



Tensions between technology integration practices of teachers and ICT in education policy expectations: implications for change in teacher knowledge, beliefs and teaching practices

Emmanuel Ayisi Abedi¹

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Abstract

In line with ICT in education policies and curricula in Ghana and many other countries, teachers are expected to integrate digital technologies into instruction to facilitate meaningful and engaging student learning experiences. More research is however needed to investigate teachers' actual classroom practices with technology to determine whether these align with national ICT in education policies and curricula expectations. This qualitative study conducted phone interviews with twenty teachers from twelve schools and used a synthesised ICT pedagogy classification framework as a lens to investigate teachers' technology integration practices in relation to Ghana's ICT policies and curricula requirements. Following a thematic analysis procedure, the article finds that teachers mainly use technology conveniently for lesson preparation and direct instruction delivery, treating technology primarily as a productivity tool to support traditional teacher-centred teaching tasks. The use of technology for constructivist practices and fostering student-centred learning appears to be limited, which contradicts the priorities outlined in ICT in education policies and curricula in Ghana. The findings highlight a discrepancy between the requirements of ICT policies and the actual classroom practices of teachers. The implications of the findings are discussed, emphasising the need to action change in teachers' knowledge, beliefs, and teaching practices in order to bridge the gap and effectively translate ICT curricula and policy plans into actual teaching practices.

Keywords Pedagogical practices · ICT policy · Qualitative · Teachers · Technology integration

✉ Emmanuel Ayisi Abedi
emmanuel.abedi@griffithuni.edu.au

¹ School of Education and Professional Studies, Griffith University, Queensland, Australia

Introduction

This exploratory qualitative study seeks to examine whether elementary school teachers' common pedagogical practices with technologies accord with recommended practices and plans outlined in national ICT in education policies and curricula in Ghana. Many countries are increasing their investments in and demand for the use of technology in education, driven by the anticipation that its introduction into schools will catalyse educational reforms, pedagogical change, and improvements in the quality of student learning (Elstad, 2016; Vegas et al., 2019). Teachers, as the key policy implementers and change agents (Ertmer & Ottenbreit-Leftwich, 2010), are expected to promote constructivist practices that align with deep learning objectives through ICT use in the classroom (Alberola-Mulet et al., 2021).

Aligned with the shift in contemporary educational practices towards “new pedagogies” that prioritise deep learning objectives, teachers are expected to assume the role of facilitators, empowering students to exercise choice, self-regulation, and control over their learning experiences in conjunction with technology. This constructivist approach fosters knowledge construction, while nurturing the growth of collaborative, creative, critical thinking, higher-order cognitive skills, and problem-solving abilities in students (Fullan & Langworthy, 2014). The acquisition of these skills, enabled by constructivist practices with technology, is seen as essential for learners' active participation and competitiveness in today's digital, knowledge-based, creative, and interdependent world (Ertmer & Ottenbreit-Leftwich, 2013; Howland et al., 2012). Thus, technology used constructively as pedagogical tools, rather than solely to facilitate the transmission and consumption of knowledge, is vital for accelerating students' deep learning and enabling them to create and apply new knowledge in the modern world.

Ertmer and Ottenbreit-Leftwich (2013) referred to the type of integration that shifts the focus from technology itself to pedagogies that enable deeper students' learning with technology as ‘technology-enabled learning’. Despite the increased availability of technology in education, prior research (e.g., Bice & Tang, 2022) indicates that many teachers are not effectively using technology in ways that promote meaningful student-centred learning. This popular claim highlights the gap between the expectations of technology for technology-enabled learning and its actual implementation by teachers in the classroom. As Prestridge (2017) suggests, teachers often use technology to supplement existing teaching practices and for direct instruction delivery, rather than for fostering constructivist practices and new student-centred learning ways. The primary objective of this study is to investigate the use of technology in classroom practices, focusing on the relationship between ICT in education policy priorities and teachers' actual teaching practices and implementation in the educational context of Ghana.

Technology integration policy and curriculum in the Ghanaian context

Research has demonstrated that ICT in education policies and curricula play a significant role in shaping the integration of technology at the school and classroom levels. ICT policy documents provide a rationale, vision, and direction for incorporating technology into educational practices (Eickelmann, 2018; Trucano, 2016). These policies and curricula, in most cases, act as catalytic forces, guiding policymakers and educators in leveraging technology effectively to enhance teaching and learning experiences. The Ghanaian government recognises the importance of ICT in its pursuit of transitioning from an agrarian to an information and knowledge-based economy, as part of its broader socioeconomic development goals (Tsapali et al., 2021). This acknowledgment reflects the government's understanding of how ICT can contribute to various sectors, including education, for overall national progress. In pursuit of this national objective, multiple ICT in education policies and curricula reforms have been implemented over the years, with the common objective of encouraging teachers' use of technology as pedagogical tools to foster student-centred pedagogy and equip learners to confidently and creatively use technology resources to develop the requisite skills and knowledge needed to be active participants in the national and global knowledge economy (Ministry of Education [MoE], 2015; 2018). Policies, such as the maiden 2003 Ghana ICT for Accelerated Development Policy (ICT4AD) and the 2008 draft and 2015 ICT in Education Policies, highlight the value of teacher preparation with a particular focus on pedagogy to foster meaningful student learning outcomes with technology in classrooms. The current elementary school curriculum equally requires teachers to 'shift' from teacher-centred towards student-centred pedagogies. In alignment with these policies and curriculum plans, teachers in Ghana are encouraged to leverage digital technology to enhance learners' collaborative, creative, problem-solving, and digital skills, while also aiming to reduce the prevalence of teacher-directed instructional approaches commonly observed in schools (MoE, 2018). The national ICT policy and curriculum documents underline the importance of integrating technology in a way that promotes meaningful learning experiences, rather than simply adding technology to existing teaching practices. This expectation underscores policymakers intent to shift towards pedagogies that advance active learner engagement and student-centred learning with the support of technology in the classroom.

According to Abdullahi and Othman (2020), little is often known about policy contents and their translation into actions. Similarly, the implementation of proposed ICT policies and curricula plans and teachers' actual use of technology in classrooms are not well perused or understood in Ghana. While there is a growing body of research on technology integration in Ghana (e.g., Arkorful et al., 2021; Amanor-Mfoafo, Edonu, Akrofi & Dowuona, 2020; Buabeng-Andoh & Yidana, 2015; Buabeng-Andoh, 2019), many of these studies do not focus on examining ICT policies and curricula expectations in relation to the technology integration practices of teachers. There is a dearth of in-depth understanding regarding how teachers are actually incorporating technology into instructional practices. Tsapali et al. (2021) scanned Ghana's educational technology research landscape and found that

many existing studies focus on technology integration attitudes, training of teachers and enactment challenges, particularly infrastructure issues. It remains unclear whether Ghana's ICT in education policy plans and teachers' classroom practices connect or are aligned as expected. This study aims to address the lack of research and bridge this gap in Ghana's research context by exploring the nature of technology integration practices from teachers' perspectives in elementary schools. To improve teachers' practice and foster synergy with policy requirements, it is essential to gain deeper insights into the specific characteristics of classroom technology integration practices and examine their alignment with the objectives outlined in existing ICT in education policies and curricula (Kozma & Vota, 2014; Wang et al., 2022). Hence, this study investigates the research question: *What are the technology integration practices of Ghana's school teachers, and how do these practices relate to the requirements of the national ICT in education policies and curriculum?*

Pedagogical practices with technology

McKnight et al. (2016) define pedagogical practice with technology as the actual ways in which teachers use technology in the classroom. Research in this area highlights the existence of various pedagogical uses of technology, which are often classified under the broad categories of traditional and constructivist-based pedagogies (Tondeur, 2020). These broad classifications provide a simplified framework to understand how technology is integrated into teaching and learning processes, with traditional pedagogies emphasizing teacher-centred instruction and constructivist-based pedagogies focusing on student-centred, interactive, and inquiry-based approaches. Traditional-based pedagogy is associated with learning *from* and *about* ICT. It is synonymous with behaviourist and teacher-centred pedagogical beliefs about teaching and learning (Ertmer et al., 2015; Ringstaff & Kelley, 2002). Traditional pedagogy emphasises teachers' explanations and the direct transmission of information to students for intended knowledge acquisition. Students typically play passive roles in the teaching and learning process as information recipients, primarily reading, listening, and memorising facts to acquire targeted knowledge (Ertmer et al., 2012). The emphasis is on technology, which is often used as an instruction delivery tool and as "tutors" to teach basic technical skills, mostly in isolation, for students to learn how to use a particular technology as an end in itself and for employment purposes (Ringstaff & Kelley, 2002). It entails using technology for ICT skill acquisition and improving existing traditional instructional processes than foster learner-centred learning (Li, Garza, Keicher & Popov, 2019). Bigum (2012) described this form of pedagogy as "domesticating" the computer, whereby technologies are made to adapt to the requirements of the curriculum rather than change teachers' pedagogic practice and improve student learning. Prestridge (2017) characterised this as the "adding-on" of technology to established teaching practices. Ertmer and Ottenbreit-Leftwich (2013) noted that such traditional pedagogy often results in 'low-level' ICT use that may be inadequate to meet the contemporary needs of 21st-century learners.

Constructivist-based pedagogy with technology is distinguished by a student-centred view of teaching and learning, currently advocated for 21st-century technology-enabled learning to meet students' interests and needs (Orlando, 2013). In contrast to passively receiving information from teachers in traditional pedagogy, students in constructivist classrooms actively engage in learning *with* technologies as cognitive amplification tools and intellectual partners in authentic and collaborative learning settings to facilitate knowledge construction, which can help them develop higher-order thinking, collaborative, creative, and problem-solving skills (Ertmer et al., 2015; Ringstaff & Kelley, 2002). Within constructive pedagogy, there is a strong emphasis on teacher-student and student-student collaboration, allowing for the co-construction of knowledge (Orlando, 2013). According to Ringstaff and Kelley (2002, p. 9), "technology is used as a learning tool, and teachers and students (not the technology) control the curriculum and instruction". Meaningful learning is a possible outcome of this new paradigm of learning with technology (Howland et al., 2012; Jonassen, 2003). Five key attributes associated with constructivist pedagogical use of technology include active inquiry, construction, authenticity, intentionality, and collaboration.

Research shows that learning *with* technologies in constructivist pedagogical settings could be more effective in promoting better and deep student learning than traditional, behaviourist-inclined pedagogies that facilitate knowledge delivery and consumption, with the use of technology as an 'authoring' or 'information presentation' tool. Ertmer et al. (2015) and Hermans et al. (2008) claimed that teachers who embrace constructivist pedagogic principles tend to use technology to facilitate the development of students' higher-order thinking, problem-solving skills, and other essential competencies required in the twenty-first century. Jonassen (2003) argued that technology should be used in a constructive manner, serving as knowledge construction and mindtools. In this approach, learners are actively engaged in designing, reflecting upon, interpreting, and organizing their personal knowledge related to the subject matter, rather than technology being used solely for information dissemination and basic skill instruction in a traditionalist context.

Classifying technology integration practices of teachers

Researchers have approached the characterisation of teachers' pedagogical practices with technology from various perspectives and multifaceted ways within the broader spectrum of traditional and constructivist pedagogy. Notable among these researchers are Tondeur et al. (2007), who identified a three-factor structure that describes teachers' actual use of technology in education: (1) using a computer as an information tool (to research and process information), (2) using a computer as a learning tool (to practice knowledge and skills), and (3) using a computer to learn basic computer skills (technological competency). Another framework proposed by Donnelly et al. (2011) classified teachers' technology integration practices into four broad categories: (1) contented traditionalist, which involves using technology alongside traditional teaching practices, (2) selective adopter, where technology is used to enhance assessment outcomes within the existing curriculum, (3) creative

adapter, which emphasises student-centred teaching and meaningful learning facilitated by technology, and (4) inadvertent user, where technology use by teachers is driven by school requirement for student-centred instruction. Inan and Lowther (2010) grouped teachers' use of technology into three categories: (1) technology for instructional preparation, involving the use of technology for preparing instructional materials, locating digital resources and creating lesson plans (2) technology for instructional delivery, which entails both teachers' and students' use of technology to present information and engage in instructional simulations, and (3) technology as a learning tool for students to enhance their problem-solving abilities, communication, and collaboration with peers. Twining (2008) proposed a Computer Practice Framework that classified teachers' use of ICT into three forms: (1) information technology, focusing on using computers to help children develop ICT skills, (2) learning tool, where computers are used to support various aspects of children's learning beyond the technology itself, and (3) other, encompassing the use of computer in a manner that is not covered by information technology or as a learning tool.

Four common categories of pedagogical practices with technology could be identified based on the preceding literature review of different but aligned technology integration practices of teachers. Primarily drawing from Inan and Lowther's (2010) classification, the four categories of integration practices identified include: (1) students' learning of basic computer skills, (2) instructional preparation and presentation, (3) learning tool to improve student learning, and (4) creative use for meaningful student-centred learning. Although Inan and Lowther (2010) treated instructional preparation and presentation as separate categories, they are combined here as one category since both practices involve using technology to enhance the productivity of traditional teaching practices-instructional preparation and presentation. Building upon these synthesised categories, a classification framework is constructed to classify the varying levels of teachers' technology integration practices within the continuum of traditional (teacher-centred), mix-balanced (teacher-centred and student-centred elements) and constructivist (student-centred) pedagogical orientations. This multidimensional framework, presented in Table 1, serves as an analytical lens for classifying the ways teachers in Ghana use technology in the classroom.

The synthesis of the literature to develop the 'ICT pedagogical practices classification framework' for categorising teachers' technology integration practices is a significant theoretical contribution of this study. Instead of a rigid categorisation between teacher-centred and student-centred pedagogies, researchers are often encouraged to adopt a multidimensional approach that considers the various positions along the traditionalist-constructivist continuum when classifying

Table 1 ICT Pedagogical practices classification framework

Pedagogical Practices with Technology	Students' learning of basic computer skills	Instructional preparation and presentations	Learning tool to improve students learning	Creative tech use for meaningful student-centred learning
Type of pedagogy	Traditional/Teacher-centred		Mix-balanced	Constructivist/Student-centred

teachers' ICT practices (Ertmer et al., 2015; Prestridge & de Aldama, 2016; Tondeur, 2020). This classification framework can be valuable in identifying diverse ICT practices and can provide appreciated insights that can inform the design of targeted professional development programs aimed at transforming teachers' beliefs, knowledge, and practices in alignment with ICT policy and curricula expectations.

Methodology

This exploratory research used an inductive and interpretive qualitative study approach to investigate teachers' pedagogical practices with technology in elementary schools in Ghana. The main objective of this study was to examine the role of technology in teachers' classroom practices and assess its alignment with ICT policies and curricula. Given the focus on teachers' perceptions of practices, a qualitative methodology was considered appropriate for addressing the research question (Bryman, 2016). The study employed an exploratory qualitative design, which typically involves small sample sizes and serves as a pilot for larger studies. This research design seeks to conduct in-depth investigations of contemporary phenomena within their natural settings, particularly in cases when there is limited existing research on the topic at hand or subject matter (Yin, 2017).

Participants and data collection methods

A sample of twenty elementary school teachers from twelve different schools across two educational districts in Ghana's Eastern region participated in the study. These districts, namely Nsawam-Adoagyiri Municipality and Fanteakwa-North District, were selected from the 260 metropolitan, municipal, and local district areas in the country using a non-probability purposive sampling method, without specific criteria for selection (Bryman, 2016). The selection of these two districts was based on their accessibility and the availability of participants within the researcher's reach, as travel to the field was hindered by COVID-19 travel restrictions. Importantly, the selection of these districts was not intended for comparison purposes but rather to include a diverse range of contexts and perspectives, allowing for a comprehensive exploration, and understanding of the study phenomenon.

The study employed purposeful sampling to select teacher participants from the targeted districts who were expected to provide valuable insights into the research question. Due to travel restrictions caused by COVID-19, the recruitment process combined purposeful sampling with the snowball sampling approach. Using the snowball sampling technique, the researcher initially identified a small group of individuals relevant to the study through personal contacts in Ghana. These individuals then recommended other potential participants who possessed the relevant experience and applicable characteristics. The researcher was unable to travel to Ghana to identify and recruit participants due to COVID-19 travel restrictions and school closures during the data collection period, necessitating the use of the snowball sampling. Five teachers were chosen from three schools in the Fanteakwa-North

District. The majority of teachers were from Nsawam-Adoagyiri Municipality, where 15 teachers were selected from nine schools.

The selected teachers for this study were chosen from diverse backgrounds, encompassing various age groups, teaching experience levels, and classroom settings with different class sizes. Among the participants, 75% ($n=15$) were male, while only 25% ($n=5$) were female. The majority of teachers, accounting for 55% ($n=11$), fell within the age range of 30 to 34, while the youngest teachers were between 20 and 24 years old. Four teachers had accumulated 10 to 12 years of teaching experience, with the least experienced teacher having two years of experience. All teachers held at least a Diploma in Basic Education. Among the participants, 11 taught in rural schools, while nine taught in urban schools. The selected teachers were engaged in teaching at both primary and junior high school levels, incorporating technology into their instructional practices. Pseudonyms were assigned to each teacher participant to ensure the protection of their identity and anonymity.

Semi-structured interviews served as the primary research instrument for gathering in-depth insights into individual teachers' perceptions and experiences regarding their use of technology in the classroom. Interviews as primary method of data collection can provide a wealth of information about how people perceive situations based on their perceptions and experiences, as well as the meanings they attribute to those experiences (Brinkmann & Kvale, 2018). A flexible interview schedule was developed based on the research question, focusing on two main topics: (1) the role of technology in teachers' classrooms and (2) the pedagogical approaches adopted by teachers for technology integration. The interviews were conducted remotely over the phone and the Internet. Internet-mediated research tools are becoming increasingly common in qualitative research due to the widespread availability of smartphones and internet connectivity in daily life (Saarijärvi & Bratt, 2021). Prior to the interviews, participants were fully informed about the study's purpose and provided their voluntary informed consent to participate and be recorded. The interviews lasted about 50 min, during which no personally identifiable information was recorded.

Data analysis

Data analysis methods, such as thematic analysis, are commonly used to analyse qualitative data and identify emerging themes and patterns from participants' perspectives on a subject matter. Thematic analysis, which relies heavily on interpretation and is a highly flexible method, is well-suited for studies seeking to explore the meanings and interpretations attributed by participants to their experiences (Clarke & Braun, 2013). In this study, the qualitative responses were first familiarised with through iterative reading, and then coded by sorting and grouping together similar ideas, phrases, and patterns. This process facilitated the emergence of initial dominant categories and themes that were relevant to the research question. These initial themes about teachers' ICT practices were then compared to identify commonalities and differences, providing a thorough understanding of the research topic.

The analysis of data followed Clarke and Braun's (2013) six-step process of doing thematic analysis. The sequence of analysis entailed: (1) data familiarisation, (2) initial code generation, (3) preliminary themes generation, (4) theme revision and review, (5) theme definition and naming, and (6) report writing. Braun and Clarke's six-phase thematic analysis provided a systematic and rigorous approach to uncovering and analysing themes within the interviews, allowing the researcher to generate meaningful findings relating to teachers' technology integration practices in the classroom and their alignment with ICT policy plans and curricula expectations.

In brief, the interview data were coded and thematically analysed in two broad steps. In the first phase, four themes relating to teachers' technology integration practices were inductively generated. Following this initial analysis, the "ICT pedagogical practices classification framework" (Table 1) was used as a lens in the second phase of the analysis. This framework was applied to the emergent preliminary themes to interpret and classify the identified practices, shedding light on the diverse ways in which teachers use technology in their classrooms. The aim was to gain a deeper understanding of the nature of teachers' pedagogical practices along the continuum of traditionalist (teacher-centred) and constructivist (student-centred) pedagogy. Gaining insight into the different prevalent practices of teachers facilitated discussions about their potential relationships and alignment with the expected ICT policies and curricula provisions in Ghana.

Research findings

This section details the four major themes pertaining to teachers' technology integration practices in Ghana's context.

Lesson presentation and demonstration

The use of technologies such as computers, projectors, and smartphones for direct lesson presentation and demonstration emerged as teachers' most dominant practices with technology. The majority of teachers ($n = 14$) reported that they regularly incorporate technology into subjects such as history, creative arts, mathematics, English, and science. They use technology to display instructional content and present lessons in digital formats, aiming to make the learning experiences more relevant and engaging for students. Teachers prioritise using technology as a presentation tool to facilitate a shift from theoretical to practical instruction, thereby enhancing students' understanding. Abena and Richard provided specific examples of how teachers embrace technology to deliver content and provide practical illustrations of abstract concepts:

We [teacher and students] talked about some females in Ghana who have contributed to nation-building. The students had heard most of their names but had yet to see these past personalities in photographs or videos. So, after teaching, I looked up pictures of these people on my phone and showed them to the

students for a description. The learners were happy seeing the pictures of the discussed personalities and wanted more on the topic. (Abena)

I recently used ICT in my creative arts lesson when I was teaching about cultural dances. The learners at first were not getting the concept very well when only the textbook and history about the dance were explained to them. I used my laptop to download some videos of these dances and played them to the learners. When this was done, the learners became very happy and were able to relate to the subject taught better than the first time. (Richard)

These excerpts highlight that teachers employ technology, particularly mobile phones, to showcase information and generate digital representations of their teaching content. They enhance abstract instruction by incorporating internet-downloaded images and videos to make lessons more relevant and understandable for students who may not have experienced the subject matter in real life. Additionally, it was observed that certain teachers use technology as a means to demonstrate instructional practices that students can learn from. Kofi, a mathematics instructor, exemplified how he uses technology to model classroom tasks for students to observe and subsequently practice. “When I want them [students] to know how to use technology to calculate something, I first demonstrate it to them using my calculator or computer, then I let them do it themselves afterwards” (Kofi).

Teacher Luke expressed that the presentation of lessons and demonstration practices with technology tends to be more teacher-centred. He highlighted that due to the limited availability of computers, students rarely have the chance to use or practice with these tools.

It is more of the teacher doing almost everything. [This is] because the children [students] do not have access to a lot of the ICT tools to manipulate with on their own. So most often, the teacher has to do it for them before they see what is going on...When it comes to using the mobile phone, most often the teacher has already downloaded the information that he wants the [students] to see or know about. So, it is just a matter of playing the video, or the audio or showing the pictures on the phone to the children...(Luke)

Research for lesson plan preparation

Twelve of the teacher participants highlighted the significant pedagogical practice of using technology to conduct research on the Internet for lesson preparation and instructional material development. They explained that this practice involves employing technology as a research tool to access up-to-date information and instructional resources, enhancing the quality and depth of classroom instruction. The excerpts from Richard and Desmond exemplify teachers' common use of the Internet to access current subject content, thereby improving lesson preparation and enriching the subject matter they present to students.

I use my phone a lot to prepare for a lesson, such as looking up definitions on the Internet or figuring out how to teach a specific topic. I do this because I always want to have the most current information about what I will be teach-

ing, as we cannot always rely on the old definitions in the textbooks we use. So, most of the time, when I am teaching in class, I just Google and find some new definitions and examples to enrich the topic. (Richard)

To have updated information about a particular subject, I research on the Internet before teaching. Regarding a topic such as “tourism in Ghana,” the textbook still lists the previous ten regions. It has not been updated to reflect the current 16 regions. So, you cannot rely on the textbook alone to teach. So, we research on the phone or laptop to get updated images of the regional maps before showing them to the children. (Desmond)

It is evident that teachers use technology to conduct research and gather information from the Internet, enabling them to prepare comprehensive lesson notes and deliver contemporary subject materials and real-world examples to students. Desmond’s remarks suggest that the primary motivation behind this practice is the necessity to acquire up-to-date instructional content, particularly because the majority of teachers have limited access to such content within traditional textbooks.

Students’ collaborative learning and group instruction

Eight teachers in the study acknowledged the use of technology to facilitate collaborative learning and group instruction among students as another common practice. Typically, teachers would divide students into small groups, allowing them to collaboratively work on assigned instructional tasks using technological tools. This practice also involved grouping students together to engage in discussions related to instructional videos and images presented by the teachers to illustrate lessons. Ronny’s remarks suggest that teachers employ technology to promote students’ collaborative learning and active engagement in the teaching process, often driven by the limited availability of ICT tools for student use.

We do not have enough ICT tools, so when I teach with technology, I usually group students and demonstrate to them what I am teaching. When I taught the students how to create email addresses, they did so in groups on my computer. Because they all work together on the computer, what I do with technology is more collaborative. (Ronny)

Abena shared her intentional promotion of student collaboration through the use of technology, aiming for students to share ideas and learn from one another. According to her, students actively engage and display enthusiasm as they work and learn collaboratively.

In addition to using it [technology] to present information in class, I also use it for students’ group work. The collaborative aspect [with technology] comes in when learners are to complete a task in groups. Let’s say when they [students] are to create a folder or do some calculations on the computer; they do it collaboratively and share ideas as a group. They feel excited when they work together to achieve a goal which is remarkably interesting. So, it is not just to present information as always coming from the teacher. (Abena)

Desmond, an ICT subject teacher, explained how he integrates technology into his teaching to encourage student participation and promote student-centred learning through group instructional approaches. Additionally, the limited availability of technological resources compared to the number of students often leads teachers to group students when using computers for instructional purposes.

I was teaching 'emailing', which is an ICT topic. Previously, I was only teaching theoretically on the whiteboard with no practicals, making it difficult for students to understand. Now by using the projector and a computer, I call groups of students (about four each) to my desk for practicals because of the limited computers, which can't serve all the students. So, as I go through the steps of opening email on my laptop with these selected students, their colleagues will be watching their desks on the projector. This occurs after we have completed the theory part on the whiteboard. This makes my teaching student-oriented, as students are engaged in the teaching and learning process. (Desmond)

Examination preparation and homework assignment

A small number of participants mentioned that teachers use technology for assigning homework and for other administrative purposes. According to five teachers, assigning technology-based assignments to students helps them develop basic technical skills in ICT. The teachers also noted that technology is used administratively for tasks such as preparing exam questions, recording, and monitoring students' academic performance. Ronny and Sly provided examples of how they employ technology to support administrative duties and promote students' acquisition of digital skills through home assignments.

I occasionally assign homework to students through the Internet. I was teaching email at the time, and after showing students how to set up an email account, I took their email addresses and sent them assignments. The following day, I projected my email account in class and discussed the email assignment with the students. They [students] learned how to send and respond to email messages because of this. (Ronny)

Aside from using ICT to teach, I use it administratively to prepare examination questions for students. I sometimes also give students an exercise or assignment, and they complete it on the computer. I use ICT to record and keep track of students' academic performances. (Sly)

The excerpts above highlight the significant role of technology in both students' homework assignments and teachers' administrative tasks. Teachers use technology as an administrative tool to streamline routine schooling practices, including preparing test questions and recording students' academic performances. Technology is integrated into students' home assignments to promote self-directed learning and assist students in acquiring essential digital literacy skills.

Discussion

The main objective of the study was to examine the integration of technology in Ghanaian classrooms and determine the extent to which teachers’ practices align with the existing national ICT in Education policy and curriculum objectives. The findings detailed four main categories of teachers’ technology integration practices: (1) lesson presentation and demonstration, (2) research for lesson plan preparation, (3) students’ collaborative and group instruction, and (4) examination preparation and student homework assignment. The predominant practices among teachers, as depicted by the blue border lines in Table 2, include the use of technology for lesson preparation, presentations, and assigning homework to students to develop their computer skills. The teachers’ technology integration practices are examined and discussed in relation to the ICT pedagogy classification framework derived from the literature review, as well as the expectations outlined in Ghana’s ICT in education policies and curricula.

The nature of the common pedagogical practices identified suggests that the teachers appreciate the use of technology as a productivity tool to improve the efficiency of routine traditional classroom activities. The teachers view technology as a means to increase classroom productivity and streamline teaching practices. In traditionalist environments, teachers tend to use technology as a means to deliver or present information to students, focusing on transmitting intended knowledge rather than engaging students in transformative and constructivist instruction that foster deep learning. The focus is on using technology as a tool for one-way communication, rather than facilitating interactive and participatory student learning experiences. Students in traditionalist environments tend to assume passive roles as listeners and receivers of information, with limited opportunities to actively engage with technologies and construct their own knowledge. In most instances, technology is used as ‘tutors’ to teach students basic technical skills (Ertmer et al., 2012; Ringstaff & Kelley, 2002), as this study also found in teachers’ practices. The teachers in this study held a positive perception of traditional teaching practices enhanced by technology and considered them as the most effective approach to integrating technology into instruction and enhancing student learning. Their integration of technology corresponds to the concept of “contented traditionalists” as described by Donnelly et al. (2011), where technology is predominantly used to support and complement

Table 2 Pedagogical practices with technology

Pedagogical practices with technology	Students learning of basic computer skills	Instructional preparation and presentations	Learning tool to improve students learning	Creative use for meaningful student-centred learning
Thematic findings from data	- assign homework involving technologies to develop students’ ICT skills	-Lesson preparation -Lesson presentation	-Students’ Collaborative learning and Group Instruction	
Type of pedagogy	Traditional/Teacher-centred		Mix-balanced	Constructivist/student-centred

traditional classroom practices, such as lesson preparation and direct instruction delivery. This finding coheres with a study conducted in the United States by Palak and Walls (2009), which revealed that the majority of teachers frequently used technology for lesson preparation but did not extensively support student-centred practices. This study and the findings of Palak and Walls (2009) both indicate a prevalent pattern of teachers' use of technology focused on streamlining traditional teaching practices rather than promoting student-centred learning experiences.

There was little evidence in the findings of this study to suggest that teachers actively engage students to use technologies to construct their own knowledge and understanding. As shown in Table 2, in the boxes outside the blue border lines, there were minimal responses suggesting teachers' integration of technology to encourage students' active participation in instruction and collaborative learning with peers. Students have limited involvement in the instructional process and lack the opportunities for independent and collaborative learning when technology is integrated by teachers in the classroom. In the few instances where technology is used as a learning tool, some teachers reported providing mobile phones and computers to small groups of students to learn with. This allowed students to interact and collaborate with peers while completing shared learning tasks with supervision. Ertmer et al. (2012) and Prestridge and de Aldama (2016) described this kind of practice as enriching the existing curriculum and a mix-balance approach of student-centred and teacher-centred pedagogies with technology. This pedagogic practice, according to Inan and Lowther (2010), constitutes the use of technology as a learning tool to extend student learning. In the classification framework in Table 2, findings of teachers' use of technology for students' collaborative learning are classified under the use of technology as a 'learning tool to improve student learning' and a 'mix-balanced pedagogy'. The study's findings revealed a lack of evidence indicating that teachers engage in entirely learner-directed pedagogic practices focused on students' creative use of technology for knowledge construction and meaningful learning, hence the absence of any data under the 'constructivist/student-centred' type of pedagogy in the classification framework. The majority of teachers' responses indicated that the scarcity of ICT tools in schools somewhat hinder teachers from directly involving students in technology use for constructivist and deep learning experiences.

Overall, the findings as represented in Table 2 show that the teachers in this study appreciate and seem to enthusiastically use technology as a productivity tool to supplement existing classroom practices rather than as "creative adapters". Ertmer and Ottenbreit-Leftwich (2013) consider the latter type of constructivist pedagogy, which seeks to change the learning ways of students and improve personal knowledge construction, as the best practice goal of technology integration to foster students' higher-order thinking and problem-solving skills for effective functioning in the modern world. As Jonassen et al. (1998) and Ringstaff and Kelley (2002) earlier stated, technology should be used in schools as knowledge construction tools that students learn 'with', not traditionally as productivity tools to learn 'from'. This study also aimed to determine the synergy between teachers' technology integration practices and the expectations defined in Ghana's ICT in education policies and curricula. By examining the actual classroom practices of teachers and comparing

them with the objectives set forth in the ICT policies, the study sought to identify any gaps or discrepancies that may exist. A few of the findings about teachers' practices (i.e., use of technology to engage students in authentic instruction and collaborative learning) seem to be in line with the ICT policy goal of using 'ICT as a learning and operating tool', which has constructivist elements. However, the largely productivity-oriented technology integration practices of most teachers, such as lesson preparation and presentation appear to contradict the core objectives of Ghana's ICT in education policy, which aims to encourage the integration of technology into instruction as a pedagogical tool for student-centred learning (MoE, 2015). Equally, most teachers' technology integration into traditional practices do not mirror the current curriculum's primary expectations for teachers to use technology for a meaningful 'shift' away from teacher-centred to student-centred pedagogy to improve learners' creativity and problem-solving skills (MoE, 2018).

The findings of the study indicate that there is a misalignment between Ghana's ICT in education policies and curriculum objectives and the actual technology integration practices of teachers at the local school or classroom level. It appears that the majority of teachers are not integrating technology in a manner that reflects the core objectives outlined in the ICT policies and curriculum. Findings of these disparities corroborate the World Bank's Knowledge Maps study findings about the gap that usually exists between ICT in education policy goals and actual classroom practices of teachers (Moonen, 2008; Trucano, 2016). In line with this study's findings, the World Bank study argued that while much of the discourse and rationale for introducing technology in education, particularly in developing countries, focuses on its potential to transform pedagogy and improve student learning, in reality, technology is commonly integrated by teachers to supplement existing traditional teaching practices. These findings cohere with Orlando's (2013) and Fullan and Langworthy's (2014) claims that, despite policymakers' justification for ICT to transform pedagogy, teachers mainly incorporate ICT into known ways to reinforce traditional schooling practices, a phenomenon Bigum (2012) described as "domesticating the computer". The study findings largely resonate with that of these studies, denoting that ICT is rarely used to support the learning process of students, as opposed to augmenting traditional teaching methods and skill-based ICT use. This study, hence, supports the claim that the prospects of technology as a pedagogic change agent for student-centred learning in many ICT in education policies are rarely realised in the actual classroom practices of teachers.

Conclusions and implications

This study sought to explore the actual practices of teachers when using technology in the classroom and assess whether these practices align with the expectations outlined in the local ICT curriculum and policy plans in Ghana. The study focused on examining the extent to which teachers' technology integration practices reflect constructivist principles, which emphasize student control, self-regulation, and collaborative learning for meaningful knowledge construction. This investigation was carried out in light of the prevalent emphasis on these expectations in national ICT

in education policies, including that of Ghana. Based on the application of the multidimensional ICT pedagogical practice classification framework, this study revealed that the predominant use of technology by teachers aligns more with a teacher-centred or traditional pedagogical approach. Teachers primarily employ technology as a resource for accessing information and as a tool for creating instructional materials, aiming to enhance their own teaching productivity and support students in acquiring basic technical ICT skills. There is limited evidence of teachers engaging students actively with technology for personal knowledge creation. This finding suggests the integration of technology to foster students' new learning ways and knowledge construction development is relatively less emphasised by teachers in their teaching practices with technology. Meaning, teachers typically adopt more learning *from* ICT approach with snippets of learning *with* ICT methods when integrating technology in Ghana's classrooms.

Although some teachers' actions and practices appear very much aligned with policy, with constructivist aspects, findings of the predominant productivity-inclined practices appear to be at odds with the aspirations and objectives of the Basic school curriculum framework (MoE, 2018) and ICT in Education Policy (MoE, 2015) in Ghana. These policy documents expect teachers to receive capacity building with a particular focus on pedagogy and to adopt technology as pedagogical tools in daily teaching activities to enhance learners' creativity and problem-solving skills. This study's finding reinforces the claim that the prospects of technology as a pedagogic change agent for student-centred learning in governments' ICT in education policies and curricula are rarely realised in actual classroom practices of teachers, which are mainly traditional, and support established teacher-centred teaching tasks. The findings further resonate with some researchers' claims (e.g., Van de Kuilen et al., 2019; Wang et al., 2022) that translating policy plans into practices that promote effective student learning is often complex for many educational establishments and classroom teachers. Based on the findings of this study, it can be argued that the aspirations of national educational policymakers to transform learning through the use of technologies do not necessarily lead to immediate changes in teachers' teaching practices. The study suggests that there is often a gap between policy intentions and the actual classroom practices of teachers when it comes to technology integration.

The findings about the disparity between teachers' practices and ICT policy plans evoke concerns and suggest implications in relation to how ICT policy priorities by Ghana's policymakers might best be implemented in schools to promote constructive practices as expected. To narrow the gap between policy aspirations and teachers' practice, there is a need for teacher education and professional development programs that trigger teacher change, mainly in their pedagogical reasoning, beliefs, and values to understand the pedagogical benefits of using technology for student-centred learning beyond integration in established traditional practices. Teachers may hold preconceived notions and beliefs about the use of technology in the classroom, which can impede their inclination to enact new practices. Also significant for bridging the gap and fostering synergy, is the need for change in teachers' knowledge, not just in terms of the contribution of technology for ICT skill development but also its pedagogical potential to enrich the curriculum and extend

student learning ways. Following Ertmer and Ottenbreit-Leftwich's (2010) suggestion, Ghana's teachers' mindset, beliefs, knowledge, and culture ought to change to embrace the belief that teaching is less effective without the pedagogical use of technology to facilitate more effective student-centred learning.

Furthermore, promoting a decentralised approach to ICT policy formulation that is responsive to teachers' perspectives, constraints, and local practices through dialogue is fundamental to foster the required use of technology in the classroom. This decentralised approach contrasts with a unidirectional process that demands teachers to unilaterally accept and implement policy and curricula plans without any input. Local measures, such as information and awareness campaigns showcasing expected practices of effective ICT use in schools, along with the enactment of school-based ICT plans that align with national ICT policy objectives, could also be crucial in fostering alignment between teachers' practice and ICT policy plans. These suggestions, coupled with sufficient ICT resources in schools, have the potential to support teachers in implementing classroom practices that align with the expectations for meaningful student-centred learning.

Although the findings of this study are specific to Ghana's school teachers and may not be directly transferable to other countries, the disparities identified between national ICT policies and curricula, and teachers' actual practices with technologies are not unique to Ghana's context. While acknowledging the possibility of contextual differences, the core strategies highlighted in this study as suggestions can also inform discussions and initiatives in other countries, helping them to address the discrepancies that may exist between ICT policy aspirations and actual teaching practices. By drawing upon the lessons learned from this study, educators, and policymakers from around the world grappling with similar disparities, can adapt the strategies discussed and work towards creating more meaningful and impactful technology integration in education, ultimately benefiting students learning and development of modern competencies.

Limitations and suggestions for future research

The first limitation is the sample size, which may impact the transferability of results to a larger population. Even though a sufficient sample ($n=20$) of teachers participated in the study, they cannot be considered representative of the entire population of elementary school teachers in Ghana. Thus, the findings may be limited and not apply to teachers in other regions of the country. Future research could use quantitative surveys with larger samples of teachers from multiple school districts in Ghana to potentially achieve more universally applicable and enlightening findings. The second limitation is that this study relied solely on teachers' self-reported perspectives due to the researcher's inability to incorporate field observation data due to travel restrictions at the time of data collection. Self-reporting methods can offer valid and reliable data collection tools in technology integration (Christensen & Knezek, 2008). However, researchers like Lawless and Pellegrino (2007) claim that these methods could be problematic, particularly for teachers' technology use practices. They argued that self-reported data often reflects personal convictions

and social preferences, which may contain prejudices. Future research may expand the scope of research methods beyond self-reported data to include on-site classroom observations to accurately explore and understand at firsthand, teachers' actual practices in relation to ICT policies and curricula intents. Further research into the motivations and drivers behind teachers' adoption of specific technology integration practices is also required. Understanding the factors that influence teachers' choice of practices can provide valuable insights into their decision-making processes as well as the conditions that facilitate or hinder the enactment of constructivist pedagogy that is expected in many ICT in education policies and curricula. This research knowledge can be used to develop targeted interventions and policies to help teachers integrate technology in ways that foster synergy between ICT policies and teaching practices to improve student learning outcomes.

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Declarations

Conflict of interest No potential conflict of interest was reported by the author.

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Abedi Emmanuel Ayisi, PhD obtained his doctorate degree from the School of Education and Professional Studies at Griffith University, Brisbane, Australia. His doctoral thesis conceptualised the relationship between technology professional development programs and teachers' pedagogical beliefs and teaching practices with technology. Emmanuel's research interests revolve around technology professional development and training, education policy, and digital pedagogies.