education that can transform the way students learn.

Based on a synthesis of the literature, Prestridge and de Aldama (2016) broadly classified ICT beliefs into three planes in their Classification Framework for Technology Enabled Practice (FrameTEP): (1) developing computer skills and supplementing subject skills, (2) enriching existing curriculum, and (3) facilitating new ways of learning. Twining (2008) labelled three modes of beliefs associated with technology as a learning tool: (1) Support — Learning objectives with technology remain the same, but the process is automated. Entails technology use to improve the efficiency of teaching without changing curriculum content; (2) Extend— Different curriculum content and/or process, but these changes could take place without a computer and (3) Transform— Different curriculum content and/or process, which could not have taken place without a computer.

Based on the common categories of ICT beliefs identified in the preceding literature review, a framework is developed to classify teachers' pedagogical beliefs about the integration of technology within the spectrum of traditional (teacher-centred) and constructivist (student-centred) pedagogical orientations. Building upon the synthesis of the reviewed studies, four distinct groups of teachers' technology pedagogical beliefs are categorised: (1) developing students' technology skills (the need for students to attain skills in the technology itself), (2) supplementing/supporting the curriculum (improving the productivity of teaching without changing curriculum content and learning objectives; process automation), (3) enriching/extending existing curriculum (different curriculum and learning practices that could still occur without technologies) and (4) transforming/facilitating new ways of learning (different curriculum content and learning processes that could not have occurred without technologies). These categories of beliefs range from technology as a productivity tool for regular curriculum practices and for students to acquire ICT skills (traditional/teacher-centred) to technology as a pedagogical tool for enriching curriculum and facilitating new students' learning methods (student-centred/constructivist). The resulting 'ICT Pedagogical Beliefs Classification Framework,' presented in Table 1, serves as an analytical tool for interpreting and categorising Ghana's teachers' distinct beliefs about technology integration.

Table 1 ICT Pedagogical Beliefs Classification Framework

Pedagogical Beliefs about Technology Use	Developing Students' technology skills	Supporting/ Supplementing the required curriculum	Extending/Enriching existing curriculum	Transforming/Facilitating new ways of learning
Type of pedagogy	Traditional/Teacher-centred		Mix-balanced	Constructivist/Student-centred

3 Methodology

3.1 Study design and instrumentation

To address the research question, this study employed a multi-method qualitative case study design to explore the factors, specifically beliefs, that shape teachers' use of technology in Ghanaian classrooms. This design was chosen due to its suitability for capturing in-depth insights into people's views. The objective of the study aligns with the primary purpose of case study design, which is typically used to conduct thorough examinations of a specific contemporary phenomenon within a well-defined context (Yin, 2017). The research question and object of this study—beliefs influencing technology integration practices of teachers—represent the single case (the explanandum/ object) the researcher sought to explore and understand in Ghana's context. The designation of the study 'object' as the 'case' or 'unit of analysis' is premised on Stake's (2006) and Merriam and Tisdell's (2015) definitions, where both scholars emphasised that the object of study can be the case to be investigated.

Employing multiple sources of evidence and methods permits researchers to address a broad range of issues, develop "convergent lines of enquiry" (Yin, 2017), and enhance the trustworthiness of a study through triangulation (Stahl & King, 2020). Hence, data for the study were collected using two data collection tools: (1) online telephone interviews and (2) open-ended questionnaires. Although traditional in-person interviews continue to be prominent, online telephone interviewing is just one of several emergent innovative methods available to researchers interested in conducting qualitative research in recent years (Fielding, Lee, & Blank, 2017). It is a promising 'new methodological frontier' in qualitative research that can produce data comparable in quality to face-to-face interviews (Weller, 2015).

Following the completion of the telephone interviews, open-ended questionnaires were administered to the same sample of participants to elicit additional textual responses to understand the investigated phenomenon better. The questionnaires had answer boxes left blank for participants to freely fill out with brief or prolonged written responses. The questions mirrored those scheduled in the telephone interviews. The objective was to account for potential limitations of the telephone interviews and give participants uneasy with telephone interviewing the opportunity to provide detailed written responses under less pressure. A sample question from all of the participant groups' interviews and questionnaires included: What are the reasons (beliefs) behind teachers' use of ICT in the classroom?

3.2 Participants and context of the study

Twenty public school teachers, five headteachers and five district education officers participated in the study. The participants were selected across different locations in two school districts in Ghana's Eastern region. The selection of the districts followed no specific criteria and was based on a non-probability convenience sampling method. The two districts considered relevant and equal to all other districts for the study objective were chosen for low-cost and budget-constraint purposes. Other reasons included their accessibility and how quickly data could be expediently collected

from a readily available pool of participants, given the researcher's inability to be present in the field due to travel restrictions at the time.

A non-probability, purposeful sampling method was used to identify and select information-rich participant groups (teachers, headteachers and education officials) whom the researcher deemed likely to provide more insight and germane information on key issues about the research question. The purposeful sampling method was used in conjunction with the snowball sampling approach to recruit participants. With the snowball sampling technique, also known as network or chain-referral sampling, the researcher first selected a small group of individuals pertinent to the study. These individuals then suggested other participants with relevant experience and applicable characteristics to participate in the study.

Concerning participants' background information, most of the teachers were between the ages of 30–34 and had a range of teaching experience from 2 to 12 years. All the teachers were professionally trained with at least a Bachelor of Education degree. The headteachers selected were all males. The majority were in the age group of 35–39, with the eldest placing between 50 and 54. 80% had a bachelor's degree in education, with the highest qualified having a master's degree in educational leadership. Their headship experiences ranged from two to six years of service. All five education officials were males and worked in various positions as Circuit supervisors, Municipal Training Officers, and Municipal ICT coordinators. Three of them had bachelor's degrees, while the other two held master's degree qualifications. Their job experiences ranged from 2 to 20 years. Participants' names are marked with the prefixes 'MT', 'FT', 'HT', and 'EO' to indicate male teachers, female teachers, headteachers, and education officials. To maintain participants' confidentiality and anonymity, all names are pseudonyms. Verbal permission and written consent were obtained from participants. The study received ethical approval from Griffith University's Human Research Ethics Committee.

3.3 Data analysis

The data obtained from the interviews were transcribed and thematic analysis was conducted using NVivo 12 qualitative data analysis software. Thematic analysis is used for analysing qualitative data, particularly in studies that aim to explore individuals' perspectives and derive meaning through shared interpretations. It provides a suitable approach for identifying, categorising, and examining patterns within the data, thereby facilitating a deeper understanding (Clarke & Braun, 2013). The study's thematic analysis adhered to Clarke and Braun's six-step framework: (1) data familiarisation, (2) code generation, (3) theme generation, (4) theme revision and review, (5) theme definition and naming, and (6) report writing. Following data transcription, an inductive coding process was employed to identify, sort and categorise initial codes related to the reasons underlying teachers' use of technology. Through iterative analysis, the initial codes were compared and organised based on their similarities and distinctions to generate initial themes. These themes underwent recursive refinement, and definition, leading to the identification of distinct and non-overlapping final themes that accurately captured the meanings conveyed by the data and repre-

sented participants' views about teachers' beliefs or reasons for using technology in the classroom.

After the initial inductive open coding and thematic analysis, the 'ICT pedagogical beliefs classification framework' (Table 1), was applied as an analytical tool to further interpret and classify the distinct reasons (beliefs) associated with teachers' use of technology. The aim was to gain an understanding of the nature of teachers' ICT beliefs and their specific positioning along the continuum between traditionalist and constructivist pedagogies. This further analysis provided insights into the particular beliefs held by teachers and their alignment with pedagogical approaches in the classification framework. Table 2 presents findings of teachers' technology pedagogical beliefs, accompanied by summaries of illustrative data codes and the corresponding number of participants.

3.4 Trustworthiness

This study used triangulation and member-checking methods to increase the trustworthiness of the findings. Triangulation, defined as combining multiple sources of information from the field to corroborate evidence, was implemented to reduce biases that may be caused by the use of a single method or data source (Stahl & King, 2020). To provide a more balanced explanation, data were collected from multiple groups of participants (teachers, education officials, and headteachers) regarding the motivations for teachers' use of technology. Multiple data collection methods, including telephone interviews and open-ended questionnaires, were also used to increase confidence in the findings. The study's credibility was bolstered by member checking. The principal investigator provided interview summaries and preliminary interpretations to five participants at random and requested clarification to ensure that these accurately reflected the participants' responses.

Table 2 Teachers' Pedagogical Beliefs about Technology Use

Teacher Pedagogical Beliefs (Themes)	Number of Participants	Summary of Main Ideas from Data (Codes)
Productivity tool for teaching and lesson plan preparation	EO (5), HT (4), T (17)	To reduce teachers' workload. To improve lesson preparation and presentation. It makes teaching faster and easier.
Develop students' ICT skills	EO (3), HT (4), T (9)	To make learners globally competitive with 21st -century ICT skills. To enhance learners' participation in global knowledge economy. To boost students' employment opportunities.
Meet curriculum requirements and expectations	EO (3), HT (3), T (2)	The need to follow and meet Basic school curriculum requirements and external expectations.
Engage students in authentic teaching and learning	EO (-), HT (-), T (7)	To facilitate students' concrete learning. To make teaching authentic, less abstract and engaging for students. To make instruction more exciting and increase students' retention of knowledge.

4 Findings

Four key themes emerged from participants' responses about the beliefs that influence teachers' technology integration practices, which are presented in this section. Quotes from interviews are denoted with an 'I', while those from open-ended written questionnaires are marked with a 'W'.

4.1 Productivity tool for facilitating teaching and lesson preparation

Twenty-six participants, comprising five education officials, four headteachers, and seventeen teachers, shared a common belief that technology usage by teachers is driven by the perception that it can enhance the productivity of daily curriculum tasks. The productivity of technology in teachers' educational practices was seen in various ways, including making lesson plan preparation and student instruction presentations less tedious, easier, and faster. Teacher Dorothy held the belief that technology serves as a productive tool, capable of reducing the workload for teachers, especially in terms of lesson delivery. In describing what motivates her to implement technology, she stated in the interview that, "I use ICT to deliver lessons because it can improve teaching and reduce my workload in the classroom."

Other teachers revealed that technology can facilitate classroom tasks and reduce routine teaching workload. Teacher Richard highlighted the use of technology for Internet research, which enables teachers to quickly prepare and present updated lesson materials. He described using technology to compensate for deficiencies in available textbooks as a major reason for integrating technology into his teaching.

Teaching becomes easier with ICT integration than without it. It makes teaching less tedious and manpower. I use ICT in my teaching because it reduces the workload on the teacher. For example, technology aids in the preparation of my lessons. Previously, I relied on textbooks for lesson preparation; however, with the availability of ICT tools such as phones, I now research online for more up-to-date information to teach. For example, when teaching about 'flowers,' the information contained in the textbook [may] not be sufficient. With the phone, you can search the Internet for more ideas and ways you can deliver better. (MT-Richard_W)

Teachers Luke further explained that the benefits of using technology to create lesson plans are a significant reason for the use of technology. Luke talked about how productive technology is for preparing and presenting instructional lessons.

ICT actually makes teaching easier and lesson presentation simpler. It helps teachers to easily research when preparing their lesson notes which is very important. This makes teaching delivery very easy and more relevant in the classroom. (MT-Luke_I)

Teacher Lexy explained that using technology in the classroom helps to reduce the amount of time and effort spent on instruction while also making teaching delivery

simpler and easier for the teacher. He stated that technology allows students to stay and learn in the classroom what they would otherwise have to be outside of the classroom to learn.

I see it [ICT] as really making teaching simple because there have been certain days that we [teachers] take the kids [students] out to maybe see the environment, but since you have your laptop or any other ICT tools, you can download certain things from the Internet for them to see in the classroom. And by so doing, you will not waste much time and effort taking students out to the environment to learn. It is pretty easy when you are with the [ICT] tools and you teach them with them in the classroom. (MT-Lexy_W)

Some headteachers recounted that teachers are driven to use technology because of the advantages it provides for lesson preparation and delivery. Headteacher Aryeh, in his telephone interview, described technology in classrooms as essential “to make lesson delivery or presentation practically-oriented and enable a better understanding of lessons taught”. Headteacher Joseph perceived likewise that teachers use technology to enable them to research and prepare lesson plans that are up-to-date and relevant for teaching and learning.

Teachers who have computers and modems use [them] to search the Internet for information before lesson preparation and during teaching [in-class instruction]. This makes the lesson content very updated, current, and relevant [for students]. (HT-Joseph_I)

4.2 Develop students' ICT skills

Three education officials, four headteachers, and nine teachers from across the districts identified the need for students to develop ICT skills for them to be globally competitive in today's information society and knowledge economy as one of the core beliefs that motivates teachers' use of technology. Many teachers consider ICT skills a sought-after 21st -century competency for learners to keep up with rapid societal changes and improve their employability. They believe that as the world continues to evolve, learners must be exposed to contemporary skills required for today's diversified and competitive work environment. “As the world changes, we need not be static; we need to prepare students with skills to conform to it,” said teacher Richard about what influences his use of technology. Morris, an ICT teacher, noted the need for teachers to use technology to teach ICT skills to cope with technological and societal changes.

Because the world is now a technology world, it [knowledge of ICT] can assist students in using basic technologies in their daily lives and learning. We [teachers] use ICT in classrooms so that students will be able to learn how to use it in the future of work. Everything is now ICT, so we must ensure that children

[students] have the necessary basic ICT skills to use these tools when they grow up. (MT-Morris_I)

Other teachers (e.g., Kofi) reported that many teachers use technology in the classroom to help students develop the skills necessary to become more globally competitive.

[Integrating technology] provides students with ICT skills that can help them to compete with colleagues from other institutions who have enough ICT tools. If they are exposed to basic teaching and learning with ICT, it can help them with skills to compete with others [peers] with advanced ICT materials. (MT-Kofi_I)

Albert, an education officer, cited the need for internationally competitive students as a motivator for teachers' use of technology. The education official stated, "Because today's world is a global village, equipping our students with the necessary ICT skills will aid them in competing with students from other developed countries".

4.3 Meet curriculum requirements and expectations

Eight participants, consisting of two teachers, three education officials, and three headteachers from both school districts, identified the use of technology by teachers in the classroom as a result of their need to adhere to external requirements, recommendations, and expectations concerning the integration of technology in teaching. The participants revealed that meeting Ghana's Basic school curriculum objectives and expectations concerning the use of technology as a cross-curricular tool to support teaching influences many teachers to integrate technology. This interview excerpt from headteacher Edu captures such an underlying reason for some teachers' use of technology.

Per the new pre-tertiary education curriculum, teachers are required to use ICT tools to help children [students] in their [learning] and development so that they do not grow up knowing nothing about ICT. Many teachers use technology in classrooms because of this (HT-Edu_I)

The remarks made by this school leader indicate that teachers are expected and influenced to incorporate technology into their instruction to enhance teaching and equip students with essential ICT skills. These expectations stem from the directives set forth by Ghana's Education Service and Ministry of Education, as outlined in the Basic School Curriculum. Other teacher participants concurred that some teachers are compelled to integrate technology to meet the requirements of the Basic school curriculum, which mandates the use of technology as an integral pedagogical tool. As Emma and Kingso noted, teachers use technology to adhere to the curriculum requirement for them to promote student-centred learning and learners' familiarity with ICT.

Teachers are now required to use technology when teaching all subjects under the new curriculum introduced by the Ghana Education Service. This is to

make teaching student-centred and for students to use technology in their learning. It [use of technology] is a must for all [teachers] to use it in teaching. (MT-Emma_I)

Technology integration is now part of the curriculum to help students become acquainted with ICT. It has become a major part of teaching and learning processes, particularly at the primary school, to help students fit well into the 21st-century world of technology. (MT-Kingso_W)

These headteachers' and teachers' comments suggest that Ghana's Basic school curriculum provides a justification for teachers' technology integration practices. These teacher beliefs about technology integration are comparable to Donnelly et al. (2011) inadvertent user categorisation of beliefs, whereby teachers believe in technology use for instruction because it is a school requirement and expectation. Other research (Baek et al., 2008) has consistently found that teachers are forced to use technology due to the need to adapt to the demands and expectations of external forces, including Education Ministries.

4.4 Engage students in authentic teaching and learning

The belief that integrating technology can change instruction to be authentic and engage students in the teaching and learning process emerged as another motivator for teachers to use technology in classrooms. Comparatively, only seven teachers indicated that teachers are motivated to use technology as a teaching and learning tool because they believe it can make lesson delivery less abstract and provide students with opportunities to observe what they are learning in practice. These participants believed that authentic instruction facilitated by technology is necessary for teachers to capture students' attention, improve their comprehension and retention of knowledge, and make instruction more engaging.

Students struggle to understand when you teach abstractly. If there are no teaching aids such as ICT tools, teaching becomes like a story to them [students]. When technologies such as computers and a projector are used to display videos, students gain a clear understanding of what is taught, and they may even assist you [teacher] in teaching. (FT-Esi_I)

Other teachers stated that they use technology because they believe it can make teaching and learning more authentic and engaging for students, particularly when students can see and experience what is being taught. Teacher Owura, an ICT teacher, explained that when teachers present instruction with technology, it encourages students' active participation in instruction. Students become more involved and appreciative of what is being taught.

In teaching, we have something known as touch and feel it. If you are teaching about something and you bring the real object to the classroom and the students can touch and feel, it sticks into their minds and stays there longer rather than doing the lecturing in abstract... For example, if you are teaching about elec-

tricity and bring an electrical gadget for students to see and feel, it sticks faster and [it] help them grasp the concepts very well.... I frequently use technology to engage students, and this makes teaching very exciting (MT-Owura_I).

Teacher Abena is encouraged to integrate technology for it can increase students' interest in learning and help them retain information longer than if she did not use it.

I previously used the traditional mode of instruction [without technology], but things have changed since I started using technology in my teaching. With technology, teaching and learning have become more interesting and enjoyable for students than before. Technology arouses the learning interest of students and increases retention of what I teach (FT-Abena_1).

These participant statements indicate that some teachers are motivated to use technology to benefit or advance student learning and active participation in the instructional process. The objective of technology use includes the need to engage students in practical instruction and bring real-world experiences into classrooms in order to kindle learners' interest, make instruction more enjoyable, and facilitate easier subject understanding.

5 Discussions

The findings presented revealed that teachers are enthusiastic about using technology, citing various reasons for the need to incorporate technology into instruction. The dominant beliefs shared include the rationale that technologies provide general productivity tools to facilitate lesson plan preparation and content delivery, as well as to develop students' ICT skills for future employment. Drawing on the 'ICT pedagogical beliefs classification framework' which was created from the literature review (see Table 1), it is evident that the predominant technology beliefs of teachers fall into the frame of technology use as a productivity tool to supplement required curriculum practices and develop students' technology skills (denoted by the blue border lines in Table 3).

Table 3 Pedagogical Beliefs about Technology Use

Pedagogical beliefs about technology use	Developing students' technology skills	Supporting/Supplementing the required curriculum	Extending/Enriching the existing curriculum	Transforming/Facilitating new ways of learning
Thematic findings from data	<i>-Develop student ICT skills</i>	<i>-A productivity tool to support teaching and lesson plan preparation -Use of technology to meet curriculum and policy expectations</i>	<i>-Technology to engage students in authentic instruction</i>	
Type of pedagogy	Traditional/Teacher-centred		Mix-balanced	Constructivist/student-centred

The nature of the dominant beliefs, which mainly aim to improve the productivity of curriculum practices indicate that many teachers in Ghana tend to espouse teacher-centred or traditional beliefs when thinking about technology use. Teachers perceive technology as a tool for facilitating teaching and other essential curriculum practices, without necessarily altering their pedagogy or the learning context. The literature shows that teachers who hold traditional, teacher-centred beliefs and orientations typically use technology in a rudimentary manner to support existing curriculum practices. These practices include tasks such as lesson preparation, content delivery, and assisting students in developing ICT skills (Ertmer et al., 2015). According to O'Rourke (2001) and Jonassen (2003), such traditional beliefs contribute minimally to the goal of using technology to engage students in meaningful pedagogy to enhance knowledge construction and promote learning outcomes. Okojie et al. (2006) argued that such traditional beliefs about technology tend to be limited. They claimed that these beliefs often confine integration to specific technologies employed as supplements to traditional teaching practices.

The two prevalent pedagogical beliefs about the use of technology are represented by the blue border in Table 3. The first dominant category of ICT beliefs in the classification framework—supporting/supplementing the required curriculum—is indicative of participants' views that teachers use technology because they believe it can improve the productivity of routine curriculum practices and meet curriculum and policy expectations. Particularly, the belief that technology, as a productivity tool, can facilitate lesson preparation and instruction presentation emerged as the primary motivation for integration. These beliefs align with the 'functional' type of pedagogical beliefs identified and categorised by Prestridge (2012). Such beliefs could also be placed in the 'convenient' category of Mama and Hennessy's (2013) typology of beliefs, which connotes teachers' prioritisation of the administrative benefits of technology over its capacity to transform student learning. Similar findings have been reported in other studies conducted in South Korea (Baek et al., 2008) and the United States (McKnight et al., 2016). These studies revealed that many teachers are motivated to use technology due to its perceived convenience, as they believe it can streamline curriculum practices, alleviate physical fatigue, and save teaching time.

The second prominent category of beliefs in the classification framework, which is focused on developing students' technology skills, indicates that teachers use technology because they believe it can effectively contribute to the development of students' ICT skills. Teachers view the acquisition of basic ICT skills as critical for students to become competitive in the global job market, participate and keep pace with the rapidly evolving society. This ICT belief resonates with past claims of learners' active participation in societal progress (Loveless, 2003), and the economic and social change rationales that drive technology use in schools (Albion & Tondeur, 2018). These beliefs align with the findings of Prestridge's (2012) study, which revealed that teachers use technology to facilitate students in acquiring basic ICT skills. Likewise in Belgium, a study by Tondeur et al. (2007) identified the need for students to learn basic computer skills and develop technological competency as among three important reasons driving teachers' use of technology. O'Rourke (2001) described this belief as technical, whose main concern is for students to develop ICT skills as an end in itself and for employment purposes.

The study found that there were pedagogical beliefs indicating the use of technology to somewhat extend or enrich the existing curriculum. However, these ICT beliefs were minor compared to those beliefs regarding the use of technology for productivity purposes and to simplify or expedite required curriculum practices. These beliefs emerged in the findings as the least popular motivation for teachers to integrate technology, hence are placed outside the blue border in Table 3. Teachers who hold these beliefs integrate technology because they believe it can make instruction more authentic and engaging for students. While these motivating factors are aligned with constructivist beliefs, the results imply that technology is still primarily in the hands of teachers, and not the students, for productivity of teacher-centred tasks. These beliefs are hence viewed as a balanced combination of constructivist and traditional beliefs and are termed “mix-balanced” (Ertmer et al., 2012; Prestridge & de Aldama, 2016). The findings of the study did not provide any evidence regarding teachers’ beliefs about using technology to transform or facilitate new learning methods, hence their absence from the classification framework in Table 3.

The need for teachers to enrich curriculum practices and facilitate new learning ways with technology, as the literature recommends, corresponds with the central themes in Ghana’s Basic school curriculum and ICT in Education Policy, which directs teachers to use technologies as pedagogical tools to facilitate student-centred instruction and engage students in authentic instruction (MoE, 2015, 2018). The lower occurrence of these beliefs as drivers for teachers’ use of technology suggests that contrary to curriculum and policy expectations, teachers in this study and, to a greater extent in Ghana, do not usually adhere to changing the context of learning or their traditionalist approaches to teaching when using technology. This finding aligns with the observations made by Baek et al. (2008) that while the belief in the enhanced capabilities of technology to improve learning or transform traditional teaching methods may appear to be the most significant justification for implementing technology in schools, it is actually the least influential factor in teachers’ decisions to integrate technology.

6 Conclusion and implications for teacher preparation and practice

The core objective of this study was to explore the perceptions of teachers, head-teachers, and education officials in Ghana regarding the beliefs that shape teachers’ practices when integrating technology. The study identified four distinct teacher beliefs through conversations with these diverse participant groups. The main beliefs for technology use are rooted in the notions of convenience and the productivity it can offer to support or supplement teachers’ regular teacher-centred practices, including the need for students to gain ICT skills. Relatively few references were made to teachers’ use of technology premised on the belief that it can engage students in authentic and collaborative instruction and facilitate new ways of learning. The findings suggest that when deciding to use technology, most teachers do not prioritise constructivist pedagogy for knowledge creation, independent and deep student learning over basic traditional uses for information delivery and consumption, and skills acquisition. Evidently, all emerging categories of beliefs are geared towards

productivity and centred on teachers preparing and delivering instruction rather than direct student engagement and personalised learning with technology. While teachers may have a strong interest and enthusiasm for technology use, their underlying beliefs suggest that they believe the best use of technology is to increase productivity, which they highly value.

For teachers to enact meaningful pedagogies with technology through a more student-centred model, it is established that their knowledge and skills need to be developed alongside the shaping of their pre-existing beliefs (Ertmer & Ottenbreit-Leftwich, 2010, 2013). Professional development that enables teachers to acknowledge, reflect and interrogate established beliefs to inform change towards improving pedagogy and deep student learning is encouraged as one of the primary starting points for disruption (Prestridge, 2017). Findings indicate the significance of beliefs, as they often exert an influence on teachers' instructional approaches and practice when it comes to technology integration (Hermans et al., 2008; Kim et al., 2013; Prestridge, 2012). Hence, the study recommends that educational leaders, including those in Ghana, should carefully plan and implement preparation strategies to ensure that teachers are professionally prepared to remain informed and develop the beliefs that can drive them to integrate technology in ways that foster constructivist practices and promote deep student learning. This training approach is vital for teachers to move beyond using technology for demonstration, content delivery, and convenience purposes alone.

The study makes a case for reorienting teachers towards accepting a new definition of 'good' teaching, which includes a belief in technologies as pedagogical tools to encourage constructivist pedagogy for today's learners to thrive in the 21st-century society. Disruptions in mindsets, orientations and existing beliefs may shape how teachers perceive the roles of technology as a learning tool in the classroom. Overall, the findings on beliefs can serve as a crucial foundation for conducting a diagnostic analysis to facilitate the design of improved professional development opportunities that specifically target beliefs change for effective pedagogical integration within the educational system in Ghana, as well as in other international jurisdictions where prevalent teacher-centred beliefs and traditional technology use practices persist among the majority of teachers. Insight into what motivates teachers' use of technology and its likely implications for teaching practice and student learning is foundational for school leaders and teacher educators to address to better prepare teachers to support deep student learning, enabling them to contribute to tackling global challenges and flourishing in the modern complex world.

This study, from the perspectives of multiple participant groups, has made a significant contribution to the literature on the classifications of beliefs that influence teachers' use of technology in the classroom. While the study successfully identified four varied beliefs underlying teachers' technology integration practices, it is important to acknowledge that there may be other crucial beliefs that were not uncovered due to the limited scope of this inquiry. Further research combining qualitative and quantitative methods in a mixed-method study, with large samples could yield more profound findings about different beliefs that impact the use of technology in the classroom. The creation of the 'ICT Pedagogical Beliefs Classification Framework' is a key addition to the literature. This framework provides a useful analytical lens for

capturing different aspects of teachers' ICT beliefs, which can result in constructive conversations to inform the layout of preparation programs and strategies that target exact areas of teachers' beliefs that may need to change, leading to more meaningful integration of technology in classrooms. However, additional research is needed to assess the applicability of this framework and refine it as an adaptable tool for examining teachers' specific beliefs across diverse education systems for change.

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Data Availability The datasets produced and analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflicts of interest No potential conflict of interest was reported by the author(s).

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