Journal of
Education and Practice
(JEP)

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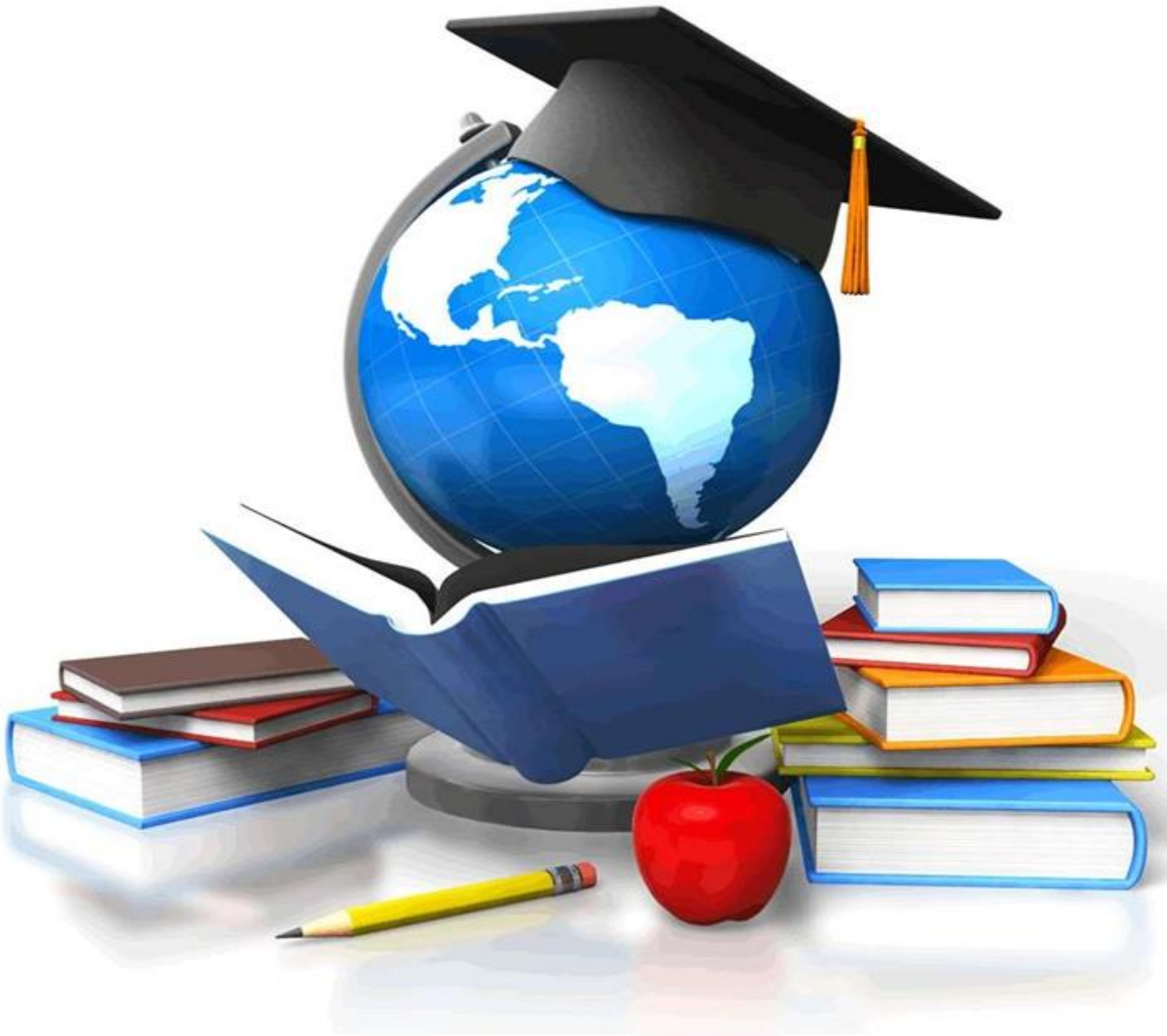

CARI Journal

Journal of Education and Practice
ISSN 2520-467X (Online)
Vol. 10, Issue No. 5, pp. 1 - 19, 2026
www.carijournals.org

Teachers' Use of Digital Tools in Kindergarten Centers in Asunafo North Municipality: A Qualitative Inquiry

Jane-Frances Yirdong Lobnibe[1], Titus Kpiero-Zuomeh Dery[2*], Issah Susorokana Ismail[3]

[1]School of Education and Lifelong Learning
University of Business and Integrated Development Studies-Wa
[2]Department of Special Education,
University of Education, Winneba, Ghana
https://orcid.org/0009-0006-2874-3246
[3]Department of Early Childhood Education
University of Education, Winneba, Ghana

Accepted: 5th April, 2026, Received in Revised Form: 20th April, 2026, Published: 7th May, 2026

Abstract

Purpose: This current study sought to investigate the perspectives of kindergarten teachers on the application of digital tools in early childhood education in the Asunafo North Municipality in Ghana.

Methodology: Using the qualitative research methodology, this investigation employed the phenomenological design. It employed the purposive sampling technique to select eleven kindergarten teachers based on their teaching experience, accessibility, and active involvement in early childhood education. The data collection was conducted through in-depth semi-structured interviews, which allowed respondents to provide rich, detailed accounts of their experiences. The data was analyzed using thematic analysis, which involves coding and categorization of data to identify recurring patterns and themes in the data collected.

Findings: The findings of this research revealed that teachers generally acknowledge the pedagogical value of digital technologies in promoting learner engagement, creativity, and basic digital literacy for young learners. However, this research identified a number of significant barriers to the integration of digital technologies in kindergarten classrooms. The barriers identified include a lack of functional digital devices, technological infrastructure, professional development, and electricity supply/internet connectivity. Consequently, while there was an indication of teachers' awareness of the importance of digital tools, their ability to utilize technology-enhanced pedagogical practices remained significantly low.

Unique Contribution to Theory, Policy and Practice: The study contributes to theory by expanding understanding of technology integration in early childhood education in resource-constrained contexts, especially in relation to the phenomenological approach to understanding teachers' experiences. From a policy point of view, the study emphasizes the need to invest in technology infrastructure and design context-specific ICT policies, especially in early childhood education in Ghana. In practice, the study points to the need to support teachers in developing the necessary skills to integrate technology in teaching and learning.

Keywords: *Digital Tools, Kindergarten Education, Teacher Perspectives, Early Childhood Education, Digital Literacy*

Background of the Study

The global education landscape has undergone a significant transformation in recent decades, with an accelerated shift toward digitalization in teaching and learning environments. UNESCO (2023) reports that global internet use expanded markedly from 16% in 2005 to 66% in 2022, and approximately half of all peri- secondary schools worldwide are now connected to the internet for pedagogical purposes.

This growing digital footprint reflects an international commitment to integrating technology as a necessary component of contemporary education. In Ghana, similar commitments are evident in national policy frameworks. The Ministry of Education's Education Strategic Plan (ESP) 2018–2030 positions digital education as a central priority for improving learning outcomes, enhancing teacher effectiveness, and supporting the broader vision of equitable and quality education for all. These national efforts align closely with Sustainable Development Goal 4, which advocates for inclusive, equitable, and lifelong learning opportunities. Despite these policy ambitions, the translation of digitalization into early childhood education remains inconsistent and uneven across the country.

Research consistently demonstrates that the successful integration of digital technology into classroom practice is contingent upon factors that reside primarily in the teacher rather than in the technology itself. Teachers' pedagogical beliefs, digital competence, self-efficacy, and disposition toward pedagogical innovation are among the most consequential determinants of whether digital tools are embedded into instruction in educationally meaningful ways (Akram et al., 2022; Alotaibi, 2023; Diz-Otero et al., 2023). Teachers' instructional practices are greatly defined by their pedagogical beliefs, and they tend to prefer technological applications that align with their existing pedagogical strategies and their broader conceptions of teaching and learning. Equally critical is teachers' willingness to innovate at the individual level, teachers' willingness to learn to use and integrate technology in their instruction is a key factor in successful integration, and where that willingness is absent, even well-resourced technology environments yield limited pedagogical transformation. In early childhood contexts specifically, teachers who hold positive beliefs about the benefits of technology, possess strong knowledge of how to use it effectively, and demonstrate a willingness to incorporate it into their practices are more likely to use technology frequently and effectively in the classroom. Teachers' perceptions, skill levels, and professional orientations toward digital tools thus function as determining factors in whether digital resources are meaningfully and developmentally appropriately embedded into early childhood instructional practice.

In the Asunafo North Municipality, evidence from teacher interviews, monitoring reports, and district assessments reveals a notable gap between national policy expectations and classroom realities (MoE, 2021). Although some educators recognize the pedagogical value of digital tools and express enthusiasm for integrating them into classroom activities, others remain hesitant often due to limited exposure, low confidence, or a lack of professional development in digital literacy.

Furthermore, teachers consistently cite challenges such as unstable internet connectivity, irregular electricity supply, inadequate training opportunities, and scarcity of functional digital devices (tablets, projectors, or computers).

These constraints collectively impede the effective introduction of digital literacy in the early years. The consequences of limited technology use in kindergarten classrooms are far-reaching. Scholars such as Resnick (2017) and Van Dijk (2020) argue that early exposure to digital tools is essential for developing foundational skills that enable young learners to thrive in a technology-driven society. The study explores teachers' perspectives about the use of digital tools in kindergarten centers in the Asunafo North Municipality, explores how teachers, access digital tools within the schools and examines how they incorporate digital tools in their teaching practices in the Municipality.

LITERATURE REVIEW

Teachers' Perspectives on the Use of Digital Tools in Kindergarten Centres

Research on digital technology in early childhood education (ECE) consistently demonstrates that teachers' perspectives, beliefs, and attitudes are among the most influential determinants of whether digital tools are adopted and integrated meaningfully in kindergarten classrooms. Studies show that teachers' views about the pedagogical value, developmental appropriateness, and usefulness of digital technologies strongly shape both the extent and quality of technology use in early childhood settings (Blackwell et al., 2014; Ogegbo & Aina, 2020; Plowman & McPake, 2013). Teachers who hold positive and informed beliefs about digital tools are more likely to integrate them in ways that support play-based, interactive, and learner-centred pedagogies, whereas skepticism or low confidence often results in minimal or superficial use (Undheim, 2022).

Globally, evidence shows that teachers' beliefs about children, learning, play, and technology strongly shape their willingness and capacity to integrate digital tools (Plowman & McPake, 2013; Neumann, 2018). This argument reflects Ertmer's (2019) influential distinction between first-order barriers (lack of devices, poor connectivity, limited infrastructure) and second-order barriers (teachers' attitudes, pedagogical orientation, and self-efficacy). In many contexts, whether well-resourced or resource-constrained, positive teacher beliefs have been found to predict higher adoption of digital technologies, whereas skepticism or low confidence often results in minimal or no integration, even when tools are available (Blackwell et al., 2014).

Survey-based research across developed contexts demonstrates that teachers generally hold cautiously positive views about digital tools, acknowledging their potential to support engagement, visual learning, emergent literacy, and differentiated instruction. For instance, large-scale surveys in the United States, Australia, and the United Kingdom revealed that kindergarten teachers believed digital tools could enhance children's motivation and creativity, yet they simultaneously expressed concern about excessive screen time, potential distraction, and the risk of undermining play-based learning (Hsin, et al., 2014; Blackwell et al., 2014). These studies typically employed

quantitative methods Likert-scale questionnaires, structural equation modelling, and regression to establish that teacher self-efficacy and exposure to ICT training significantly predicted positive attitudes and higher levels of technology use. Qualitative studies conducted through interviews and ethnographic studies conducted in early childhood settings in Australia revealed that teachers' perspectives were influenced by their professional identity, comfort with technology, and beliefs about child development (Yelland, 2011; Fleer, 2014). Teachers who viewed themselves as facilitators of inquiry and multimodal learning were more enthusiastic about experimenting with digital tools. Conversely, teachers who adhered to traditional views of early childhood education centred on tactile play and minimal screen exposure expressed hesitation. These qualitative accounts also highlight the role of emotions and personal experience: teachers who used technology confidently in their own lives tended to embrace it in the classroom, whereas those who experienced anxiety or lacked prior exposure were reluctant (Fleer, 2014).

In sub-Saharan Africa, research shows that teachers often perceive digital tools as valuable but distant due to infrastructural challenges, limited training, and concerns about cultural relevance. Studies conducted in Tanzania, Kenya, and Uganda revealed that teachers appreciated the potential benefits of digital tools but often viewed them as foreign, difficult to maintain, or unsustainable without external support (Plowman, McPake, & Stephen, 2012; Mtebe & Raisamo, 2014). In Ghana specifically, Ministry of Education monitoring reports indicate that many kindergarten teachers especially in rural districts understand the importance of digital literacy but demonstrate limited usage due to insufficient digital competence, lack of access to devices, irregular power supply, and weak professional development structures (MoE, 2021). Teachers' interviews in rural districts like the study context show that they value technology for its potential to improve teaching, yet they lack confidence, training, or resources to adopt it meaningfully. Across methodologies; surveys, interviews and case studies, scholars have concluded that teacher perspectives are not static but shaped by training opportunities, policy expectations, community pressures, and personal experiences.

Teachers Incorporation of Digital Tools into Their Teaching Practices

A substantial body of research has examined how kindergarten and early childhood teachers incorporate digital tools into daily instruction, revealing a wide continuum of practices ranging from minimal, surface-level use where technology simply supports traditional activities to more complex, transformative integration that fundamentally reshapes teaching and learning (Plowman & McPake, 2013; Danby et al., 2021).

Studies consistently show that teachers use digital tools in three main ways: (a) instrumental use playing videos or using devices for attendance; (b) pedagogical-supportive use integrating apps or digital media to scaffold literacy or numeracy; and (c) transformative use designing learning experiences that leverage the unique affordances of digital tools to enhance play, inquiry, and creativity (Hughes, 2012; Neumann, 2018). Observational studies provide the most detailed evidence of how teachers integrate digital tools in practice. For example, research in early

childhood classrooms in Australia and the UK used systematic classroom observations and video analysis to document that teachers often used tablets for digital storytelling, drawing, documenting children's work, and supporting emergent literacy (Neumann, 2018; Marsh et al., 2005). In these classrooms, teachers who adopted open-ended, dialogic approaches asking questions, encouraging collaboration, and linking digital activities to hands-on play produced stronger child engagement and learning outcomes. In contrast, teachers who treated digital tools as "reward systems" or isolated entertainment stations generated limited learning value.

A number of quasi-experimental studies, though fewer in number for early childhood contexts, explored the impact of structured digital interventions. These studies evaluated the use of interactive literacy apps, phonics games, or math activities in kindergarten classrooms. For instance, Hirsh-Pasek et al. (2015) showed that children who used carefully designed educational apps with teacher mediation demonstrated improvements in vocabulary and early reading skills. These studies often involved pre- and post-intervention testing and revealed that teacher involvement was crucial: child gains were significantly smaller when technology was used independently without pedagogical framing.

In developing countries, including African contexts, digital integration is shaped by infrastructure limitations and local innovation. Studies in Tanzania and Kenya documented that teachers used projectors, audio-visual materials, and mobile phones to support storytelling, early literacy, and numeracy (Mtebe & Raisamo, 2014). Some teachers used offline videos and locally adapted apps to overcome connectivity challenges, blending digital learning with traditional play-based activities. In Uganda, where tablets were introduced in selected preschools through NGO partnerships, teachers integrated apps into storytelling and vocabulary lessons but often paired them with hands-on activities to maintain children's sensory engagement (Ssenyonga et al., 2017). These studies typically used qualitative case studies or mixed methods (observations, teacher interviews), revealing that cultural relevance, language, and contextual adaptation were crucial for meaningful integration.

Evidence from Ghana remains limited, but existing monitoring reports and small-scale studies indicate that teachers incorporate digital tools sparingly and mostly for instrumental purposes (MoE, 2021). Teachers in rural districts report using mobile phones to show pictures, play audio songs, or display short videos, but lack the devices, training, and reliable power supply needed for deeper pedagogical integration. Teachers who did receive digital training during in-service workshops or NGO programmes exhibited more varied use such as digital drawing, audio-recording children's stories, or using apps to teach shapes and colours but these practices were isolated and project-dependent.

Across the literature, three major determinants of effective incorporation emerged: (a) pedagogical orientation teachers who viewed digital tools as part of play-based learning used them more creatively; (b) professional development teachers with classroom-based coaching used technology more meaningfully than those who received only one-off workshops (Sheridan et al.,

2019); and (c) institutional support schools with strong leadership, clear ICT policies, and reliable infrastructure fostered richer digital integration (Plowman & McPake, 2013). Yet, several gaps persist. Few studies examine digital integration in African kindergarten classrooms using rigorous, sustained observation. There is also limited research on how teachers in resource-constrained environments adapt digital tools to culturally grounded pedagogies.

METHODOLOGY

The study was a qualitative inquiry, employing a phenomenological design to explore the perspectives of kindergarten teachers regarding the use of digital tools in early childhood classrooms. The design was appropriate because it allowed for an in-depth exploration of teachers' personal meanings, interpretations, and daily encounters with digital technology, thereby providing rich insights into how digital tools were perceived and used in instructional contexts (Creswell & Poth, 2018). The study was conducted in selected schools within the Asunafo North Municipality of the Ahafo Region of Ghana, a predominantly rural and semi-urban area with considerable disparities in digital infrastructure. Early childhood centres in the municipality often operated under limited technological conditions, making the context ideal for exploring teachers' experiences with digital integration (Ghana Education Service, 2021).

This study applied clearly defined inclusion and exclusion criteria to ensure that participating schools and teachers possessed relevant, sustained experience with the use of digital tools in kindergarten instruction. Initially, fifteen (15) kindergarten centres in the Asunafo North Municipality were identified through records from the Municipal Education Directorate. From this group, eleven (11) centres were purposively selected based on their suitability to address the study objectives. Centres were included if kindergarten teachers used digital tools consistently as part of classroom instruction**,** rather than occasionally or experimentally. Consistent use in our study referred to the integration of digital tools such as mobile phones, tablets, laptops, projectors, or audio-visual materials several times within a typical teaching week. This criterion was essential because qualitative inquiry depends on participants with prolonged engagement with the phenomenon under study, enabling reflective and credible accounts (Creswell & Poth, 2018; Patton, 2015). Teachers also demonstrated basic to moderate familiarity with digital tools, including the ability to operate devices and access digital instructional content with minimal support. Only centres with active kindergarten classes during the data collection period and teachers who provided informed consent were included. Centres were excluded if teachers did not use digital tools for instructional purposes or reported minimal familiarity with digital technologies. Centres with inactive or irregular kindergarten classes, as well as those where consent for participation or classroom observation was not granted, were also excluded. The application of these criteria ensured the selection of information-rich cases capable of illuminating how digital tools are experienced and enacted in practice.

Using purposive sampling, eleven teachers were selected based on their teaching experience, familiarity with digital tools, willingness to participate, and ability to provide reflective accounts

(Etikan et al., 2016). The sampling strategy ensured coverage across the municipality and captured diverse experiences among teachers who had interacted with digital tools. Data were collected by the researchers using a semi-structured interview guide developed in alignment with the research objectives. The guide focused on teachers' perspectives, perceived benefits and challenges, and actual instructional practices related to digital tools.

To complement interview data and examine enacted pedagogical practices, the study employed non-participant classroom observation**.** Observation is a well-established method in qualitative educational research, offering insight into classroom realities that may not be fully captured through self-reports (Cohen et al., 2018). Observations focused on Mathematics and English lessons, as these subjects form the foundation of early numeracy and literacy development in kindergarten education.

In Mathematics lessons, attention was given to how digital tools supported concepts such as counting, number recognition, shapes, and patterns. Observations documented the types of digital tools used, the alignment between digital content and lesson objectives, and the points within the lesson where technology was introduced. Particular emphasis was placed on teacher mediation**,** including explanations, questioning, and scaffolding, given evidence that teacher-guided technology use yields stronger learning outcomes than passive exposure (Hirsh-Pasek et al., 2015; Neumann, 2018). Learner engagement and the balance between digital activities and hands-on materials were also observed, reflecting the importance of play-based learning in early childhood contexts (Plowman & Stephen, 2005).

Observation of **English lessons** focused on the use of digital tools to support early language and literacy skills, including vocabulary development, phonics, listening, and speaking. The study examined how teachers used digital stories, songs, images, and audio materials to stimulate interaction and support language development. Attention was paid to teacher–learner interaction, children's responses and engagement, and the extent to which digital content was integrated with familiar oral practices such as storytelling and singing. This focus aligns with research emphasizing the importance of culturally responsive and contextually grounded approaches to technology integration in early childhood education (Plowman & McPake, 2013; Selwyn, 2016).

The instruments were validated through expert review and piloted in a neighboring district to refine clarity and sequencing. Face-to-face interviews were conducted in participants' schools over a six-week period, with each interview session lasting 30–45 minutes. Participants' gave their consent for the observations and the interviews to be audio-recorded, and field notes were taken to compliment the interviews. Interview recordings were transcribed verbatim and repeatedly read for familiarization where transcripts and preliminary interpretations were later shared with participants for member checking to ensure accuracy and credibility. Data analysis followed Braun and Clarke's (2006) thematic analysis process. Initial coding was carried out by identifying significant statements, which were then grouped into categories and refined into major themes relevant to the research questions.

The final themes reflected teachers' perspectives on digital tools and the practices through which digital tools were integrated into instructional activities. Interpretations were guided by existing literature on early childhood technology use and Ghanaian educational policies. Trustworthiness of the study was ensured using Lincoln and Guba's (1985) criteria. Credibility was achieved through prolonged engagement, triangulation of interviews, observations, field notes, and member checking. Transferability was supported through thick descriptions of the research context and procedures. Dependability was ensured by maintaining an audit trail documenting methodological decisions. Confirmability was enhanced through reflexive journaling, peer debriefing, and ensuring that findings were grounded in participants' narratives rather than researcher bias. Ethical procedures were rigorously followed. Approval and permission were obtained from the Asunafo North Municipal Education Directorate. Permission was also granted by school heads. Participants were fully informed about the study's aims, confidentiality measures, and voluntary participation. Written consent was obtained, and no incentives were provided. Data were stored securely and used solely for academic purposes in accordance with ethical guidelines for human subjects research (Resnik, 2015).

RESULTS AND DISCUSSIONS

This section presented the data from the participants and discussion emanating from the data

Table 1: Participants Bio-Data

Participant (Pseudonym)	Gender	Age Range	Teaching Experience (Yrs)	Highest Qualification	Digital Tool Familiarity
Tr 1	Female	30–35	5	Diploma in Basic Education	Basic
Tr 2	Male	40–45	12	B.Ed. Basic Education	Moderate
Tr 3	Female	28–30	3	Diploma in ECE	Basic
Tr 4	Female	35–40	8	B.Ed. Early Childhood	Moderate
Tr 5	Female	45–50	15	Certificate in Teaching	Basic
Tr 6	Male	50–52	18	Diploma in Education	Low
Tr 7	Female	30–35	7	B.Ed. Early Childhood	Moderate
Tr 8	Female	28–32	4	Diploma in Basic Education	Basic
Tr 9	Male	38–42	10	B.Ed. Basic Education	Moderate
Tr 10	Female	33–37	6	Diploma in ECE	Basic
Tr 11	Female	35–40	9	B.Ed. Early Childhood	Moderate

The participants consisted of eleven kindergarten teachers eight females and three males ranging in age from 28 to 52 years. Their teaching experience varied between 3 and 18 years, ensuring that both early-career and seasoned educators were represented. Qualification levels ranged from Certificate to Bachelor's degrees in Early Childhood or Basic Education. Most teachers demonstrated basic to moderate familiarity with digital tools, primarily using mobile phones for instructional support, while only a few had experience using laptops or projectors. This diversity provided a rich range of perspectives on digital tool integration within rural Ghanaian kindergarten settings. This variation in experience, qualifications, and technological familiarity provided a comprehensive understanding of how digital tools are perceived and utilized in rural Ghanaian kindergarten classrooms. The implication is that any initiative to integrate digital tools must consider these differences in skill level and access, highlighting the need for **t**argeted training and resource support to ensure equitable and effective implementation.

PRESENTATION OF DATA FROM PARTICIPANTS

RQ1: Teachers' Perspectives on the Use of Digital Tools in Kindergarten Centers

The study explored the perspectives of kindergarten teachers regarding the use of digital tools in teaching and learning. The findings revealed two major themes: positive perceptions toward digital tools and concerns about screen time and cultural impacts.

Theme one: Positive Perceptions toward Digital Tools

Many teachers expressed strong positive attitudes toward the use of digital tools in kindergarten classrooms, highlighting their potential to enhance lesson delivery, improve learner engagement, and increase teaching efficiency. Teachers reported that children were more attentive, motivated, and responsive when multimedia elements such as videos, pictures, and songs were incorporated into lessons. For instance, one teacher noted:

> *"Digital tools have significantly eased my teaching process. Using my phone to show pictures or play sounds during lessons makes the content more engaging for the children. They respond positively and show more interest in the lessons, which encourages participation and curiosity. I have noticed that when lessons are visually or audibly supported, children are more attentive and retain information better."* (Tr, 3)

Another teacher emphasized the effectiveness of videos and songs in sustaining attention:

> *"Children tend to learn more effectively and quickly when I incorporate videos and songs into my lessons. These digital resources capture their attention, maintain their focus, and make learning enjoyable. Lessons become more interactive and dynamic, and children often recall concepts better because the teaching methods appeal to multiple senses."* (Tr, 7)

Additionally, teachers highlighted the benefits of educational apps:

> *"Educational apps on tablets or phones have been very helpful in reinforcing learning. They allow children to practice concepts at their own pace, and the interactive nature of these apps motivates them to participate actively. I have found that lessons become more student-centered, and children are more confident in trying new activities when technology is involved."* (Tr, 11)

What stood out clearly during the classroom observations was how positive digital tools shaped both teaching and learning digital tools shaped both teaching and learning. Whenever teachers introduced pictures, videos, or songs into their lessons, the children's attention shifted immediately toward the activity. Learners were seen watching the screen closely, responding eagerly to questions, and showing excitement through smiles, laughter, and movement, suggesting that the use of digital tools made the lessons more appealing and meaningful to them. Videos and songs, in particular, helped sustain the children's focus. During these moments, learners stayed engaged for longer periods, followed instructions more easily, and actively participated by singing along or copying actions from the screen. Teachers were also observed revisiting earlier concepts, and many children were able to recall and explain what they had learned, indicating that the multisensory nature of the digital content supported understanding and memory. The use of educational applications further encouraged children to take ownership of their learning. When tablets or phones were used, children approached the activities with curiosity and confidence, working through tasks at their own pace while teachers offered gentle guidance. Learners appeared less hesitant to try new activities and more willing to participate, creating a classroom atmosphere that was interactive, supportive, and learner-centered.

These responses suggest that teachers view digital tools as valuable instructional enhancers that support active, learner-centered pedagogy. This aligns with constructivist theories of learning, which emphasize that children construct knowledge actively through interaction with their environment, including multimedia and interactive resources (Piaget, 1972; Vygotsky, 1978). Digital tools offer opportunities for visual learning, differentiated instruction, and scaffolding of concepts, enabling teachers to address the diverse needs of young learners (Blackwell et al., 2014; Plowman & Stephen, 2005). The findings also mirror existing literature indicating that technology can simplify teaching processes, make lessons more dynamic, and foster engagement through multi-sensory learning experiences (Hsin et al., 2014).

Theme Two: Concerns about Screen Time and Cultural Impacts

While teachers generally appreciated the benefits of digital tools, they expressed concerns regarding excessive screen time and the potential cultural implications of early technology use. One teacher remarked:

> *"Too much screen time is not good for young children. Excessive use of computers or tablets can strain their eyes, which may lead to long-term vision problems. It can also interfere with their ability to practice basic skills such as writing by hand or drawing,*

which are essential for developing fine motor skills, creativity, and concentration. I believe that balancing screen activities with traditional hands-on activities is very important for their general development." (Tr, 2)

Another teacher emphasized cultural considerations:

"Our culture does not fully support the heavy use of computers at early stages of learning. Introducing children too early to digital devices may distance them from our traditional ways of learning, which involve storytelling, hands-on activities, and social interaction. These cultural practices are important for nurturing values, creativity, and social skills" (Tr, 7)

Concerns about over-reliance on technology and reduced social interaction were also raised:

"Introducing computers too early may make children overly reliant on technology for learning. It could reduce their ability to focus on tasks that require patience and critical thinking, such as reading, puzzles, or classroom discussions. Children need time to develop concentration skills through physical and social activities before relying heavily on digital tools." (Tr, 9)

Another teacher added that;

"Excessive use of computers might limit children's opportunities to interact with their peers and teachers directly. Social interaction is crucial at this stage for developing communication skills, empathy, and teamwork. If children spend too much time on screens, they may miss out on learning from each other and building strong relationships." (Tr, 10)

This theme highlights a cautious stance among teachers regarding digital integration. Concerns about screen time reflect fears of physical strain, reduced development of fine motor skills, and limited engagement with traditional hands-on activities, consistent with early childhood development literature emphasizing balanced exposure to digital and tactile, play-based experiences (Plowman et al., 2010; Livingstone & Haddon, 2009). The cultural dimension underscores the importance of context-sensitive integration strategies; digital tools should complement rather than replace indigenous knowledge systems, traditional teaching methods, and communal learning practices (Selwyn, 2016). These findings suggest that successful technology integration in early childhood classrooms requires careful consideration of developmental, social, and cultural factors.

RQ2: How do teachers incorporate digital tools into their teaching practices?

The study investigated how kindergarten teachers integrated digital tools into their teaching practices and yielded two key findings: the use of mobile phones and basic digital devices, and infrastructural and technical challenges.

Theme One: Use of Mobile Phones and Basic Digital Devices

The findings show that teachers rely mostly on simple, rather inexpensive, digital tools in enhancing instruction. Mobile phones cropped up as the most used technological aid because of their easy transportability and accessibility and also because they have multiple functions. Teachers described how they use the phones to search for educational songs, rhymes, images, and short videos that supplement lessons. One teacher said:

> *"Sometimes I use my mobile phone during the lesson to search for some songs or rhymes and play them with the children. They like to dance and sing along, making the lesson more active. Since music and movement are used, it enhances the concept while making the experience enjoyable for the kids in developing coordination, rhythm, and memory skills." (Tr, 1)*

In addition, teachers also demonstrated creativity in terms of making the most of limited digital resources. One teacher mentioned how she used one shared laptop with a speaker at school to facilitate storytelling activities:

> "*There is only one laptop in the school, but we put it to optimal use by hooking it up with a speaker during storytelling sessions. In this way, all the children get to listen together, and the storytelling becomes more interactive and far more effective. Even with scarce resources, the integration of technology enhances their imagination, listening skills, and an overall interest in learning."* (Tr, 4)

Besides, some teachers encouraged students to interact with the digital content directly:

> *"I sometimes encourage kids to interact with the digital content directly, like clicking through some slides or identifying objects in the pictures on the school tablet. Hands-on use of technology provides a sense of involvement and responsibility among them, making the lesson more participatory and thereby conceptualizing the lesson more concretely"* (Tr, 6)

Classroom observations indicated that teachers primarily relied on basic and readily available digital tools, particularly mobile phones, to support instruction. Teachers were observed using their personal phones to play short songs, rhymes, and videos, which visibly increased learners' attention and participation. Children frequently responded by singing, moving, and clapping along, suggesting that the digital content supported both concepts understanding and active engagement. Observations also highlighted teachers' efforts to optimize limited digital resources. In one classroom, a single shared laptop connected to a speaker was used during a storytelling activity, enabling all learners to listen simultaneously. The teacher periodically paused the narration to prompt questions and responses, sustaining learners' interest despite the scarcity of technological resources.

In addition, some teachers were observed encouraging direct learner interaction with digital devices. Learners were invited to click through images or identify objects displayed on a tablet, which appeared to enhance their sense of involvement and responsibility during the lesson. Overall, the observations demonstrate that, even with basic digital devices, teachers effectively integrated technology to promote participation and enrich instructional delivery.

These findings indicate that even with limited resources, teachers are seamlessly integrating digital tools in a functional and innovative manner. The mobile phones and laptops represent a basic, teacher-directed level of digital integration whereby technology is mainly used to support lesson delivery and engagement rather than to create fully interactive or even student-driven learning experiences. This was confirmed in previous research where, in low-resource early childhood settings, teachers were seen too often utilize personal devices as alternatives to meet instructional needs (Plowman & Stephen, 2005; Blackwell, Lauricella, & Wartella, 2014). Such practices also align with the constructivist perspective, promoting active learning, multisensory engagement, and concept scaffolding through accessible digital tools (Vygotsky, 1978; Piaget, 1972).

Theme Two: Infrastructural and Technical Challenges

Despite the teachers' readiness for the use of digital tools, they also reported a number of infrastructural and technical challenges that hinder consistent and meaningful integration. These included unreliable electricity, malfunctioning devices, a general lack of digital equipment, and poor internet connectivity. One teacher said:

> *Sometimes, the projector refuses to work, or there is no electricity in the classroom. In that case, we use the traditional methods of teaching, such as using the blackboard or telling them stories orally. These challenges disrupt the flow of lessons and sometimes limit the ways we engage children with digital content.* (Tr, 2)

Other teachers pointed out the shortages of devices and inconsistent access to the internet:

> "*We have huge difficulties, as for example not all the students have devices, and the internet is not always available. Even if I prepare something and would like to show videos or pictures or other things which are online, I cannot do it. These constraints make it not possible to fully integrate technology in the learning process and limit children's experience with interactive learning."* (Tr, 5)

Technical glitches were also reported as a barrier: Sometimes, even when devices were vailable, either due to software or kindly check, here sounds like a verbatim response indicated that children got frustrated, and at times extra time was spent in trouble shooting rather than teaching children. On one occasion, the researchers observed that a teacher spent over 20 minutes trying to reboot the only computer shared among the children so that a lesson concept could be demonstrated, leading to a noticeable interruption in learning. In another instance, ongoing technical problems forced a teacher to abandon a planned digital activity altogether, relying instead on verbal explanations and the chalkboard. These experiences illustrate how limited and unreliable

technology not only disrupts classroom instruction but also diminishes opportunities for students to engage meaningfully with digital learning tools.

These challenges make the lessons go slower and at times reduce children's interest in using technology for learning. These findings point to systemic and infrastructural impediments that are linked to integrating digital tools in early childhood classrooms. Inconsistent electricity disrupts lesson continuity, whereas equipment shortages and breakdowns encumber the effective use of technology by teachers. Poor internet connectivity exacerbates the problem even more, especially when the teacher relies on online resources. Such findings are consistent with the broader literature on early childhood digital education in developing contexts, which recognizes inadequately resourced infrastructure, limited resources, and technical challenges as major constraints to effective technology use (Hsin, Li, & Tsai, 2014; Plowman, McPake, & Stephen, 2010; Selwyn, 2016).

RQ3: How do teachers access digital tools within the Municipality?

This research question examined how kindergarten teachers in the Asunafo North Municipality gain access to digital tools for classroom instruction. Analysis of interview and observational data revealed that access to digital tools is largely informal, uneven, and dependent on teachers' personal efforts rather than structured institutional support. Teachers described navigating multiple access pathways in order to integrate digital resources into their lessons. Three interrelated themes emerged from the data: reliance on personal digital devices**,** limited and unreliable school-provided resources**,** and shared or externally sourced access to digital tools**.**

Theme One: Reliance on Personal Digital Devices

A central finding of the study was that most teachers accessed digital tools primarily through their personal mobile phones. In the absence of adequate school-owned digital resources, teachers relied on their own devices to search for instructional materials, download songs and videos, and display images during lessons. Teachers explained that without their personal phones, digital activities were often impossible.

As one teacher stated:

> *"Most of the digital tools I use are my own. I use my personal phone to download songs, pictures, and sometimes videos before coming to class. If I don't bring my phone, then there is no digital activity for that lesson."* (Tr, 1)

Another teacher similarly noted:

> *"The school does not provide us with tablets or laptops, so whatever digital thing I do in class is from my phone. I buy my own data and prepare materials at home before coming to school."* (Tr, 8)

Classroom observations confirmed these accounts where teachers were repeatedly seen using their personal phones during lessons, often holding the device close to learners or moving children nearer so they could see images or hear audio clearly. These practices reflect both creativity and constraint, illustrating how teachers adapt to limited resources while also revealing the physical and pedagogical limitations of relying on small, personal devices.

This pattern suggests that access to digital tools in the municipality is teacher-driven rather than system-supported. Similar findings have been reported in other low-resource educational contexts, where teachers compensate for institutional shortages by using personal devices to support instruction (Plowman & Stephen, 2005; Blackwell et al., 2014). While this demonstrates commitment and professional agency, it raises important concerns about sustainability and equity, as access becomes tied to teachers' personal financial capacity rather than guaranteed through educational polic.

Theme Two: Shared, Borrowed, and External Sources of Access

In response to these limitations, some teachers accessed digital tools through shared or external sources, such as borrowing devices from colleagues or school administrators, or sourcing digital content outside the school environment. In several cases, teachers downloaded materials at home or in internet cafés and later used them offline during lessons.

One teacher explained;

> *"Sometimes I borrow a computer from another teacher or the headteacher when I want the children to watch and listen to songs clearly. We share what we have."* (Tr, 6)

Another teacher noted:

> *"because internet is not reliable in school, I download videos at home or at a café and then bring them to class to play for the children."* (Tr, 9)

These strategies reflect deliberate planning and adaptive problem-solving by teachers. Rather than relying on real-time internet access, teachers anticipated infrastructural challenges and prepared digital content in advance. This practice was evident during classroom observations, where teachers used pre-downloaded videos and audio materials without internet connectivity.

Similar adaptive practices have been documented in other low-income contexts, where teachers depend on informal networks, offline resources, and personal initiative to integrate digital tools into early childhood instruction (Plowman et al., 2012; Selwyn, 2016). While these approaches demonstrate resilience and innovation, they also underscore the fragmented and precarious nature of digital access within the municipality.

The findings indicate that teachers' access to digital tools in the Asunafo North Municipality is largely informal, uneven, and personally mediated**.** Access is primarily achieved through personal

ownership of mobile phones, limited and shared school resources, and improvised external arrangements. This mode of access places a considerable burden on teachers and reinforces inequalities between those who can afford devices and internet data and those who cannot. Consistent with existing literature, such access constraints limit the depth and frequency of digital tool use, often restricting integration to basic, teacher-led activities such as playing songs or displaying images (Blackwell et al., 2014; Neumann, 2018). Although teachers demonstrate creativity and willingness to use technology, the absence of structured institutional support constrains the development of more transformative, learner-centred digital practices.

These findings suggest that positive teacher attitudes alone are insufficient to ensure meaningful technology integration. Without reliable access to functional digital tools, stable electricity, and institutional provisioning, teachers' capacity to implement technology-rich pedagogies remains limited. As argued by Selwyn (2016) and reflected in national policy assessments (MoE, 2021), equitable digital integration in early childhood education requires sustained systemic investment rather than reliance on individual teacher effort.

CONCLUSIONS

Kindergarten teachers in the Asunafo North Municipality generally hold a positive attitude toward the use of digital tools, acknowledging their potential to make learning more engaging, interactive, and effective. They recognize that technology can enhance children's understanding and participation, particularly through the use of mobile phones, laptops, projectors, videos, and songs. However, teachers remain cautious about excessive use of digital tools, citing concerns about overexposure, cultural appropriateness, and potential impacts on traditional learning methods. Despite their willingness to integrate technology, the overall use of digital tools in classrooms is limited due to availability, technical difficulties, insufficient devices, unreliable internet access, and a lack of targeted training.

RECOMMENDATIONS

Based on the findings, we recommend that:

1. Ghana Education Service and other relevant stakeholders should take deliberate steps to support adequate supply/provisions of digital tools in public schools and funding streams for their maintenance.
2. The Ministry of Education (MoE) and the Ghana Education Service (GES) should strengthen infrastructural support in kindergarten centers, particularly in rural and under-resourced areas, by providing adequate and reliable digital devices, ensuring stable internet connectivity, and offering ongoing technical assistance to teachers and students
3. The Curriculum Research and Development Division (CRDD), together with school administrators, should promote culturally responsive approaches to technology integration, by incorporating ICT training into ongoing professional learning communities (PLC)

sessions in schools to ensure that digital learning tools enhance and complement traditional teaching practices rather than replace them.

ACKNOWLEDGEMENT

We *acknowledge the use of Elicit, an artificial intelligence language model, which assisted in enhancing the clarity, organization, and grammar of portions of this manuscript. All ideas, interpretations, and analytical decisions remain solely our own.*

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