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BUILDING BRAILLE COMPETENCE: TEACHERS' KNOWLEDGE AND RESOURCES AVAILABILITY FOR BRAILLE LITERACY DEVELOPMENT IN BLIND LEARNERS IN GHANA

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Abstract:
This study examined teachers' knowledge and the availability of resources for Braille literacy development among learners with visual impairments in Ghana. Using a qualitative research design, data were collected through interviews and observations from teachers in three foremost schools for the blind in Ghana. The findings revealed that while teachers demonstrated a foundational understanding of Braille as a code and were aware of the appropriate sequence for introducing Braille literacy, variations existed in their instructional approaches. The study also found that schools possessed a range of Braille-related resources such as slates and styluses, Braille printers, tactile learning tools, and talking computers, but these were often inadequate, outdated, or poorly maintained. Again, the study established that the ways of improving resource availability for Braille literacy require coordinated interventions across supply, teacher and transcriber capacity, technology, and sustainable financing. The study concludes that strengthening teacher training, standardising instructional practices, enhancing resource provision, and fostering community and institutional partnerships are essential for building Braille competence and promoting inclusive literacy outcomes for blind learners in Ghana. It is therefore recommended that the Ministry of Education develop and implement a national Braille literacy policy to guide teacher preparation, resource allocation, and sustainable support systems across all schools for the blind in Ghana.

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1. Introduction

Literacy serves as a fundamental cornerstone for education, social participation, and empowerment (Ngwacho, 2023; UNESCO, 2022). For learners with visual impairments, the ability to read and write in Braille is not only a tool for communication but also an essential means of accessing knowledge, fostering independence, and achieving educational equity (Dogbe, 2024). Globally, research has shown that Braille literacy significantly enhances academic achievement, vocational opportunities, and social inclusion for learners with blindness or severe visual impairment (Ryles, 2019; McCall, 2022). Despite its importance, the acquisition of Braille literacy is influenced by multiple factors, including teachers' professional competence, availability of appropriate resources, and the instructional strategies employed in classroom settings (Dogbe, 2024; Khaliq et al., 2023).

In Ghana, education for persons with visual impairments has received increasing attention within the framework of inclusive education policies and the Sustainable Development Goal 4, which emphasises equitable and quality education for all learners (Opoku, 2020; Kana, 2025). Specialised schools such as the Akropong, Wa, and Wenchi Schools for the Blind play pivotal roles in the development of Braille literacy and the academic advancement of learners with visual impairments. However, effective teaching and learning of Braille remains challenged by limited teacher preparation, scarcity of teaching and learning resources, and inadequate adoption of evidence-based pedagogical strategies (Avoke, 2020; Agyei & Owusu, 2022). These challenges not only affect learners' mastery of Braille but also limit their opportunities for functional literacy, which is essential for lifelong learning and social participation.

Teachers' knowledge of Braille instruction, the resources at their disposal, and the strategies they employ are therefore central to the development of Braille competence in Ghanaian classrooms. Teachers serve as the primary facilitators of literacy, and their ability to systematically understand the Braille code, scaffold learning experiences, and integrate modern assistive technologies can significantly shape learners' educational outcomes (Ametepee & Anastasiou, 2015; Biri & Twum Ampofo, 2025). Despite the acknowledged importance of Braille literacy, there remains a gap in understanding the extent to which teachers in Ghana possess the requisite knowledge, instructional strategies, and resources to effectively build Braille competence among learners with visual impairments (Dogbe, 2024). While schools for the blind exist to promote literacy and inclusion, anecdotal evidence and existing studies suggest that some teachers may lack adequate training in Braille pedagogy, often relying on limited resources and outdated methodologies (Biri & Twum Ampofo, 2025). Additionally, the scarcity of teaching and learning resources, combined with the slow adoption of assistive technologies, further constrains the teaching and learning of Braille (Khaliq et al., 2023).

These challenges raise critical concerns about the effectiveness of current practices and their implications for literacy development among learners with visual impairment in Ghana. Consequently, this study examines how the knowledge base of teachers and resource availability provides valuable insight into Braille competence within blind schools in Ghana. Indeed, understanding these dimensions is critical not only for strengthening teacher preparation programmes but also for informing policy and practice toward equitable and inclusive literacy education. The study is therefore guided by the following research questions.

1) What knowledge do teachers possess in instructing braille literacy among students with visual impairment?
2) What are the resources available to support teachers in developing Braille literacy skills for students with visual impairment?
3) What are the ways to enhance the supply and maintenance of learning resources to promote Braille literacy development within Ghana's schools for the blind?

2. Theoretical Framework

This study is grounded in Shulman's Pedagogical Content Knowledge (PCK) model, which emphasises that effective teaching requires more than just mastery of subject matter (content knowledge) or general teaching skills (pedagogical knowledge) (Shulman, 1986). PCK refers to a teacher's ability to transform subject matter into forms that are understandable and accessible to learners (Shulman, 1986, 2022). This includes knowing what makes specific topics easy or difficult to learn, anticipating student misconceptions, and selecting the most effective teaching strategies, representations, and resources (Shulman, 1986, 1987). At its core, PCK emphasises that successful instruction is not simply about knowing the subject matter or about applying general teaching methods; instead, it is about the integration of both (Shulman, 1986).

The first element of the model is Content Knowledge (CK), which refers to a teacher's mastery of the subject matter. In the context of Braille literacy, this means that teachers need a strong grasp of the Braille code, both uncontracted and contracted, along with knowledge of tactile graphics, transcription rules, and how Braille literacy develops over time (Shulman, 1986, 1987). Without sufficient content knowledge, teachers may present information inaccurately or fail to support students' progression beyond basic symbol recognition. The second component is Pedagogical Knowledge (PK), which encompasses general strategies and methods for teaching and learning. This includes skills such as classroom management, motivating students, differentiating instruction, and assessing learning progress. For Braille instruction, pedagogical knowledge is reflected in how teachers create supportive learning environments, maintain learner engagement, and adapt teaching methods to suit different abilities (Shulman, 1986, 1987). Another important element is Curriculum Knowledge, which refers to teachers' familiarity with the materials, tools, and resources available for instruction. In Ghanaian schools, this might involve using Braille textbooks, Perkins braillers, tactile diagrams, or

digital Braille devices. Teachers not only need access to these resources but must also know how and when to incorporate them effectively to enhance students with visual impairment literacy experiences. Lastly, Knowledge of Learners and their characteristics is central to effective teaching. Tailoring instruction to these diverse learners' characteristics ensures that teaching is both inclusive and effective. In summary, Shulman's framework is a unique blend of content and pedagogy and is well-suited for this research (Shulman, 1986, 1987, 2022).

2.1 Teachers' Knowledge in Braille Literacy

Teaching the Braille alphabet is widely recognised as a foundational step toward full Braille literacy, and a teacher's knowledge is repeatedly identified as a central determinant of early success in Braille literacy. Studies show that many students with visual impairment acquire basic letter-level Braille skills when instruction is present, but achieving fluent, comprehension-based reading requires more than symbol memorisation, rather, it depends on teacher expertise in sequencing instruction, diagnosing errors, and linking code instruction to broader literacy processes (McCall, 2022; Koenig & Holbrook, 2000; Toussaint & Tiger, 2010). Research also indicates that preservice and in-service professional development improve teachers' confidence and fidelity when teaching the Braille alphabet. For instance, structured teacher training in Braille reading and writing has been found to enhance teachers' instructional knowledge and improve student outcomes in symbol recognition, transcription, and early writing tasks (OCALI, 2019). These studies suggest that scalable, context-sensitive training and coaching are effective levers for increasing teacher knowledge (McCall, 2022).

In Ghana and other low-resource settings, evidence highlights how resource constraints interact with teacher knowledge and competence. Research suggests that many teachers compensate for the lack of readiness activities, tactile materials, and Braille textbooks when introducing the Braille alphabet, and that this improvisation can limit systematic progression from alphabet knowledge to fluency (Ry-Kottoh et al., 2022). Teachers often introduce letters without preparatory tactile readiness or distributed practice. Such contextual barriers mean that even well-intentioned teachers struggle to implement best practices unless material and institutional supports are in place (Komba et al., 2025). Indeed, the role of assistive technology, that is, finding potential benefits of digital embossers, software, and hybrid tactile-audio tools provide potential benefits in supporting Braille practice. However, research reports that technology improves outcomes only when teachers are trained to integrate devices pedagogically. Thus, teacher competence includes not only knowledge of the Braille code but also the ability to incorporate and troubleshoot technologies and to design practical activities that build tactile discrimination and automaticity. Without teacher training in technology integration, devices often remain underused or misapplied (Hoskin et al., 2024).

2.2 Resources Availability for Braille Literacy

Effective braille teaching requires a range of instructional resources, and the empirical literature consistently highlights Braille texts and books as essential classroom materials. Several studies document limited supply and uneven distribution of Braille books in many blind schools, making teachers often lack sufficient graded readers and curricular texts to provide repeated, distributed practice, which remain essential ingredients for developing Braille literacy (Ry-Kottoh et al., 2022). Where Braille book supply is adequate, teachers report greater opportunities for guided reading, independent practice, and scaffolded vocabulary development (McCall, 2022).

Empirical studies also highlight contextual and systemic supports, such as library services, national braille production centers, maintenance infrastructure, and policy frameworks, as resources that indirectly but powerfully support teachers. Thus, according to Ry-Kottoh et al. (2022), the absence of centralised braille production, irregular access to embossing services, and weak repair networks place disproportionate burdens on teachers, forcing improvisation and reducing instructional continuity. On the other hand, countries that invest in braille libraries, teacher resource centers, and reliable assistive-technology servicing show better uptake and sustained use of materials in classrooms (Komba et al., 2025).

Again, assistive devices and Braille production technology, including Perkins braillers, refreshable braille displays, embossers, and low-cost hybrid tools, offer important opportunities for both writing and reading practice. Though such devices can expand practice opportunities and allow faster production of learning materials, their effectiveness depends heavily on teacher knowledge and their integration into pedagogy (Hoskin et al., 2024). Indeed, technology is a potentially powerful resource, but only when teachers are trained to use devices pedagogically and when maintenance systems exist (Kapperman & Sticken, 2003). Thus, resources interact with teacher competence to deliver maximum benefit only when teachers possess the pedagogical skills to deploy them (Hoskin et al., 2024).

2.3 Supply and Maintenance of Learning Resources for Braille Literacy

Access to appropriate instructional materials and Braille books remains one of the most frequently reported barriers to Braille literacy worldwide (Toussaint & Tiger, 2010; McCall, 2022). Empirical studies document uneven distribution and chronic shortages of graded Braille readers and curricular texts, which limit opportunities for guided reading, repeated practice, and vocabulary building (McCall, 2022; Ry-Kottoh et al., 2022). Ineffective national or regional braille production and library services often limit the urgent supply and maintenance of learning resources, therefore reducing the scope and continuity of instruction (Ry-Kottoh et al., 2022). Indeed, infrastructure and assistive-technology maintenance present huge constraints to braille literacy. Although modern devices, including embossers, refreshable displays, and low-cost hybrids, can accelerate production of materials and expand practice opportunities, their benefits depend on functioning maintenance systems and teacher training in pedagogical integration (Abu

Shokhedim et al., 2024; Hoskin et al., 2024; OCALI, 2019). Studies show that broken equipment, lack of spare parts, and absence of local technical support frequently render technology underused or unusable, placing extra burdens on teachers and schools (Hoskin et al., 2024; Ry-Kottoh et al., 2022).

Research has identified several strategies that can leverage the supply and maintenance of learning resources for effective and efficient. For instance, Komba et al. (2025); and OCALI (2019) in their separate studies suggest that targeted teacher training interventions and programmatic coaching have shown measurable improvements in the supply and maintenance of learning resources. Also, Hoskin et al. (2024) stress that appropriate technology adoption offers potential to multiply the supply of Braille materials and support individualised practice. In fact, when teachers are well trained on the usage and maintenance of embossers, refreshable displays, and tactile-audio hybrids, these resources' lifespan is elongated. In addition, partnerships among ministries, NGOs, universities, and international donor agencies have helped to establish braille libraries, teacher resource centers, and localised production capacity to enhance the supply and maintenance of the learning resources (McCall, 2022; Ry-Kottoh et al., 2022). Furthermore, literature highlights the production of locally adapted, low-cost tactile materials and community engagement to enhance the steady supply and maintenance of these learning resources. Developing teacher-led production of tactile graphics, using everyday objects for concrete experiences, and mobilising community volunteers for material production are indeed seen as pragmatic strategies for supplying and maintaining learning resources in low-resource settings like Ghana (Ry-Kottoh et al., 2022).

3. Methodology

The study adopted a qualitative research approach situated within the interpretivist paradigm. Qualitative research emphasises the interaction between the researcher and participants within their socio-cultural and natural contexts (Kusi, 2012). It seeks to capture rich, detailed descriptions of participants' experiences rather than generalised accounts of a phenomenon (Bryman, 2008; Creswell, 2018). According to Ary et al. (2010), this approach allows for the collection of data that reflects participants' perspectives, thereby deepening understanding of the phenomenon under investigation. In line with this orientation, the qualitative narrative design was employed in order to generate a comprehensive account of teachers' knowledge and resource availability in advancing Braille literacy in Ghana.

3.1 Research Design

The study adopted a case study design (Yin, 2014) to explore the distinctive knowledge teachers possess and the resources available to build braille competence in blind schools in Ghana. This design was deemed appropriate because it facilitates an in-depth examination of real-life contexts and practices, thereby allowing for a comprehensive

understanding of teachers' knowledge and resource availability within the schools (Maare, 2007).

3.2 Population and Sample

The target population for the study consisted of all teachers from the foremost blind schools in Ghana, thus the Akropong, Wa, and Wenchi Schools for the Blind. In total, the teacher population across the three schools was seventy-seven (N = 77), comprising 30 teachers at Akropong, 25 at Wa, and 22 at Wenchi. From this population, a sample of twenty-eight (n = 28) teachers was purposively selected, including 12 from Akropong, 9 from Wa, and 7 from Wenchi. The purposive sampling strategy was employed because the study specifically focused on teachers directly engaged in Braille literacy, thus teachers who teach English Language and/or any of the Ghanaian Languages. These teachers were deemed most suitable to provide rich, authentic insights into teachers' knowledge and resource availability in advancing Braille literacy. With the assistance of school administrators, the researchers obtained lists of teachers responsible for Braille literacy, from which the final sample was drawn.

3.3 Data Collection Instrument

The instruments used for the study were a semi-structured interview guide and an observation checklist. The semi-structured interview guide consisted of open-ended questions designed to elicit teachers' knowledge, availability, supply and maintenance of learning resources in building braille competence, which underpinned the three research questions that guided the study. The interview guide was deemed appropriate because it provided participants the opportunity to freely express their experiences and perspectives while granting the interviewers the flexibility to seek clarification and pursue deeper probing where necessary (Avoke, 2005; Yin, 2014).

In addition to the interview guide, the researchers employed structured, non-participant observation as a means of triangulating the data obtained through the interview. The observation focused on examining teachers' knowledge and resources available in building braille competence. The use of the structured observation schedule was intended to minimise observer bias, as it ensured systematic and objective data collection rather than reliance on preconceived notions (Gerrish & Lacey, 2010). Through this process, the researchers were able to directly observe teachers' real knowledge and resource availability in building braille competence, thereby strengthening the trustworthiness and credibility of the findings (Cohen et al., 2004).

3.4 Pre-testing of the Instrument

The interview guide and observation checklist were pre-tested on eight teachers from the Blind Unit of the Cape Coast School for the Deaf. This population was selected because the school closely resembles the target population for the study. The pre-test exercise revealed ambiguities, repetitions, and overlapping items within the instruments. Based on the feedback obtained, revisions and modifications were made to eliminate

redundancies and enhance clarity, thereby improving the internal consistency and reliability of the instruments (Alumode, 2011; Vanderstoep & Johnston, 2009).

3.5 Trustworthiness

In validating qualitative instruments, the trustworthiness procedure is considered most appropriate. This comprises the elements of credibility, transferability, dependability, and confirmability. To ensure credibility in this study, the researchers developed early familiarity with the sampled schools by visiting the teachers on two occasions for casual interactions. Also, with expert guidance, an observation checklist was developed, which facilitated the collection of consistent data (Bell & Silverman, 2018). The use of an observational schedule was particularly important in minimising or eliminating variations that might arise from individual perceptions of events and situations. Furthermore, during group interactions, questioning techniques were employed to cross-check and compare participants' responses to the same questions. To strengthen credibility further, the researchers verified transcripts against the original verbal responses to ensure accurate representation of participants' verbatim accounts.

With respect to confirmability, the researchers engaged multiple participants from three different schools, thereby triangulating their responses. In addition, verbatim statements were incorporated into the analysis to substantiate the findings. The researchers personally undertook the processes of data collection, transcription, thematic coding, and analysis, thus maintaining a clear audit trail of the study.

Again, on the issue of transferability, although the findings cannot be statistically generalised beyond the sample, they remain applicable to contexts with characteristics similar to those of the study setting (Kusi, 2012). This is justified by the involvement of the three premier blind schools in Ghana and the focus on teachers who teach Braille or languages within natural school settings.

Finally, dependability was addressed in line with Shenton's (2004) argument that credibility and reliability are closely linked, with credibility serving as a foundation for dependability. The researchers enhanced dependability by engaging teachers in focus group interviews and employing an observation checklist during instructional hours to triangulate the data. This combination of methods strengthens the likelihood that a repetition of the study would yield comparable results.

3.6 Data Collection

The researchers conducted focus group interviews with teachers, involving between four and seven participants in each group. These interviews were unstructured and guided by open-ended questions designed to elicit the participants' views and opinions in a free and comprehensive manner (Creswell, 2009). The discussions were held in serene environments to minimise external disruptions, thereby ensuring participants could express their experiences without undue pressure. With the consent of the participants, the sessions were tape-recorded and later transcribed for analysis. To enhance the accuracy of the data, the researchers reconvened with the focus groups to conduct

member checking, allowing participants to verify that the transcripts accurately reflected their shared views and experiences.

In addition, a structured, non-participant observation method was employed during instructional hours of Braille reading or language classes, each lasting approximately two hours. This approach enabled the researchers to focus on specific events and behaviours relevant to the teachers' roles in advancing Braille literacy (Kusi, 2012). To strengthen reliability, the researchers engaged close associates to observe the same instructional events, ensuring consistency across multiple observers. This aligns with Denscombe's (2017) assertion that the purpose of an observation checklist is to provide a systematic framework for observation to enable all observers to focus on the same activities, record data thoroughly, and produce consistent findings when two or more researchers witness the same event. However, a noted limitation of this method is the tendency for "unexpected" behaviours or events to be overlooked, as the structured framework may constrain the observer's attention (Kusi, 2012).

3.7 Data Analysis

The analysis of data was done sequentially by beginning with the interview data and subsequently incorporating the observation data for each research question. Interview transcripts were analysed thematically, drawing on narrative themes from the recorded and transcribed data. For identification purposes, transcripts were coded as Group 1, Group 2, and Group 3, corresponding respectively to teachers from Akropong, Wa, and Wenchi Schools for the Blind (Fraenkel & Wallen, 2009). To further refine the process of identifying emerging themes, colour coding was employed to facilitate the organisation of categories and patterns in advance (Creswell, 2012). Where appropriate, verbatim excerpts from participants were incorporated into the analysis to preserve authenticity, and the thematic content was structured around the research questions and the data obtained.

With respect to the observation data, the researchers engaged two additional independent observers, who were close associates, to record the phenomena under study. To establish inter-observer reliability, the degree of agreement between the researchers and the observers was calculated as a percentage. Specifically, an observational statement endorsed by two observers (66.6%) or all three observers (100%) was deemed to have occurred, whereas statements supported by only one observer (33.4%) were not considered as evidence of occurrence. This procedure ensured greater rigour and reliability in the interpretation of the data observed.

3.8 Ethical Considerations

To ensure adherence to ethical standards, the study received ethical approval prior to data collection, and participation was entirely voluntary. Written informed consent was obtained from all participants, and explicit permission was sought for the audio recording of interview sessions. Confidentiality and anonymity were rigorously maintained by replacing participants' real names with pseudonyms throughout the

study. Furthermore, the scheduling of data collection sessions, including the day and time, was mutually agreed upon by the researchers and participants to promote comfort and convenience.

4. Presentation of Results

The interview data were systematically coded and subjected to thematic analysis, from which themes and sub-themes were generated to answer the research questions that guided the study. In contrast, the observation data were analysed through inter-observer agreement, which was established by calculating the percentage of agreement between the researchers and the two additional observers.

Theme 1: Teachers' Knowledge of Braille Instruction

During the interaction process with the participants, they revealed that in teaching the Braille alphabet, the first thing to know is that Braille is a code and not a language itself. There are different "grades" and versions of braille. The most basic is "grade one braille", in which every letter is transcribed. For every letter in the English alphabet, there is a Braille character, and each Braille letter is made of a combination of raised dots in the Braille cell. The braille cell is the basic component of braille, and the braille alphabet uses a pattern throughout the alphabet. However, the evidence from the data suggests that teachers' knowledge of the appropriate order of teaching the Braille alphabet to students varies from one teacher to the other.

For instance, a teacher said:

> *"When you come, I will let you know that the braille is made up of dots. Also, I will let you know the braille alphabet and arrange the dots on the pin plug for you to feel it before I send you the paper, then I will be putting your fingers on it, showing you how they are."*

Another teacher said:

> *"It starts from the basics. Fundamentally, if you want to teach a child how to write, then you can start from sand writing, writing in the air, and then Braille, too. We allow them to braille just normal dots as if they are playing. Children learn through play, so the child will think he or she is playing, but you, the teacher, know what you are doing, so later, when you see that the child is conversant, then you introduce him or her to the frame and the stylus."*

Another teacher affirmed that:

> *"I will also say that scribbling, sand play, as my sister said later, then we bring them to the hand frame and the stylus to start brailling the correct thing."*

In addition, a teacher added that:

"Okay with children, I get some flash cards which have been shaped for them to feel and tell the shape of it. Also, I add sand to glue, put them on paper to show them the map and to identify the names on it."

Furthermore, another teacher stated that:

"Apart from using the orders to introduce the braille alphabet to the learners, I equally used them to teach learners shapes and geometric figures, especially those at the lower level, since those orders helped the learner and me to bring the world into the classroom."

Lastly, a teacher added that:

"I equally use flash cards to introduce them to shapes, and I start with circles, triangles, squares, and rectangles. So, I have some shapes here. I will mention the shape and tell them we have some different types of shapes, so when I describe a particular shape, I give it to them and ask them to tell me what shape they think looks like this shape, and they mention it. So, I give the shape for them to fill and tell them the number of sizes they have, maybe circle has how many sizes? After feeling the object, I ask them how many sizes they think this shape has? Some will say different numbers, then after that, I tell them it has this number. The triangle has three sizes, so I help them to identify the size and give examples of objects that look like a triangle. I do the same thing to squares and rectangles, too."

From the comments the teachers gave, it was clear that the teachers demonstrated fair knowledge of the appropriate order of teaching the Braille alphabet.

Theme 2: Resources Available to Support Braille Literacy

In response to research question two, participants elicited their views on the resources available for developing braille reading skills. These included Braille alphabet or printed materials, tactile reading tools, optical devices (magnifiers and lenses) to read Braille books, talking calculators, talking computers with printouts, Braille printers, Braille computers, readers, cassette-recorded books, diagrams, schemes, pictures, and embossed maps. Individual participants were asked to describe the aforementioned resources available in their school.

For example, a teacher said:

"The braille alphabet enables students with visual impairment or those with low vision to learn how to read and write…so the learners have printed materials containing braille alphabets that enable them to learn."

When asked to describe what the braille alphabet is, one of the teachers said:

"It consists of patterns of raised dots which are arranged in cells of up to six dots in a 3x2 configuration…each cell represents a braille letter, numeral or punctuation mark."

Another teacher explained that:

"The braille codes are in versions of grades 1, 2 and 3. Accordingly, grade 1 has 26 letters of the alphabet and punctuation and is used by beginners of braille reading…contractions are added in grade 2, whereas grade 3 is a kind of shorthand, with entire words shortened to a few letters, such as found in letters, diaries, and notes."

Also, slate and stylus were mentioned as one of the learning resources available for teaching Braille literacy.

For instance, a teacher stated that:

"The slate and stylus consist of a slate or template with evenly spaced depressions for the dots of braille cells, and a stylus for creating the individual braille dots."

Another teacher said:

"The slate and stylus used by students with visual impairments is just the equivalent of paper and pencil that the sighted students use."

Again, tactile resources were mentioned as one of the reading tools that teachers used to develop the students' braille reading.

One of the teachers explained that:

"Tactile reading provides a connection with the text more than visual reading or listening."

A teacher also mentioned some of the tactile resources, such as:

"Sensory shapes and stones, textured cards, fabrics, ball sets, finger fidgets and much more will aid concentration and help develop colour recognition and fine motor skills through play."

The participants, however, complained about the lack of sufficient optical devices, such as magnifiers and lenses, to read Braille books.

For example, a teacher said that:

"The optical devices will enable those with low vision to develop their reading skills, but in our school, currently, we do not have enough of that."

Another teacher said:

"We do not have enough optical devices as the number of students with low vision increases…some of the students can learn to read if they have lenses."

In addition, some participants mentioned tape recorders and other note-taking devices as some of the resources that were not adequate for the students.

According to one teacher:

"The students can tape-record the lessons so that later on, on their own, listen and even transcribe…it should be a basic requirement for all the students with visual impairments."

Another teacher added that:

"Braille reading is not only about reading but also writing. I believe that when they tape-record lessons and try to transcribe it on their own, it will help them learn how to read as well as they write using the slate and stylus."

Furthermore, it emerged from interaction with the participants that Braille computers and printers could also be useful in teaching Braille reading.

For example, a teacher stated that:

"If we get more braille computers and printers, we can guide the students to do independent reading even if the teacher is not there with them to read."

Another teacher commented that:

"With the advent of computers and other technological devices, it is important that students with visual impairments are introduced and encouraged to learn how to use the computer."

In addition, a teacher said that:

"The school needed a modern computer laboratory that is furnished with braille computers and printers, considering the rapid growth and expansion of technology and its impact on education."

From the above comments, it can be deduced that even though some of the participants mentioned inadequate resources in the school to support braille reading, a number of resources were described.

Theme 3: Ways to Enhance Resource Availability to Promote Braille Literacy Development

In response to research question three, participants suggested that the supply and maintenance of the learning resources require coordinated interventions across supply, capacity, technology and financing. Evidence gathered showed that local production, teacher and transcriber capacity, reliable consumables, improved logistics, and community partnerships produce the largest, most sustainable gains.

For instance, a teacher suggested that:

"There is a need to strengthen the production and supply chain for Braille materials by establishing regional Braille production hubs equipped with embossers, transcription software, and trained personnel to ensure the timely and sufficient availability of textbooks, storybooks, and teaching aids. I think localising Braille content production will make resources more culturally relevant and engaging while reducing dependence on imported resources."

Another teacher recommended that:

"With the provision of adequate funding earmarked specifically for Braille education, covering consumables such as Braille paper, maintenance of embossers, and training of staff. This, I believe, can be achieved through government budget allocation, public-private partnerships, and collaboration with NGOs and development partners."

Also, the teacher added that:

"Improving the distribution system to ensure equitable access across urban and rural blind schools in Ghana, coupled with proper inventory management and monitoring, I am certain, will enhance efficiency and minimise delays in the delivery of learning resources."

Again, a teacher proposed that:

"I think capacity building remains central to sustaining Braille literacy. I strongly believe that teachers, transcribers, and support staff should receive regular training in Braille production, transcription, and technology integration to increase local expertise and reduce reliance on external technicians."

In addition, a teacher suggested that:

"Schools should be equipped with assistive technologies such as digital Braille displays, screen readers, and accessible computers to complement traditional Braille and expand learning opportunities. I also suggest robust community participation through alumni

networks, parent associations, and local volunteers to mobilise additional resources and foster shared responsibility for maintaining Braille facilities."

5. Discussion of Findings

The foremost objective of this study was to examine teachers' knowledge and resource availability for Braille literacy development in Blind learners in Ghana. The research questions that guided the current study were: the knowledge teachers possess in instructing braille literacy; the resources available to support braille literacy; and the ways to enhance resource availability to promote Braille literacy development. With respect to the first research question, the results indicated that teachers demonstrated enough knowledge on the order of teaching literacy to the learners. They indicated that learners were introduced to the oral recognition of the letters before they were introduced to reading. This finding confirms what Toussaint and Tiger (2010) opined, that one of the earliest skills for braille literacy development is the ability to name individual characters correctly. Ehri and McCormick (2022) also emphasise that early braille literacy development begins with oral language competence and phonological awareness, which serve as foundational skills for later decoding and comprehension. Similarly, Perkins School for the Blind (2023) and the International Council for Education of People with Visual Impairment (2021) stress that structured Braille instruction should begin with oral recognition, language enrichment, and tactile discrimination exercises before introducing reading and writing. These findings affirm that the teachers' instructional sequence, that is, starting from oral letter recognition and progressing to reading, reflects evidence-based best practice in early literacy and Braille education (Perkins School for the Blind, 2023; McCall, 2022).

On the issue of resources available to support braille literacy, the results from this study showed that a considerable number of resources, such as braille alphabet and printed materials, slate and stylus, tactile resources, optical devices, and braille computers and printers. The findings of this current study corroborate with lots of studies (Abdelrahman, 2020; McCall, 2017; Okonkwo & Mba, 2021; Phutane et al., 2022). For instance, Okonkwo and Mba (2021) conclude that most teachers use tactile objects frequently, and optical devices such as magnifiers and lenses emerged as some of the resources available to support students to read braille books. Similarly, Phutane et al. (2022) suggest that tactile materials, such as tactile graphics and three-dimensional objects, are regularly used to scaffold spatial and literacy concepts in learners with visual impairments. Indeed, the literature confirms that a diverse toolkit of Braille and assistive technologies is essential for effective literacy instruction. For example, the use of a slate and stylus as a low-tech writing tool is particularly useful in low-resource or portable contexts (Braille Authority of North America, 2023). Moreover, technological and tactile supports, including refreshable Braille displays, tactile graphics, and optical aids for learners with some vision, play a significant role in broadening access to texts and improving independent reading opportunities (Paths to Literacy, 2024).

Last but not least, research question three revealed that improving resource availability in Ghanaian schools for the blind requires coordinated interventions across supply, capacity, technology and financing. Evidence gathered from the participants showed that local production, teacher/transcriber capacity, reliable consumables, improved logistics, and community partnerships produce the largest, most sustainable gains. For instance, UNESCO (2017) and Perkins International (2023) posit that local production of learning resources reduces dependence on costly imports and helps ensure steady access to the special paper and consumables that embossers require. Likewise, multiple recent studies report that teacher training in Braille pedagogy, transcription, and basic device maintenance dramatically improves classroom use of resources and student outcomes (Abu Shokhedim, 2024; Kyei-Gyamfi, 2025; Perkins International, 2023). Indeed, evidence establishes that community partnerships and financing mechanisms again increase impact by combining resources, sustaining recurrent costs, and enhancing local ownership (Phutane et al., 2022; Perkins International, 2023).

6. Conclusions

From the findings, it can be concluded that while teachers possess a foundational understanding of the Braille system, their approaches to teaching the Braille alphabet vary considerably. Therefore, there is a need for consistent pedagogical frameworks and structured training to ensure that all teachers follow evidence-based steps in introducing and reinforcing Braille literacy skills. Also, the study concludes that although a variety of Braille-related resources exist within the school, participants consistently highlighted inadequacy in both quantity and maintenance. This suggests that while the school possesses essential tools for developing Braille reading skills, access is uneven and often hindered by outdated or non-functional equipment. Lastly, it is concluded that sustainable resource availability for Braille literacy depends on collaborative planning and investment across multiple levels; thus, policy, institutional, and community need to create a resilient and self-sustaining support system for learners with visual impairments.

6.1 Recommendations

Based on the findings of this study, it is recommended that the Ghana Education Service, in collaboration with special education units and teacher training institutions, develop and implement a standardised Braille literacy curriculum and training guide that outlines a clear sequence for introducing the Braille alphabet. Such measures will promote consistency, improve instructional quality, and ultimately enhance Braille literacy outcomes among learners with visual impairment in Ghana. In addition, it is recommended that blind schools in Ghana, in collaboration with the Ghana Education Service and relevant stakeholders, strengthen the resource mobilisation, maintenance, and replacement systems to ensure consistent access to functional Braille learning resources. Through a coordinated and sustainable resource management strategy, blind schools can create a more supportive learning environment that enhances Braille reading

proficiency. Lastly, it is recommended that the Ministry of Education, through the Special Education Division of Ghana Education Service, adopt a comprehensive national strategy for Braille resource management and development. This strategy should focus on establishing regional Braille production hubs, strengthening teacher and transcriber training programmes, and ensuring a steady supply of Braille consumables and maintenance services.

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