UNIVERSITY OF EDUCATION, WINNEBA

INSTRUCTIONAL STRATEGIES TEACHERS' USE IN DEVELOPING BRAILLE READING SKILLS OF STUDENTS AT AKROPONG SCHOOL FOR THE BLIND

JUSTINA BIRI

(200022628)

MASTER OF PHILOSOPHY

2022

UNIVERSITY OF EDUCATION, WINNEBA

INSTRUCTIONAL STRATEGIES TEACHERS' USE IN DEVELOPING BRAILLE READING SKILLS OF STUDENTS AT AKROPONG SCHOOL FOR THE BLIND

JUSTINA BIRI

(200022628)

**A thesis in the Department of Special Education,
Faculty of Educational Studies, submitted to the school of
Graduate Studies in partial fulfillment**

**of the requirements for the award of the degree of
Master of Philosophy
(Special Education In the University of Education, Winneba**

APRIL, 2022

DECLARATION

Student's Declaration

I, **Justina Biri,** declare that this thesis, with the exceptions of quotations and references contained in published works which have been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole for another degree elsewhere.

Signature ……

Date ……

Supervisors' Declaration

We hereby declare that the preparation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Principal Supervisor: Dr. Adam Awini

Signature…….

Date ……

Co-Supervisor: Dr. Daniel Dogbe

Signature…….

Date ……

DEDICATION

I dedicate this work to my mother, siblings, friends, and loved ones.

ACKNOWLEDGEMENTS

Producing this thesis was actually not easy, but with determination and assistance of certain personalities, it became possible. Thanks to my supervisor, Dr. Adam Awini who steered me in the right direction and gave me great support throughout the work process. His constructive criticism and advice really had a great impact on this work. I would also like to appreciate Dr. Daniel Dogbe, my second supervisor, for his professional directives and immense contributions.

I am highly indebted to my mother, who sacrificed in diverse ways to make sure I have the best opportunities in life. Finally, my special appreciation goes to all my friends most especially, Mr. Emmanuel Ankomah, Mr. Luke Bonney and Mr. Fredrik Donkor who have been supportive and helpful in the course of the study. May the good Lord continue to bless you all and replenish whatever energy you might have lost.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The purpose of study was to explore the instructional strategies teachers use in developing braille reading skills among students in Akropong School for the Blind in the Eastern Region. The qualitative approach using the case study design was employed in the study. Data were gathered using semi-structured interviews and observation schedules. The purposive sampling technique was used to select twelve teachers for the study. Using thematic analyses, data from the interviews were manually analysed via themes that emerged from the data. The study revealed that teachers in the school took into consideration the age of onset of the disability, task analysis approach and dual media approach when setting up a braille literacy programme. The findings showed that teachers demonstrated fair knowledge on the appropriate order of teaching braille; however, they demonstrated little or no knowledge in the use of technology in teaching braille literacy. It was again revealed that teachers used a lot of instructional resources including but not limited to magnifiers, braille sheets and printers in teaching literacy to their learners. Finally, the findings from the study showed that teachers used motivation, and teaching from simple to complex, to influence the interest of their learners in literacy activities. The researcher recommended among other things that the Ghana Education Service should post more braille literacy teachers to the school to augment the overwhelming tasks on the few available. Management of the school should organise periodic in-service training for the teachers on how to employ electronic technological devices in teaching braille literacy, and how to also employ phonemic awareness in their braille literacy instructions.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

Braille is a system of communication that enables individuals with visual impairment to read and write through touch. Each letter of the English alphabet is represented by a unique dot configuration represented by the presence or absence of six dots, each approximately 1 mm in diameter, within a matrix of two columns and three rows, with 1.5 mm between the midpoints of each adjacent dot. These small patterns differ only by the presence or absence of dots, making braille alphabet learning difficult (Millar, 2020).

Braille remains the main medium of communication for persons who are blind. Ghana adopted braille code which is made up of six dots. Braille writing equipment includes Perkins braillers and slate and stylus. Perkins braillers are quite ideal for writing but rather expensive. The slate and stylus on the other hand are a cheaper alternative. However, when using the slate and stylus, the child writes from right to left, thus contradicting the left-right eye orientation. The child turns the paper when it comes to reading what has been written. This makes the process rather slow. This is also cumbersome and more so to the young children who are blind (Dogbe, 2020).

Certain degenerative conditions, such as glaucoma and degenerative myopia, have an onset early in childhood with vision worsening over time. Students with low-vision in particular those with degenerative visual impairments, are at risk for not receiving appropriate braille instruction while some level of sight remains (National Federation of the Blind, 2010). The use of augmentative technology with this population may

delay the need to learn braille, but the transition to braille reading will be ultimately necessary to maintain literacy. These individuals in particular may benefit from braille instruction prior to losing their functional sight because relations can be established between braille and other symbols that already exist in their repertoires (i.e., letters and numerals; Hall & Newman, 2020). One of the earliest skills for braille literacy development is the ability to name individual characters correctly. Difficulty in this basic skill impedes learning more complex braille-reading skills, such as producing and combining letter sounds (Hampshire, 2002). These combined phonics skills are a key component of reading acquisition (National Institute of Child Health and Human Development, 2000). Despite the need for braille letter naming as a precursor for braille reading, limited research exists on effective methods for teaching this skill, and it is rarely included in commercially available braille curricula. Research has even shown that the human fetuses are able to memorize sounds from the external world by the last trimester (7-9 months) of pregnancy with particular sensitivity to melody; both music and language with high pitch and intonation, repeated, short in sequence and melodious (Gadagbui, 2012).

The American Foundation for the Blind (2019) estimated that fewer than 10 percent of people who are legally blind in the United States and fewer than 40 percent of the estimated number who are functionally blind are braille readers (Frieman, 2006). Ghana may not be an exception to the situation in the United States. Although a great deal of technology is available to aid in the literacy of children who have some usable vision- computer voice programmes, magnifying devices, audio devices, among others. These children also need a knowledge of braille in order for them to reach their maximum level of literacy and self-sufficiency. As Maneki (2020) points out, problems arise when the person with visual impairment who has not been properly

trained in braille is forced to rely on clearly inadequate partial vision rather than the more efficient braille system. Although some children with visual impairments can make use of enlarged print generated by computers and video technology, Maneki notes that the limits of depending on large print only- eyestrain, slowness, and the relative lack of portability of equipment makes a convincing argument that braille must be taught as well.

Amato (2002) noted specifically that teachers of braille need to be able to demonstrate proficiency in all five of the braille codes: literary, Nemeth (Maths and Science), music, foreign language, and computer. She goes on to suggest that the national literary braille competency test be used by teachers' preparation programs as an assessment of their preservice teachers' braille skills. Allman (2014) also supported this assertion when he stated that if vision teachers are expected to teach braille and related skills, they must learn these skills in their preservice training. Knowlton and Berger *(*2000) point out that teachers not only need to know braille, but also need to use the new computer technologies that enhance a teacher's ability to produce braille materials.

The importance of braille literacy is well documented. A study conducted in 2018 study found that adults with visual impairments who used braille at least once a week have higher employment rates (65% versus 45%) (Bell & Silverman, 2018). Braille usage has also been shown to contribute to self-esteem, life-satisfaction, and job satisfaction for people who have learned braille at any stage through childhood, adolescence, or adulthood (Silverman & Bell, 2018). Compared to auditory methods, braille leads to better comprehension, less mind wandering (Russomanno et al., 2015) and the development of grammar and spelling skills (Foulke, 2021). Despite the well-

documented importance of braille, braille literacy is decreasing. The National Federation of the Blind has declared a braille literacy crisis (National Federation of the Blind, 2009). It is thought that braille instruction is not being provided to some students for whom it may be appropriate (Musgrove & Yudin, 2013). This may be due to the misconception that braille is isolating or stigmatizing, or due to a lack of qualified braille teachers (National Federation of the Blind, 2009).

Dogbe (2020), opines that many learners struggle with learning to read, and that many teachers and parents confirm that reading failure has exacted tremendous long-term consequence for children's development of self-confidence and motivation to learn, as well as for their later school performance. While there are no easy answers or quick solutions for optimizing reading achievement, an extensive knowledge base now exists to show us the skills children must learn in order to read well. During recent years, methods of reading instruction have become more student centered, fostering not only knowledge and ability but also independence (Grace, 2005). It is vital for students to have a strong knowledge base when they begin to learn to read. Children who do not have a strong knowledge of the environment and concepts about print would experience reading problems which might last for a long time.

The researcher, having worked at the resource centre in the Department of Special Education of the University of Education, Winneba, observed that students with visual impairments who were products of the Akropong School for the Blind had limited skills in braille reading and comprehension. They often got the spellings of familiar words wrong as well as wrong pronunciation of words which they struggled to pronounce. It is therefore on this basis that the researcher seeks to find answers as to the resources available for teaching braille literacy, the teachers' level of

knowledge or competency in teaching the braille alphabet, and the teachers' instructional strategies that influence the braille reading of students with visual impairments. Finally, the research is to seek answers to the braille literacy programmes instituted by the school to teach and improve the reading skills of learners with visual impairments. Dogbe (2020) stated that a successful instruction for learners with visual impairment and their effective participation in class depends largely on their proficiency in reading and writing braille. This would enable learners with visual impairment who use braille as their mode of communication search for information on their own.

1.1 Statement of the Problem

Developing braille literacy empowers students to construct meanings from text and to play with the words in a creative way, thus enhancing their knowledge and interests towards learning braille. Developing braille reading skills among students who are blind is a priority and a challenge for teachers. There are several factors that are attributed to the limited knowledge of braille for students who are blind. Swenson (2008) observed that students who are blind are not provided with the same level of braille experiences as their peers who read print. The researcher, having worked at the resource centre in the Department of Special Education of the University of Education, Winneba, observed that students with visual impairments who were products of the Akropong School for the Blind had limited skills in braille reading and comprehension. They often got the spellings of familiar words wrongly spelt as well as wrongly pronounced as they struggled to pronounce. It is therefore on this basis that the researcher seeks to find answers to the resources available for teaching braille literacy, the teachers' level of knowledge or competency in teaching braille alphabet, the teachers' instructional strategies that influence the braille reading of students with

visual impairments and finally, to seek answers to the braille literacy programmes instituted by the school to teach and improve the reading skills of learners with visual impairments. This study will therefore investigate teachers' instructional strategies that are used to develop braille reading skills for students at Akropong School for the Blind in the Eastern Region of Ghana.

1.2 Purpose of the Study

The study sought to investigate instructional strategies teachers' use in developing braille reading skills of students at Akropong School for the Blind.

1.3 Objectives of the Study

The following objectives were raised to guide the study:

a) Examine steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind.
b) Investigate knowledge teachers' have on the appropriate order of teaching the braille alphabet to students in Akropong school for the Blind.
c) Identify resources that are available to support teachers in developing braille reading skills for students in Akropong school for the Blind.
d) Examine the instructional strategies teachers employ to influence the development of braille reading skills for students in Akropong school for the Blind.

1.4 Research Questions

The following research questions guided the study:

1. What are the steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind?

2. What do teachers' have knowledge on the appropriate order of teaching braille alphabet to students Akropong School for the Blind?
3. What resources are available to support teachers in developing braille reading skills for students in Akropong School for the Blind??
4. What instructional strategies do teachers employ to influence the development of braille reading skills for students in Akropong School for the Blind?

1.5 Significance of the Study

The findings from the study would help reveal the steps teachers follow in setting up a braille literacy programme in Akropong School for the Blind. This would enable teachers in this school to effectively ensure that appropriate literacy programmes that would facilitate and improve literacy skills in learners with visual impairments be implemented. Furthermore, the findings from the study would assist in revealing teachers' knowledge on the appropriate order of teaching the braille alphabet. This would enable the appropriate stakeholders as well as teacher training institutions put appropriate steps to impart the necessary skills in teachers and pre-service teachers in braille literacy skills. Moreover, the result of the study would also help Identify resources that are available to support teachers in developing braille reading skills for students who are blind. This would enable the school authorities and teachers in the school to supply and make good use of the appropriate resource materials that would facilitate the teaching of braille reading. To add to the above significance, the result of the study would help in finding out the extent to which teachers' instructional strategies influence the development of braille reading skills for students who are blind. This would enable teachers in the school adopt effective instructional strategies to facilitate effective braille reading in students with visual impairments. Finally, the

findings from this study would also be added to existing literature to serve as a source of reference research.

1.6 Delimitation

Although there are several areas of concern in the education of students with visual impairments as well as a number of schools in Ghana that admit students with visual impairments, this research focused only on the instructional strategies employed by teachers to develop braille reading skills in learners with visual impairments at Akropong School for the Blind in the Eastern Region of Ghana. This is because the instructional strategies of teachers in teaching literacy skills have a great influence on the literacy skills of the learner. Literacy in itself is a matter of concern because it determines the future independent life of the learner. The study involved only teachers who teach students with visual impairments because students with visual impairments are the only disability group in the school. The setting of the research is Akropong School for the Blind because that is the only special school in the region that educates students with visual impairments.

1.7 Operational Definition of Terms

Instructional Strategies: The techniques and procedures teachers employ in imparting knowledge into learners with visual impairment.

Braille: A system that enables individuals with visual impairment to read and write through touch in which characters are represented by patterns of raised dots that are felt with the fingertips.

Reading: The process of decoding symbols to derive meaning by learners with visual impairment.

1.8. Organisation of the Study

The study is organised in six chapters. The first chapter of the study sets out the background and the purpose of the study. It also covers the statement of the problem, the purpose of the study, and research questions. Other aspects of the chapter are the significance, delimitation, limitations, operational definition of terms and organization of the study. Chapter two deals with the review of related literature; it presents an overview of the theoretical framework of the study and also outlines what other authors or writers have written about the instructional strategies that are used to develop the braille reading skills of learners who are blind. Chapter three focuses on the general methodology that is adopted for the study; it details the research approach and design, the population, sample size and sampling techniques, instruments that were used to gather the data, trustworthiness and dependability of the instruments, and the procedures for data collection. Also covered in the chapter are procedures adopted for data analysis. Chapter four also presents the results and analysis of the data in line with research quetions. Chapter five presents the discussion of results and findings. Finally, Chapter six the summary, conclusions, recommendations and suggestions for further research constituted the concluding chapter.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section reviewed related literature on the instructional strategies used to develop the braille reading skills in learners. The literature was reviewed under the following sub-headings:

a) The theoretical framework

b) Steps in setting up a braille literacy programme.

c) The order of teaching the braille alphabet.

d) Resources used in developing braille reading skills in students who are blind.

e) Instructional strategies that influence the acquisition of braille reading skills.

2.1 Theoretical Framework

This study is underpinned by Koehler and Mishra's theory of Technological, Pedagogical and Content Knowledge (TPACK) of 2009. TPACK was regarded as a suitable theory to the frame of the study because the teachers' instructional strategies in developing braille reading skills of students with visual impairments were being investigated. Koehler and Mishra's theory is built on Lee Shulman's construct of Pedagogical Content Knowledge (PCK). Koehler and Mishra (2009) articulate that there are three main components of teachers' knowledge of technology integration in the theory of TPACK. These components are content, pedagogy and technology. Content knowledge is knowledge of the subject matter that has to be taught or learnt in a particular grade (Mishra & Koehler, 2006; Shulman, 2022). In this study, it was expected that the teachers would have knowledge of important concepts, skills and

facts of literacy as a fundamental subject in the foundation phase, particularly emergent literacy skills.

The second component of TPACK is Pedagogical knowledge (PK). PK is a teacher's knowledge of teaching and learning methods, practices and processes that are used to construct knowledge (Ball, Thames & Phelps, 2008; Mzimela 2012; Shulman, 2022). Teachers need to be knowledgeable of the diverse learning styles of the learners in their classrooms, and they need to be able to design teaching strategies that enhance their teaching. Knowing that learners are from diverse cultural and linguistic backgrounds enable teachers to employ various teaching strategies. Such strategies should be included in their planning (Koehler & Mishra, 2009). Moreover, knowing learners' diverse learning styles enables teachers to plan differentiated lessons (i.e. instruction) which considers individual learners' readiness, interests and profiles.

The third component of this theory is the knowledge of technology. Technology knowledge is knowledge about 'standard technologies such as books, chalk and blackboard, and more advanced technologies such as the internet and digital video' (Koehler & Mishra, 2009). Teachers teaching students with visual impairments should to be knowledgeable of the standard braille technologies for learners who are visually impaired, such as the braille stylus, slate, the Perkins brailler and advanced technologies such as the Mountbatten brailler, the Perkins Smart brailler and other braille note-taking devices. They should also overlay their knowledge of technology with knowledge of how to operate those technologies while teaching reading to learners who are visually impaired learners.

Koehler and Mishra (2009) further define TPACK as: "The basis of effective teaching with technology, requiring an understanding of the representation of

concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts easy or difficult to learn and how that technology can help redress some of the problems that learners face; and knowledge of learners' prior knowledge" (p. 66). To use technology to support meaningful learning, teachers need additional knowledge of the content they are required to teach, the pedagogical methods that facilitate learners' learning and the specific ways in which technology can support those methods (Ertmer & Ottenbreit-Leftwich, 2010:37). Using technology in teaching requires teachers to expand their knowledge of pedagogical practices across multiple aspects such as planning, implementation and assessment processes.

Teaching reading skills is the cornerstone of all learning; therefore, teachers' adherence to this mandate is important. However, it becomes complicated and challenging if the teacher has to teach reading skills to learners with visual impairments. In the light of this challenge, researchers have endeavoured to determine the Technological Pedagogical and Content Knowledge (TPACK) that teachers should possess for the effective teaching of reading in classrooms with learners who are visually impaired.

2.2 Steps in Setting Up a Braille Literacy Programme

Braille is a system that enables individuals with visual impairment to read and write through touch. Each letter of the English alphabet is represented by a unique dot configuration represented by the presence or absence of six dots, each approximately 1 mm in diameter, within a matrix of two columns and three rows, with 1.5 mm between the midpoints of each adjacent dot. These small patterns differ only by the presence or absence of dots, making braille alphabet learning difficult (Millar, 2020).

Braille reading constitutes a highly specific and active tactile process, in which fingers, arms, and even elbows are involved (Millar, 2020). It seems that appropriate hand movements for reading braille depend on (a) brain asymmetry, (b) the sensitivity of each finger, and (c) training received at an early stage of learning (Lorimer, 2012). A very recent hypothesis suggests that the necessary level of tactile sensitivity for braille reading is already achieved during the beginning stages of reading and no further improvement in tactile spatial resolution occurs (Veispak, Boets, & Ghesquiere, 2013). Braille reading presupposes effective tactile spatial acuity, so that the reader will be able to identify the relative spatial position of the braille dots and eventually acquire the maximal amount of information from each braille character (Vakali & Evans, 2014).

One of the earliest skills for braille literacy development is the ability to name individual characters correctly. Difficulty in this basic skill impedes learning more complex braille-reading skills, such as producing and combining letter sounds (Hampshire, 2022). These combined phonics skills are a key component of reading acquisition (National Institute of Child Health and Human Development, 2000). Despite the need for braille letter naming as a precursor for braille reading, limited research exists on effective methods for teaching this skill, and it is rarely included in commercially available braille curricula.

Two studies were identified to have evaluated steps for teaching braille-letter identification. Both studies shared the approach of establishing a novel relation between the tactile stimulus (i.e., a braille symbol) and an auditory or vocal stimulus (i.e., the spoken letter name). Mangold (2015) taught students who are congenitally blind to vocalize letter names while touching the braille. Crawford and Elliott (2014)

sang songs to low-vision braille learners as they touched the braille symbols (e.g., as students placed their finger over the braille p, the experimenter sang "p as in the alphabet, p, p, p," three times) and prompted the students to repeat this song. Although both of these approaches have been shown to be effective in establishing early braille-letter naming, teaching the relation between the braille symbol and a visual stimulus (i.e., a printed letter), as opposed to the spoken letter, may benefit learners with some level of vision who have acquired textual knowledge of the alphabet already. First, the presentation of visual stimuli will allow a motor-selection response. By requiring a motor response, teachers or therapists ensure that they will be able to prompt correct responses to facilitate learning as opposed to vocal responses in Mangold (2015), Crawford and Elliott 2014). Also, many students with degenerative visual impairments often begin learning to read in print. Including a familiar printed stimulus into the instructional milieu may facilitate the transfer of stimulus control across modalities (visual, auditory, and tactile) and enter into a stimulus equivalence class.

A stimulus equivalence class is demonstrated by the emergence of relations between previously non-associated stimuli (Green & Saunders, 2016; Sidman & Tailby, 2021). In particular, there are three tests of emergent relations that are commonly assessed in a matching-to-sample (MTS) format. The first is a test of reflexivity, which is demonstrated when each member of the stimulus class can be matched to itself. For instance, an individual would select the braille letter Z from an array of comparison stimuli when presented with an identical sample stimulus, the braille letter Z. Second is the test for symmetry, which is demonstrated when bidirectionality exists between two stimuli. For instance, if one is taught to select the printed letter Z when presented with the braille letter Z, symmetry would be demonstrated should he or she then be

able to select the braille letter Z when shown the printed letter Z. The third and final test is that for transitivity, which is demonstrated when uninstructed conditional relations emerge in the presence of novel discriminative stimuli (Fienup, Covey & Critchfield, 2010). Given the previous example, following instruction to select the printed letter Z when presented with the braille letter Z and to name the letter "Z" when presented with the printed letter Z, transitivity would be demonstrated if the individual could then select the braille letter Z when presented with the spoken letter name and if the individual could state the letter name when touching the braille letter Z.

Stimulus equivalence procedures have been demonstrated to teach a variety of prereading and reading skills such as classifying vowels and consonants (Lane & Critchfield, 2016), matching letters to their corresponding names and sounds (Connell & Witt, 2004), and matching pictures to printed and spoken words (De Rose, De Souza, & Hannah, 2006). Rosales and Rehfeldt (2014) taught two participants with evere mental retardation to select the correct picture and text of preferred items when provided with the corresponding name of the items. By teaching these auditory–picture and auditory/printed-word relations, the participants demonstrated the emergence of the picture/printed-word relation by requesting preferred items using printed words rather than pictures.

Bush (2013) provided some initial evidence that the formation of equivalence classes among printed, braille, and the spoken names of these stimuli may be likely. Bush presented 6- and 7-year-old children with tactile displays of two-dot configurations (arranged vertically, horizontally, and diagonally) or Greek letters (gamma, lambda, and xi), visually similar displays (i.e., the same characters presented on a computer

screen), and arbitrarily assigned spoken names ("zel," "mot," and "raf"). Following instruction to select the tactile characters when presented with the spoken names, each child demonstrated the formation of equivalence relations in which he or she was then capable of naming the tactile displays and selecting the visual representations that matched the tactile displays (i.e., could select a picture of two dots arranged vertically after feeling two dots arranged vertically). This study provided support that training relations between tactile and visual or auditory stimuli could result in the cross-modal transfer of stimulus control and equivalence relations, but given that this was a basic laboratory procedure and included relatively simple tactile stimuli (i.e., two-dot configurations), the efficacy of a procedure that arranged the formation of equivalence relations between auditory, visual, and braille tactile stimuli in a learning curriculum has yet to be ascertained.

The degree of vision loss, efficiency of vision use, parental preference and prognosis influence decisions about which format to use in developing and maintaining literacy skills for children with severe visual impairment (Corn & Koenig, 2012). Koenig and Holbrook (2010) designed the Learning Media Assessment (LMA) procedure to help teachers determine whether children should receive literacy instruction through a combination of braille and print (dual media), braille or through print. Stressing that the results of the LMA should not be regarded as the only basis, they recommended that the continued appropriateness of the child's literacy medium should be assessed and determined on regular basis.

2.2.1 Assessment of Reading

It is generally accepted that the accurate assessment of literacy performance is important in informing literacy teaching. Assessment provides teachers with an

insight into pupils' progress and the particular problems they may be experiencing. This applies to the teaching of literacy through braille as it does to teaching literacy through print. Such assessment tools can also be used in arriving at decisions about appropriate literacy media for children with visual impairment (Steve et al., 2011). In two specific studies, Greaney et al. (2016) and Douglas et al., (2012) report on adaptations made to the Neale Analysis of Reading Ability (NARA); a reading test designed for fully sighted children aged six to thirteen that tests comprehension, reading speed and accuracy. The authors' aim was to generate norm scores for braille and low vision print readers respectively. Douglas et al., (2012) tested the reading of 476 children with low vision using an unmodified print version of the NARA.

The data revealed that the average reading ages for accuracy, comprehension and speed for children with low vision fall below their chronological age. Greaney et al., (2016) also measured the reading of 317 braille readers (in the UK and Ireland) using a Braille version of the NARA. The data revealed that the average reading ages for accuracy, speed and comprehension for the sample were not only below those of their fully sighted peers but more importantly, they were below the reading ages of the low vision readers in Douglas et al.'s sample. In the USA, the assessment of braille literacy skills is commonly based upon reading measures developed for children who are fully sighted. For example, the ABC project adopted annual literacy assessments that included the following: the Texas Primary Reading Inventory (TPRI, 2003), the Brigance Comprehensive Inventory of Basic Skills (BRI, Brigance 2020) the Johns Basic Reading Inventory (Johns, 2003), since they are commonly used in elementary classrooms and are easily available in braille (Emerson, Holbrook & D'Andrea, 2009 p. 613).

2.2.2 Reading media choice

In the education of students with visual impairment, the choice of reading media has become a focus of research. Lusk and Corn (2006b) are of the view that while reading speed should not be the only requirement, it is important for children to develop a ‘ “functional and competitive reading speed in either print or braille” (p. 655). Children who learn to read through print and then transfer to braille require teaching methods that are different from those required for children learning to read beginning with braille. For children who are print users and who experience deteriorating vision, the question often becomes one of “when and how” rather than “whether” to introduce Braille and the decision can be a “profoundly emotional one” (Wormsley & D’Andrea, 2011). A relatively small percentage of children will require access to both braille and print, however, most of them will focus on one medium.

A study in UK by Rogers (2014) found that only 107 children used both print and braille for reading or writing (approximately 17% of the population of children aged between five and sixteen used Braille). Rogers suggested that because teachers often see visual processing being faster and more efficient than tactual processing, print initially may be viewed as the preferred format for children with very low vision, especially in lower primary classes, where children are not required to process large amounts of information. Almost all the children (86%) in her sample had begun by learning print in kindergarten, but by age seven, 54% had been introduced to braille. The study found that dual media users did not use braille and print in equal amounts and identified three groups: predominantly print users, predominantly braille users and children who appeared to use both print and braille successfully. Some children who were predominantly braille users preferred using print for curriculum subjects where there were relatively small amounts of text to process for example

mathematics. In the same study, teachers reported parents' attitudes as being a significant factor in determining the extent to which children who used print accepted Braille. It was reported that positive attitude to braille among parents, class teachers and learning assistants was essential if braille was to be introduced successfully. The present review sought steps teachers use in setting up braille literacy programme. Lusk and Corn (2006a) observed that a single-medium policy was common in the United States in the 1970s but currently, dual media is regarded as a positive advantage for some children. They examined dual-media learners in the United States and investigated the instructional approaches and curricular decisions in teaching dual media to students with low vision, reporting the teachers' expectations for future levels of literacy, the students' present literacy levels and reading rates. The study not only found a generally positive attitude towards both print and braille among the students, but also that the most common factor in teachers' decision to introduce dual media instruction was a major concern among teachers and parents owing to the progressive nature of the child's eye condition.

2.3 The Order of Teaching Braille Alphabet

Toussaint and Tiger (2010) notes that "one of the earliest skills for braille literacy development is the ability to name individual characters correctly". Struggle in learning this foundational skill hinder the acquisition of learning more complex braille-reading skills later on, such as producing and joining the letter sounds. The researcher further highlights the significance of naming braille letters correctly as an antecedent for braille reading, however, not enough research is available on effective methods for teaching this skill and it is rarely incorporated in the braille curriculum.

Swenson (2008) remarks that there is nothing wrong about the "letter of the week," which is a frequently used approach in kindergarten (KG) classes, nor is it essentially the most successful practice to introduce the letters of the alphabet in order. The researcher notes that besides using both approaches, the KG students may be more interested and invested in their learning as they choose the letters and words with which they have an emotional connection with (Swenson, 2008). And as soon as they learn few alphabets and words, they start to read and write sentences about people, places and activities that they understand (Swenson, 2008).

McCall, McLinden and Douglas (2011) stressed the importance of the order in which braille symbols are taught to minimize the confusion of reversals and inversions etc. (McCall et. al., 2011). Mangold (2015), designed "The Mangold Braille Programme of Tactile Perception and Braille Letter Recognition," which is used to teach tracking and beginning braille. It teaches the tactile perception, recognition of symbols, surfaces, geometric shapes and braille alphabet to children. The students gain the ability of recognizing tactile symbols by touch and read letters, in a right way without any confusion. D'Andrea (2009) describes the programme created by Mangold as a series of 29 lessons to improve braille reading habits and letter recognition, which indicated that 90% of braille readers in Mangold's study benefited from this approach. The following is the order of teaching letter names:

1. Teaching the first 10 letter alphabet
2. Review the previous letters and add extra dot 3 to make the next 10 letter alphabet.
3. Review the previous letters and introduce the letters a and b.
4. Review the previous letters and introduce the letter s.
5. Review the previous letters and introduce the letter w.

6. Review the previous letters and introduce the letters p and o.
7. Review the previous letters and introduce the letter k.
8. Review the previous letters and introduce the letter r.
9. Review the previous letters and introduce the letters m and e.
10. Review the previous letters and introduce the letter h.
11. Review the previous letters and introduce the letters n and x.
12. Review the previous letters and introduce the letters z and f.

The relevance of braille in the modern technological era has become a heated debate among educators of learners with visual impairment. In the USA, controversy surrounded the publication of an article in the New York Times Magazine in December 2009 when a successful blind business executive questioned the continuing relevance of braille in the new information technology era, describing braille as "an outdated means of communication which for the most part should be abolished" (Aviv, 2009). The article prompted a strong defense for Braille in publications such as the NFB's Braille Monitor.

In the UK, a recent RNIB-funded research project investigating braille teaching to adults with acquired sight loss (Douglas, Weston, Franks, & Clements, 2009) identified a perception by some rehabilitation workers and blind people on the need to make a choice between teaching or learning braille and teaching/learning technology skills. In their comprehensive book "Assistive Technology for Students who are Visually Impaired" Presley and D'Andrea (2008) discuss the impact of developments in technology and its effect on access to information for learners who are blind in inclusive schools. They underscore the rapid changes in a society where much of the information is digital in origin and has not been converted from print, but is created,

shared and accessed in electronic form. According to Presley and D'Andrea (2008), indications about when to introduce specific technology skills can best be determined by looking at the tasks sighted classmates are doing. They reflect on the commonly held view that children with visual impairment need to be able to use a combination of technological tools to accomplish literacy tasks in both printed and electronic form. They describe a technology practice that begins with low tech tools, moving to increasingly higher tech tools as children's skills increase with age.

Other researchers and commentators have adopted a different standpoint or approach, advocating for early exposure to technology to support the development of literacy. In an investigation on the use of technology in early literacy teaching, Murphy, Hatton and Erickson (2008) carried out a survey of specialist visiting teachers of pupils with visual impairment who work with preschool children in the USA. They found that most preschool children with visual impairment were not given access to assistive technology devices that may potentially facilitate literacy development, with only 3% always, providing access to electronic text from the internet.

In another study, Kelly and Smith (2008) found that young people with visual impairment used computers and telephones for social purpose not only less often than sighted children, but also less often than some other disability groups. They identified the use of assistive technology devices and software to access digital social networking forums as a 'component of the specialized Expanded Core Curriculum that is taught to students who are visually impaired' (p. 538). A year later, Kelly (2009) analyzed data collected between 2001 and 2004. It revealed that between 59% and 71% of the students with visual impairment in the USA who were most likely to benefit from assistive technology did not have the opportunity to use it. They argued

that access to information and social networking websites through mobile devices, via adaptive hardware and software is vital if children and young people who are visually impaired are to connect fully with others. Kelly recommended that immediate attention be given to this area which has the potential to overhaul the education of students who are visually impaired.

In another American study on the use of assistive technology for students with visual impairment, Zhou, Parker, Smith and Griffen-Shirley (2011) reported that the lack of skills and knowledge by teachers of pupils with visual impairment was a main barrier hindering the use of technology in schools. In an attempt to understand the specific deficits in knowledge and skills of qualified teachers for pupils with visual impairment, they asked 165 teachers in Texas to compare the levels of expertise they perceived they had with the level of those they perceived they were expected to have across 74 competencies for teachers of pupils with visual impairment related to Assistive technology as defined by Smith et al. (2009). The survey revealed a self-assessed deficit in 55 of the 74 competencies. They also found that only 41% of the teachers surveyed felt confident or very confident that they could teach most or all forms of assistive technology. Among the competencies where teachers felt they were lacking were: assistive devices relating to Braille literacy and its application, use of screen reading software, use of braille translation software, electronic braille devices and sourcing funds for technology devices. The researchers concluded that training in this area needed strengthening through increased emphasis on the topic in specialist teacher preparation programmes and through better in-service training for qualified teachers of pupils with visual impairment. Given the pace of change in this sector however, they believed that the development of "assistive technology specialists" as

"new types of professionals in the field of visual impairment will ultimately be necessary." (p. 208).

In Kenya, digital literacy programme has been introduced in all primary schools nationwide. For learners with visual impairment, specialist teachers will have to train in the use of assistive technology. The question was: Did teachers at the time of the study consider technology superior to braille or were they of the view that the two were complementary? It is for this purpose that the researcher sought to establish teachers' perceptions towards the use of technology and braille in teaching literacy to learners with visual impairment. Literature in this area is nonexistent in the country.

2.4 Resources Used in Developing Braille Reading Skills

Life of an individual who is not able to acquire fundamental information in the environment because of visual impairment is limited substantially. As educational experiences occurring in classroom setting requires seeing generally, students with visual impairment face with difficult situations. Moreover, many experts agree that students with visual impairment may be educated with the sighted students in a general educational setting in the same way (Bardin & Lewis, 2008). However, teachers find it necessary to make some adaptations and changes in the education process. Educational adaptations required for students with low vision or blind students focus generally on education of their reading and writing skills, daily life skills, independent movement skills and relaxation skills. Students with visual impairment use their reading and writing skills and braille alphabet or printed material alternatives. Students with visual impairment may develop reading and writing skills in the level of their peers through appropriate teaching and assessment activities.

Many tactile reading tools, devices and materials have been produced for individuals with blindness in the past two centuries. Majority of reading books was produced by using embossed letters printed by using thick ink print method. Furthermore, students with blindness were included in the educational process by using carved wooden letters and letters made by using bent wire. In the following periods, braille alphabet consisting of various codes for students with visual impairment was developed. Braille alphabet was invented by Louis Braille (Nolan & Kederis, 2020). Many applications are being developed in order to simplify lives of individuals with visual impairment thanks to this alphabet. Each braille character included in braille alphabet is made of 6 points, as 2 columns and 3 lines. Owing to the alphabet generated by domination of some points over the other points in each letter, individuals with visual impairment are to feel and read (Wetzel & Knowlton, 2000). Individuals with visual impairment feel the dominating points in braille letters by their hands and read. Braille symbols are created in field units known as braille cells. A braille cell is made of six points of different combinations consisting of three points and two parallel vertical columns. It is possible to generate 63 combinations by using one or more of these six points. Cells are used to represent a letter, number, punctuation and a part of a word or even the entire word. In case a student is not able to read large font print on a normal size paper or the student could not achieve functional reading speed by using few optical devices, braille literacy must be considered as a complementary means (Wetzel & Knowlton, 2000. It is not sufficient to read braille texts and to have only cognitive skills and fundamental terms, at the same time, finger sensitivity and fine motor coordination must be possessed to maintain continuous touching and systematic follow up on paper (Willings, 2019).

Reading process is achieved by the help of two hands and index fingers. Average reading speed is 125 words per minute. However, it is possible attain higher speeds up to 200 words per minute. Large font books and text magnifying devices are the means used by students with low vision in the teaching of reading and writing. Whereas normal sighted students use books written with 10 or 12 font sizes, students with low vision can benefit from books printed by using font sizes in the range of 18-24. Due to carrying and storing problems of large font books, students with low vision use optical devices (magnifiers and lenses) instead of large font books.

Any adaptable device or service improving participation, success or independence of a student with special need is regarded as assistive technology. What devices, tools and technologies would be appropriate for meeting learning needs of the student must be determined based on personal needs of the student (Petrie & Gill, 2020). Assistive technologies must provide students independency, instead of giving them unrighteous advantage, to compete with their peers effectively (Gompel, van Bon & Schreuder, 2004). Assistive technologies help students with visual impairment access general curriculum and improve their academic performance (Smith et al. 2009). Some of these technologies ensure access to information provided in electronic environment and the others are devices to be used independently (Smith et al., 2009). Talking calculators, talking computers with print out, braille printers, braille computer with no paper produced based on technological advances are some of electronic assistive technologies assisting these individuals (Hersh & Johnson, 2008). Majority of blind students who are blind can use various assistive technologies, including readers, cassette recorded books and sometimes braille materials. Furthermore, students may also need assistive materials consisting of diagrams, schemes, pictures, embossed maps and three-dimensional models of physical organs and drawings of figures and

microscopic organisms. Some of assistive materials to be used by students with visual impairment are as follows:

2.4.1 Braille imaging device

Braille imaging device is an electronic environmental tool improving interaction of individuals with computer and connecting to a standard computer with a special cable and converting braille characters sent to computer monitor to a normal text. Students transform this text to normal writing when writing a text by using braille characters.

2.4.2 Braille printer

Braille printer is a printer used to generate copies of braille texts and it works when connected to a computer. Students can print braille copies of their personal notes, written questions and documents about the class by using braille printer.

2.4.3 Electronic braille note taker

Students may take notes in class by using this device supported by braille keyboard. These notes may be transferred to a computer later on to be saved or may be printed in braille print formats. Majority of note taking devices have word processors, calculators or clocks. They have almost any feature of a computer. Some note taking devices have braille talking programmes as well. In other words, students transform a text they have written in braille format into an audial language used daily. Note taking devices are in the size of a book in general and can be carried by students easily.

2.4.4 Talking books

This technology offers unmatchable opportunities to students with visual impairment to make information more accessible. Books read vocally are recorded in an electronic environment or a cassette and prepared for student access. Websites having

a talking book collection and designed specifically enable students to access information about specific disciplines without a need for any special hardware. These websites may be accessed by means of smart telephones or tablets. However, educators must not only trust talking books because students need to use magnified printed text or braille in order to develop their literacy skills effectively.

The question of whether the huge increase of information in digital form that can be converted into speech means that children with blindness are now less reliant on braille is a controversial one. Presley and D'Andrea (2008, p337) acknowledged that accessing print information through auditory means often initiates concerns among specialist teachers of pupils with visual impairment about 'giving up' on the students' use of braille. They go on to argue that speech access should be regarded as a useful tool to support learning 'once literacy skills are firmly established' (p337) and note the limitations of speech as a primary learning medium. As an example, they point out that use of compressed (speeded) electronic speech may be useful for reading a chapter in a history textbook, but is unlikely to be of similar value when reading a maths textbook. However, the authors of this report believe that although computer-based speech access alone would not be an appropriate or satisfactory route to literacy for any child, the position that children who are blind should have limited access to digital technology until braille literacy is established is unrealistic.

While screen reading software with speech output (e.g. Jaws) is in common use in schools and colleges, a technical solution which allows for accessing digital information through braille rather than speech is also available in the form of refreshable braille displays (electro-mechanical devices for displaying braille characters). Presley and D'Andrea (2008, p103) argue that providing braille readers

with access to electronic text through the use of a refreshable braille display can, 'even at a young age ... increase their library from just a few books to hundreds'. Refreshable braille is available in a range of forms. It can be accessed through peripheral hardware devices that can be connected to standard computers to allow users to read by touch what appears on the computer screen. These devices contain displays commonly made up of a single row of 40 or 80 refreshable cells, and typically have in built navigation devices to allow readers to negotiate large amounts of text usually in either contracted or uncontracted braille. These freestanding displays remain relatively expensive and although precise figures are not available, they are thought to be still relatively uncommon in UK schools. However, braille note-takers (portable braille computers) with inbuilt refreshable braille displays are in more common use. The braille displays on note-taker devices are normally shorter (18-30 cells), but the note-takers often allow for the option of speech or braille outputs.

Obviously, literacy is not just made up of access to text (reading), but also involves writing, and here the choice for children who are blind essentially rests between devices with braille or QWERTY keyboards. Note-takers, for example, may have braille or QWERTY keyboards and there are clear advantages for children to have mastery of both input options. Therefore, a relevant question is 'when should children who use braille be taught QWERTY keyboard skills?' According to Presley and D'Andrea, as a broad rule of thumb, indications about when to introduce specific technology skills can best be determined by looking at the tasks sighted classmates are doing (although they do see advantages in the proactive teaching of technology skills to anticipate future needs). They reflect the commonly held view that children with visual impairment need to be able to use a combination of technological tools to accomplish literacy tasks in both printed and electronic form. They describe a

'technology continuum' that begins with low tech tools, moving to increasingly higher tech tools as children's skills increase with age. For example, moving from a mechanical or semi mechanical writing machine that produces hard copy to a portable braille notebook with a refreshable braille display. Other researchers and commentators have taken a different, arguably less conservative, approach advocating early exposure to technology to support the development of literacy.

In an investigation of the use of technology in early literacy teaching, Murphy, Hatton and Erickson (2008) carried out a survey of specialist visiting teachers of pupils with visual impairment who work with preschool children in the USA. They found that most preschool children with visual impairment were not given access to assistive technology devices that may potentially facilitate literacy development, with only 3% always, or almost always, providing access to electronic text from the internet e.g. digital books, 15% providing regular access to screen reading software, and 20% to CCTVs on a regular basis.

Kelly and Smith (2008) found that young people with visual impairment used computers and telephones for social purposes not only less often than sighted children but also less often than some other disability groups. They identified the use of assistive technology devices and software to access digital social networking forums as a 'component of the specialised Expanded Core Curriculum that is taught to students who are visually impaired'. (p538). Kelly (2009) analysed data collected between 2001-4 that suggested between 59% and 71% of the students with visual impairments in the USA who were most inclined to benefit from assistive technology did not have the opportunity to use it. They argued that access to information and social networking web sites through mobile devices via adaptive hardware and

software is vital if children and young people who are visually impaired are to connect fully with others academically, professionally, and socially. Kelly recommended that immediate attention should be given to this area which has the potential to re-orient the education of students who are visually impaired.

Zhou, Parker, Smith and Griffen-Shirley (2011) in another American study of the use of assistive technology for students with visual impairments reported that a major barrier hindering the use of technology in school was the lack of skills and knowledge by teachers of pupils with visual impairment. In an attempt to understand the specific deficits in knowledge and skills of qualified teachers of pupils with visual impairment, they asked 165 teachers in Texas to compare the levels of expertise they perceived they possessed against the levels of expertise they perceived they were expected to possess across 74 competencies for teachers of pupils with visual impairment related to assistive technology defined by Smith et al. (2009). The survey revealed a self-assessed deficit in 55 of the 74 competencies. They also found that only 41% of the teachers surveyed felt confident or very confident that they could teach most or all forms of assistive technology. Among the competencies where teachers felt they were lacking were: assistive devices relating to braille literacy and its application, use of screen reading software, use of braille translation software, refreshable braille displays and related software, electronic braille devices, and sourcing funds for technology devices. They concluded that training in this area needed strengthening through increased emphasis on the topic in specialist teacher preparation programmes and through better in-service training for qualified teachers of pupils with visual impairment. Given the pace of change in the area however, they believed that the development of 'assistive technology specialists' as 'new types of professional in the field of visual impairment will ultimately be necessary' (p. 208).

Kelly and Smith (2011) analysed research into the impact of assistive technology on the educational performance of children with visual impairments. They make the point that assistive technology tends to be developed faster than what researchers can evaluate, so evaluating its effectiveness on educational performance is very difficult. While acknowledging that there was a wide knowledge base relating to technology in the field of education and visual impairment, they concluded that 'the extent to which the field has researched the effectiveness of assistive technology used by students who are visually impaired using rigorous, scientific-based methods is close to non-existent.'(p79). The only article that met their rigorous search criteria was an early study by Koenig and Holbrook (2010) that found no significant difference between the use of a mechanical and an electrical version of a Perkins brailler on writing rates and accuracy.

Kelly (2011) provided the results of a secondary analysis of data from a national longitudinal study that included the views of parents of children with a visual impairment. Children whose parents were confident that their children would get a paid job were 1.5 times more likely to use assistive technology, and children of parents who took an active part in parent meetings or parent training sessions were 1.4 times more likely to use assistive technology. In addition to the importance of parental involvement and expectations as predictors for technology use, she found that placement was also a salient factor in determining likelihood of the use of technology. She found that high school students with visual impairment who attended residential schools were 1.8 times more likely to use assistive technology devices than those who did not attend such schools.

Given the range of options and the lack of clear evidence about the relative educational effectiveness of devices, decisions about the type of technology the child needs, e.g. whether to use an accessible conventional laptop or a dedicated braille computer (Braille Personal Digital Assistant, PDA), are often difficult ones to make. Nevertheless, Presley and D'Andrea (2008) argue that a comprehensive assistive technology assessment forms a 'critical part of the education' for each child with a visual impairment, and should follow on naturally from a clinical low vision evaluation, a functional vision assessment and a learning media assessment. They see these assessments as essential to determine which sense the student can most effectively utilise to obtain information from the environment. They provide (very) detailed preformats in their book for such assessments.

A related issue to the development of technology is the move to create a single braille code which could be applied across all subject areas (except music) and all English-speaking countries. The Unified English Braille (UEB) code would make it easier for computer software to translate contracted braille to print and print to braille. It is designed to allow for the more precise capture in braille of the subtleties of print presentation. With increased exposure to digital information derived directly from print, children who are blind need increasingly to be aware of print conventions and layout when accessing or communicating information through screen readers or QWERTY keyboards, and UEB has the potential to improve this awareness. UEB has already been adopted as the standard code by countries such as Australia and there is a move to recognise it as the standard code in the UK.

The empirical literature in relation to the interaction between digital technology and the teaching of literacy through braille appears to be underdeveloped. However, there

is no evidence in the research literature to support the view that technology has an adverse effect on the development of literacy through braille. It is also difficult to find hard evidence for the argument that developments in technology make it more likely that teachers will sustain instruction through print to the detriment of braille instruction (see also the section of this report on dual media use). There is surprisingly little research into the potential of digital technology to support the teaching of early literacy through braille. Research does however suggest that digital technology can play a key role in supporting the consolidation of braille literacy skills through developments such as refreshable braille, and has the potential to provide children with hugely increased access to braille text in both digital and hard copy formats. In relation to the timing of the introduction of technology that uses speech rather than braille to access text, there appears to be a disagreement between commentators as to the best pedagogical approach to take: some argue caution, believing that early introduction to speech technology may undermine braille literacy development; while others focus upon the importance of the teaching of ICT skills as early as possible. Further reflection and research is needed in relation to this emerging issue so that clear guidance can be offered to teachers.

The authors of this report believe that advances in digital technology should not be seen as a threat to braille, the threat comes from children not having sufficient access to the technology that can enhance and encourage learning through braille. It is essential that children who are blind should have access to technology that will allow flexible access through both touch and hearing to the wave of digital information that is entering the classroom and helping to shape all children's educational development and social communication. Digital technology has huge potential for opening up

access to learning materials in braille and for facilitating more flexible access through braille to key areas such as national examinations.

2.5 Instructional Strategies that Influence the Acquisition of Braille Reading Skills

Vision loss can affect a student's proficiency with learning to read and write. Teachers of students with visual impairments are responsible for conducting comprehensive assessments to determine the optimum primary literacy medium for their students and to identify if there is a need for dual-media instruction in both print and braille (Koenig & Holbrook, 2010). Visual efficiency, reading efficiency, and prognosis are important considerations in the assessment process (Bell, Ewell, & Mino, 2013; Koenig & Holbrook, 2010). If a student is likely to experience progressive vision loss, it is essential to address both immediate and long-term literacy needs, which may require providing reading and writing instruction in both print and braille. Some students begin literacy instruction as dual-media learners, some students begin as print readers and later learn to read braille, and, in rare cases, some students initially read braille and later learn to read print (Koenig & Holbrook, 2010).

Research investigating the reading and academic performance of students who are dual-media learners is limited. Lusk and Corn (2006) gathered information about 103 students in the United States and Canada who were receiving simultaneous literacy instruction in both print and braille. Teachers reported that although 35% of their students were reading below grade level in print, 57% were reading below grade level in braille (Lusk & Corn, 2006). These findings were of concern, since both reading proficiencies were so low. Identification of the factors, assessment strategies, and

materials necessary to support increased print and braille reading efficiency were identified as areas for further study. In addition, Lusk and Corn (2006) suggested that future research explore at what level of visual acuity and visual field should dual media be implemented. A variety of approaches exist for providing braille literacy instruction, including beginning with uncontracted or contracted braille; using a basal reading approach; implementing a whole-language approach; using an individualized, student-centered approach; or utilizing a combination of two or more of these. Prior to the ABC Braille Study, a clear consensus could not be reached on the most effective strategies for teaching braille reading skills (D'Andrea, 2009). The ABC Braille Study found that introduction to more contractions earlier in instruction correlated to better performance on reading measures such as vocabulary, decoding, spelling, and comprehension (Emerson, Holbrook, & D'Andrea, 2009). The authors concluded that regardless of the approach used to introduce the braille code, basic reading skills and processes should be the primary focus of braille literacy instruction (Emerson et al., 2009).

Students with effective literacy skills can derive meaning from what they read, which significantly affects motivation for reading and leads to higher levels of reading achievement (Melekoglu & Wilkerson, 2013). Students who are less engaged in reading are at risk of failing to learn to read proficiently (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). If students lack the literacy skills to obtain meaning from what they read, their motivation for reading decreases or fails to develop altogether. Melekoglu and Wilkerson (2013) reported that a lack of reading motivation limit students' willingness to improve critical reading skills and strategies necessary for academic success. In contrast, students with higher levels of motivation for recreational reading were characterized by increased academic performance and

positive reading behaviors such as engagement and comprehension (Naeghel, Keer, Vansteenkiste, & Rosseel, 2012).

Reading motivation trends among students who read braille mirror those of their print reading peers. Data from the longitudinal ABC braille Study demonstrated that prekindergarten through fourth grade students in the high-achieving reading group were more likely than students in the low-achieving reading group to read by themselves and to report that they liked reading (Sacks, Hannan, & Erin, 2011). Students in the low-achieving reading group were more likely to report that they did not like anything about braille, and students in the high-achieving group more often reported there was nothing they disliked about braille. The researchers concluded that motivation is a critical factor in reading achievement and that teachers of students with visual impairments need to work in collaboration with other team members to identify and implement strategies for motivating students who are struggling to learn braille.

Braille has been the primary reading system for blind persons for over a century. There is general support for the view that reading in braille has much in common with reading through print (Edmonds & Pring, 2006), although the potentially reduced opportunities for the incidental learning of letters and words prior to formal instruction, and the sequential nature of early reading through touch, clearly affect the reading process for children who are blind. For example, beginning braille readers in the USA were found to 'have not yet acquired the tactile proficiency in the act of reading that allows them to process groups of letters or whole words as beginning print readers can' (Emerson, Holbrook & D'Andrea, 2009, p611). In a review of research on the development of phonological awareness by braille readers, Monson

and Bowen (2008) found that research evidence to that date concerning the relationship between phonological awareness and braille was uncertain because of: the lack of commonality among the studies; the extent of contradictory findings; and the small number of studies involving beginning braille readers. The contradictory findings are particularly apparent in relation to children in the 7-12 age range, with Greaney and Reason (2016) finding that braille readers outperformed sighted readers in phonological tests, and Gillon and Young (2002) and Dodd and Conn (2000) finding delays in phonological development compared to fully sighted children.

In a study in UK, Greaney and Reason (2016) measured the phonological performance of a sample of 22 braille readers aged 7:10-12:1 year. They found that the scores achieved for each test of phonological awareness/memory were higher than those expected from the norms of sighted children. However, in spite of this phonological superiority, the braillists did not read as well as sighted children, and Greaney and Reason concluded that progression from phonological to orthographic awareness was hard to achieve for children who were blind. Gillon and Young (2002) compared the phonological-awareness skills of 19 New Zealand children aged 7-15 years who were using braille as their reading medium, with those of a control group of sighted children who were chronologically three years younger but of the same reading age. They found that children who had difficulty reading braille were also delayed in their development of phonological awareness, demonstrating strengths and weaknesses that were similar to those of the younger sighted children.

A study by Dodd and Conn (2000) in the UK, asked children (average age 10:1) with and without visual impairments to segment words phonemically with and without braille contractions. They too found that braillists performed below the level of

sighted children on reading measures, but also found that they performed relatively poorly on phonological awareness skills in comparison with a matched group of sighted children. In particular, they found that the participants who were blind scored lower on segmenting words that contained braille contractions, concluding that the logographic nature of braille (e.g. the fact that contracted braille symbols such as 'the' in the word 'further' can cut across phonological boundaries) affects a reader's ability to segment words phonemically and that some phonological difficulties might be related to 'the nature of contractions in braille orthography'. (p9). In relation to young pre-school children, Barlow-Brown and Connelly (2002) noted that 'congenitally-blind do not receive exposure to environmental print and do not generally learn to recognise written letters of the alphabet prior to schooling in braille.' (p259). In comparison, Treiman and Rodriguez (2018) found that most fully sighted children begin school able to recognise approximately 15 print letters. Barlow-Brown and Connelly found that blind children 'with no knowledge of written letters or written words showed no ability at measures of phonological awareness' whereas 'Blind children with knowledge of written letters and no written words showed much increased phonological awareness' (p259). The authors noted that letter learning is a major contributor to the development of phonological awareness in children who are blind, and phonological awareness skills develop only after children who are blind experience a written form of language, arguing that 'learning to recognise braille letters provides the impetus for improvements in phonological awareness' (p267). They concluded that, whereas for sighted children knowledge of letter names goes hand-in-hand with knowing what the letter name refers to (the orthographic symbol), 'until blind children learn braille letters, they cannot make this connection and the development of phonic awareness is stifled as a consequence' (p267).

In a survey of the early literacy practices of 192 specialist visiting teachers of pupils with visual impairment who work with preschool children in the USA, Murphy, Hatton and Erickson (2008, p136) investigated strategies for promoting phonological awareness used by teachers. These included: singing and listening to songs, nursery rhymes and chants; reading stories with interesting sounds/rhythms; building knowledge of sound-symbol associations in meaningful contexts; inventing words that rhyme with child's name; playing with sounds in words (e.g. tongue twisters, nonsense rhymes); playing word games with children to identify beginning sounds in words; pointing out particular sounds in words when reading a storybook; emphasising the number of syllables or phonemes in spoken words (p140). The study found that most teachers did not use direct structured instruction to promote phonological awareness, such as pointing out particular sounds in words or emphasising the number of syllables or phonemes in spoken words, nor were they implementing recommended practices in early literacy such as promoting phonological awareness and the function of writing. The authors suggested that this may be for want of an access to current resources on teaching literacy, and concluded that there was a need for the development of resources that address phonological awareness skills.

Crawford and Elliott's research into phonological methods for learning to read braille involved six Australian braille readers in primary schools (Crawford & Elliott, 2007). Crawford found that teaching braille letters as phonemes resulted in more efficient performance than teaching braille letters as graphemes, and they reported that their work confirmed results from an earlier study with preschool blind children (Crawford, et al., 2006) which found that introducing braille words as onset- rimes 'produced

statistically significant better performance in comparison to instruction in braille words as whole words' (p542). This in turn mirrored the findings of Vik and Fellenius (2007) with six primary school braille readers in Norway. This finding implies that some contractions may interfere with a style of teaching which emphasises phonic analysis, for example, simple upper word signs (such as 'p' for people), or where contractions do not align with phonic boundaries (such 'the' in 'other' and 'of' in 'roof'). Studies of blind children in the early stages of schooling generally support the view that they match children who are fully sighted in most aspects of phonological awareness. However, Emerson, Holbrook and D'Andrea (2009), reporting on the findings of the ABC Braille study, suggest that while young beginning braille readers in kindergarten and first grade (ages 4-6) did not have great difficulty acquiring basic reading skills, they began to show 'deficiencies in acquiring higher level decoding skills' (p621) in second grade and above (age 6+ years). The tests that focused specifically on phonemic awareness showed most children in kindergarten (75%) had acquired 5-7 of the 7 basic skills for this age range including blending word parts, blending phonemes, detecting initial sounds, and linking letters to sounds. By first grade the children had developed 7 or 8 of the 8 basic reading skills, including substituting initial/final consonants, and blends in the final position. However, when it came to applying these phonological skills to acquire higher level skills such as recognising CVC words (e.g. mat), or CVC words with a 'Magic E' (e.g. mate), children's results were much less consistent. Indeed, Erickson and Hatton (2007) identified specific strategies such as repeated readings, direct instruction in phonics, and big word decoding that emphasizes morphemes, as being of great benefit to school-aged children with visual impairments and blindness.

Also, Hatton, et al. (2010) examined the phonological awareness of 22 young children with visual impairments and no additional disabilities aged 4-7 (average age 5.4). The study tested for syllable-segmentation, 'sound-isolation' (the ability to recognise onset and produce isolated sounds at the beginning of words), and sound-segmentation skills (the ability to segment individual words into sounds and phonemes) and 'letter sound knowledge' (the ability to identify letters and digraphs when they are written down). The study found that the phonological awareness skills of the children in the sample was commensurate with those of children who were fully sighted. It also found that within the sample of children who are visually impaired, potential braille readers scored better on the first three tests than potential print readers. Among the possible explanations they put forward for this finding was that potential braille readers are more attuned to the sounds in oral language than potential print readers who may be more attuned to visual stimuli. Another suggested reason was that parents and teachers focus more on the development of phonological skills in potential braille readers because they realise that these children may not acquire them incidentally through vision.

Hatton et al.'s conclusions (2010) tally with earlier findings of Millar (2020) who found that 'the phonological skills and preferences of young children who are blind should make it easier for them to learn the phonemic detection and segmentation skills that are needed for learning braille'. As mentioned by Conroy (2005), teaching English to visually impaired students is a technique where the teacher can combine the strategies such as create, modify, and adapt lessons referring to student's needs. The most important in teaching the blind is advanced planning, organization for structuring the learning environment, and the materials used in teaching. According to Basaran (2012), it is clearly indicated that EFL teacher in Turkey almost have the

same teaching techniques and material to teach sighted students and the blind. Furthermore, none of the teachers' had any formal training on teaching English to. Eventually, they had several challenges and problems and they did not know how to solve it. In the meantime, the students with visual impairment have different social behavior and learning styles.

Moreover, there were experiences from three English teachers in Indonesia as stated by Susanto and Nanda (2018) regarding their strategies in teaching English to students with visual impairment. The students described that some of their teachers were unknowledgeable to effectively teach them and they also thought that their teacher was lacking an interest to help them succeed because of the extra effort required to understand and provide for student's needs. Meanwhile, one English teacher named EK mentioned that braille takes a longer time to learn new words in the classroom. And, it creates an added step to the learning process that is not essential to learning the new words for the students. Students GV, JW and DS found that braille in learning new words were inconvenient. They felt that it was also time consuming for them. We noticed that in the classroom, the students learnt and memorized the new words and they preferred to give up using of Braille texts completely unless the teacher used the texts.

In addition, a study was conducted by Efstathiou and Polichronopoulou (2015) indicated that the teaching materials used by teachers are partly consistent with Conroy's study. Specifically, Conroy's study concludes that most teachers use frequently tactile objects (N=52, 78.8%), audio recordings (N=49, 74.2%), braille materials (N=47, 71.2%) and large print materials (N=45, 68.2%). It concluded that the teachers reported facing more difficulties in using tactile materials, braille

materials, tactile books and magnifiers. Furthermore, Topor and Rosenblum (2013) presented the list of six common strategies used with English language learners who are visually impaired which covered; use of the natural approach, building vocabulary, language experience approach, and speak simply.

a. Use of the natural approach. In teaching reading, English speaker should use the new language when delivering the material. The language used by English speaker also is based on student's level of English proficiency.

b. Building vocabulary. Selecting targeted words or phrases to build a child's vocabulary.

c. Language experience approach. In this strategy, students produce ideas for stories by their own words. The stories are based on the students' actual experiences. It means the content of the stories can be predicted.

d. Speak simply. While teaching English to the child, the English speaker should select oral language at their level of comprehension to facilitate learning.

e. Physical approach. English speaker must be able to make physical approach by restate the student's response.

f. The Sheltered Instruction Observation Protocol (SIOP). A model of teaching for promoting the students' English language development by learning in strategic ways. It focuses on teaching content to make the subject matter concepts understandable.

Furthermore, Conroy (2005) also classified teaching strategies for students with visual impaired into seven variations, which are; total physical response, cooperative learning, learning centers, interactive read aloud, writing workshops, language experience approach, and guided reading.

a. *Total Physical Response*, an approach that uses the research on first-language acquisition. Students acquire a first language by developing receptive language and develop their understanding through moving their bodies and they attempt to speak until they are ready. The students follow the command by performing the actions that demonstrate expected movement by the teacher. The teacher uses demonstration slowly while student responds to the verbal commands. This method is adapted by teacher with putting the students with a visual impairment through the motions of the expected movement while using the appropriate verbal command. In the first method, the teacher gives the verbal command such as "Stand-up" and assists them to stand up. While the students have understood what the words mean, the teacher uses only the verbal "stand up" and they can perform the action without assistance by the teacher and they understood the vocabulary.

b. Cooperative learning, a strategy which students work together in the groups to accomplish a task. According to Johnson, Johnson, & Holubec (2022) as cited in Ning (2010) that cooperative learning is a part of strategies in which students work together in a small group to maximize their own and each other learning. Likewise, Cooper and Mueck (1990) as cited in Tuan (2010) defined Cooperative Learning as a structured and systematic instructional design in which students in small groups work together to reach a common goal.

A current debate in literacy instruction for children who are blind revolves around whether reading and writing in braille is best introduced through uncontracted braille or contracted braille. Since the 1970s contracted braille has been commonly used in the UK as the medium of instruction for young braille readers. However, as increasing numbers of young children who use braille as their main medium for literacy receive their education in mainstream settings, their literacy skills are developed within the

context of a national framework for the introduction of literacy with a predominant focus on the teaching of reading through print. It is argued by some teachers that the 'letter-for-letter' correspondence with print that uncontracted braille offers, allows greater opportunities for literacy learning alongside sighted children. Another argument is based around the fact that in mainstream settings, literacy instruction in braille is often delivered by a range of non-specialists professionals (e.g. mainstream class teachers or teaching assistants) who may have little or no experience of supporting a braille reader (Keil & Clunies-Ross, 2002). As such, it is argued that uncontracted braille allows for greater participation of non-specialists in the teaching process.

Arguments used by professionals for the use of an uncontracted alphabetic braille code are generally linked with the perceived increased opportunities for inclusion, and stress the benefits it affords for learning alongside print readers and the concomitant social benefits that arise from co-learning. It is also argued that uncontracted braille improves spelling because children learn words in the original uncontracted form, (seen as a particular benefit when writing using Qwerty keyboard technology). On the other hand, proponents for the early introduction of braille contractions argue that it can allow 'beginning readers to take in larger chunks of text at a time and thus help them to process information faster' (Emerson et al., 2009, p 611), as well as helping to avoid the teaching of familiar words in two different forms – uncontracted and contracted braille. Hong and Erin (2004) compared the reading and spelling skills of students who were taught to read using uncontracted braille with those of students who were taught to read using contracted braille. They found no significant differences in performance over a range of skills, such as reading speed, reading accuracy, comprehension, and spelling ability, between initial instruction in the two

types of braille. Nor did they find any evidence that 'changing to contracted braille later in school will impede the speed and efficiency of reading' (p335). While acknowledging that contracted braille takes up to around a quarter less space, they questioned the assumption that it increases reading rates, citing Troughton (2022).

In the UK, Clunies-Ross (2005) summarised the contemporary debates in the United States over the use of uncontracted braille, noting its increasing use with particular groups, including beginners of all ages, children with learning difficulties, mainstream teachers, and parents. She reported that uncontracted braille is generally seen as an additional option rather than a replacement for contracted braille, and it is usually introduced on the assumption that learners will make the transition from uncontracted to contracted braille at some stage in their future learning. Clunies-Ross noted concerns in Canada about the lack of books in uncontracted braille for early learners and anxieties that there are no guidelines to help teachers of students make the transition from uncontracted to contracted braille. She also reports a "heated" debate about whether to teach uncontracted or contracted braille to beginning readers in Australia, noting that in 'integrated' classrooms uncontracted braille is perceived as easier to teach and manage, but that there are concerns that staff members who have only uncontracted braille knowledge may be unable to facilitate children's move to contracted braille. Clunies-Ross reported claims that in Scandinavia the policy of producing all materials in uncontracted braille has increased the number of users and made production more economically viable. She concluded that the "place of uncontracted braille is growing within the range of options on offer to blind readers" and suggested that "new groups such as older learners, very young learners, those in mainstream education, those who are adventitiously blind, children with learning

difficulties and people for whom English is a second language are finding it easier to learn" (p. 72).

Despite these reported claims, this review could not identify any empirical evidence about the relative long term effects on reading literacy achievements of instruction through uncontracted or contracted braille. Typical braille learners make the transition from uncontracted and contracted braille at some point, albeit at different rates, and even though teachers may report using 'uncontracted' braille, it is rare that no contractions enter into the child's reading and writing. This has a confounding effect on research in this area, because of the difficulties of identifying a group of typically developing children who can read uncontracted British or American braille fluently but have no knowledge of contractions. This confounding effect was referred to in the five-year longitudinal ABC Braille Study ('Alphabetic Braille and Contracted' braille), which tracked the progress of 42 children in Canada and the USA who were introduced to literacy through braille (Emerson et al., 2009). Although the children's teachers had identified their approach at the start of the study as 'contracted' or 'uncontracted', most students in the 'uncontracted' group did learn contractions, but not as many as those in the 'contracted' group. What distinguished the two groups was the degree of 'contractivity' involved in their instruction.

At the end of the study, researchers compared the progress of five children who had been taught fewer than 25 contractions (low contractivity) with five who had been taught all 189 contractions (high contractivity). When the reading outcomes of the two groups were measured 'students who were reading primarily uncontracted braille were reading at much lower levels and demonstrating worse vocabulary and spelling skills' (Emerson et al., 2009, p620) than the children in the high contractivity group.

The children who were introduced to more contractions earlier in instruction performed better on virtually all reading measures including vocabulary, decoding, and comprehension and the use of contractions did not seem to impinge on fluency in oral reading.

On the face of it, this seems to suggest unqualified support for use of contracted braille from the start. However, since there was no matching between the two sample groups in the study design, it was not possible to conclude definitively that the differences between the groups could be attributed to the introduction or non-introduction of contractions. As the findings suggested, it could be, for example, that the children in the 'high contractivity' group were introduced early to contractions because they 'showed an early aptitude for reading' Emerson et al., p621).

The argument that uncontracted braille affords more opportunities for social interaction with sighted children in mainstream settings was also investigated as part of the ABC Braille Study. Sacks, Kamei-Hannan, Erin, Barclay, and Sitar (2009) compared the social experiences of beginning braille readers in literacy activities using a mixed qualitative and quantitative design. They found no differences in the quality or quantity of social experiences over time between children introduced to literacy through contracted and uncontracted braille. Nevertheless, children's level of achievement in acquiring literacy skills was found to be strongly correlated with the frequency and quality of their interactions with their sighted peers. They recommended that further research should be conducted to determine whether children experience more interactive social experiences in literacy as they become more efficient with braille reading and writing, and to determine if group work with peers in literacy activities influences positive social outcomes.

2.6 Summary of literature review

There is general support in the literature for the view that phonological instruction is beneficial for beginning braille readers and importantly, that there are key similarities in the underlying processes of reading development whether a child is using braille or print. Further, there is some evidence to suggest that typically developing children who are blind compare well to children who are fully sighted in acquisition of early phonological skills, but take longer to develop higher level phonological skills and apply them to reading.

The empirical literature in relation to literacy development, and the teaching of literacy through braille appears to be underdeveloped. It seems there is no evidence of research available in Akropong School for the Blind in particular on what instructional methods and how the use of it by teachers influence the literacy development of learners especially, those with visual impairments. It is also difficult to find hard evidence for the argument that developments in technology make it more likely that teachers will sustain instruction through print to the detriment of braille instruction

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This section dealt with the methodology for the study. The following areas were covered; research approach, research design, population, sample size, sampling technique, instrumentation, trustworthiness and dependability, and procedure for data collection, data analysis and ethical considerations.

3.1 Research Approach

The study employed the qualitative research approach to explore instructional strategies employed by teachers in Akropong School for the Blind in developing braille reading skills in the students. Qualitative research involves an interaction between the researcher and the researched in the socio-cultural/ naturalistic context of participants of a study (Kusi, 2012). Qualitative approach was appropriate for the study because the study explored participants' views/opinions with regards to the instructional strategies they employ to develop braille reading skills in their students who are blind. Findings of the study were arrived at through the exploration of participants' in-depth views and opinions using interviews and observations but not by statistical procedures and quantification or generalisation. In qualitative research, Bryman (2008) and Creswell (2018) suggested that participants are expected to give detailed rather than general information on the features of the specific phenomenon under investigation. Qualitative research approach considers collecting information from participants in order to understand the phenomenon under the study from the perspectives of those involved in the research (Ary, Jacobs & Sorensen, 2010). The current study therefore sought to use the qualitative approach, in order to have a detailed account of the instructional strategies employed by teachers in Akropong

School for the Blind in developing the braille reading skills of their students. This account will come from the teachers' own perspective.

3.2 Research Design

The study employed the case study design (Yin, 2014) because the study sought to understand the unique teaching strategies adopted by the teachers of the Akropong School for the Blind. This case study design offered the researcher the opportunity to investigate in-depth, instructional strategies employed by the teachers in Akropong School for the Blind in teaching braille reading to their students who are blind (Maare, 2007).

3.3 Population

The study was conducted in Akropong School for the Blind in the Eastern region. The target population of the study included all the teachers in the school. The total population of the study is thirty teachers (*n=30*) as shown in Table 1.

Table 1: Distribution of the Target Population for the Study

Population	Frequency (n=30)
Junior High School Teachers	8
Primary Teachers	18
Kindergarten Teachers	4
Total	**30**

Note. Field data, 2021

3.4 Sample

The total sample size for the study was twelve (*n=12*) participants comprising 4 teachers each from the Junior High School (JHS), the Primary, and the Kindergarten. These sample size comprised teachers who taught any of the languages in the school

(English, French or Twi), or specifically teach braille, or teach pre-reading activities in the Kindergarten.

Table 2: Distribution of the Sample Size for the Study

Population	Frequency (n=12)
Junior High School (JHS) Teachers	4
Primary School Teachers	4
Kindergarten Teachers	4
Total	12

Source: Field Data, 2021

3.5 Sampling Technique

The researcher employed a non-probability sampling technique involving the purposive sampling techniques in selecting the participants. The purposive sampling technique was employed in selecting the teachers for the study. The researcher purposely selected the teachers because not all the teachers teach braille reading or languages. With the help of the headmistress of the school, the list of teachers who handle braille reading and the languages was made available to the researcher together with the teaching timetable.

The researcher therefore purposively chose the teachers who taught either braille reading or any of the languages (English, French, and Ghanaian Languages) in the school since they were in a better position to respond to the phenomenon under study, thus the instructional strategies they employ in teaching braille reading skills to their learners. So, since the researcher wanted to ascertain the phenomenon of braille teaching strategies in the school, she purposely chose the teachers who taught languages or braille reading since these are subjects that involve the teaching of

reading hence, they were in the best position to give the situational report to the researcher (Avoke, 2005; Fraenkel & Wallen, 2000).

3.6 Instrumentation

The instruments that were used for the study were observation checklists and semi-structured interview guides.

3.6.1 Semi structured interview guides

A semi-structured interview guide was used for collecting the data for the study. According to Avoke (2005), interviews can be described as a dialogue. Babbie (2007) explained that questions used in semi-structured interviews tend to be open-ended so that the interviewees are at their own will to decide how they will answer questions in terms of the words they use and the length of response they give. The flexible nature of semi-structured interview method allowed the interviewer to ask initial questions followed by probes meant to seek clarification of issues raised. The use of semi structured interviews, according to Yin (2014), gives an in-depth understanding of the participants' thoughts and feelings, and their focus phenomenon, than closed-ended questions. The interview guides were generally open-ended questions that elicited the views of teachers on the instructional strategies they employ in teaching braille reading skills to their students in Akropong School for the Blind. The interview questions were prepared based on the four (4) research questions raised on the study. Semi-structured interview guides were employed for the study because it offered the interviewees the opportunity to express their views and experiences freely and also gave the interviewer the freedom to direct the questions in the schedule to seek clarifications. It again allowed for further and deeper probing of issues from participants.

3.6.2 Observation checklist

The researcher employed observation techniques to triangulate the responses from the interview. The researcher conducted the observation in the school selected for the study and recorded the relevant facts and actions concerning the research problem. The researcher used structured and non-participant observation for this part of data collection. The structured observation schedule helped the researcher to minimize observer bias in that the data collected were not predetermined (Gerrish & Lacey, 2010).

The researcher therefore saw the live instructional strategies employed by teachers teaching braille reading skills instead of taking second-hand information from the teachers. Cohen, Manion & Morrison (2004) added that, as with other data collection techniques, issues of trustworthiness beset observation. From these views, the researcher found it expedient in adopting it in support of the interview. An observation checklist was used as a guide.

The focus of the observation was to ascertain the steps teachers follow in setting up a braille literacy programme, it also focused on the order in which teachers follow in teaching the braille alphabet, the observation again focused on the resources available to teachers to develop the braille reading skills and finally how the instructional strategies actually influence braille reading skills in their learners.

3.7 Pre Testing of Instrument

The interview and observation checklist were pre-tested on five teachers who were at Wa Methodist School for the Blind in the Upper West Region. The researcher chose the pre-test population from Wa Methodist School for the Blind because the school is similar to Akropong School for the Blind as it also admits students with visual

impairments. Therefore, the characteristics of the population in Wa Methodist School for the Blind are similar to those of Akropong School for the Blind, hence the choice of that site for the pre-test. The pre-test detected ambiguities, and repetitions of some items. Some other items carried same meaning. Through the responses in the pre-test those for correction and modification were done so as to improve the internal consistency of the instrument (Alumode, 2011; Vanderstoep & Johnston, 2009).

3.8 Trustworthiness

When validating a qualitative instrument, trustworthiness procedure is the most recommended one. Its elements include credibility, transferability, dependability and confirmability. In ensuring the credibility of the findings of this study, the researcher developed early familiarity with the school by visiting the participants on two occasions to have a casual interaction with them. The researcher also engaged in debriefing sessions with his supervisor for his expert inputs. The researcher again employed questioning during the group interactions in order to compare the responses of the participants of the same question. Finally, on the credibility principle, the researcher cross-checked the transcript of the verbal responses to ensure that verbatim response was presented.

Secondly, the researcher ensured confirmability of the data by engaging multiple participants in the study thus, constituting three different groups from each stage (JHS, Primary and KG) to triangulate the responses of the participants. The researcher then provided verbatim statements in the analyses to confirm the data. The researcher personally carried out the data collection, data transcription, thematic coding and analyses of the results.

In terms of the transferability of the findings, although it is not possible to generalize the findings of the study beyond the sample, it is transferable to contexts that share similar characteristics with the study context (Kusi, 2012). In line with the assertion of Kusi (2012), the study involved only one special school for the blind in the Eastern Region of Ghana. The respondents included teachers in the JHS, the Primary and the Kindergarten who teach either braille or languages. The school was used as a natural setting for the interview of the teachers.

Finally, in ensuring the dependability of the data results, Shenton (2004) stressed that there is a close tie between credibility and reliability arguing that a demonstration of credibility ensures dependability. The researcher, therefore, achieved the dependability by engaging the teachers in focus group interviews whilst also using the observation checklist to observe the teachers during instructional hours to ensure triangulation. Hence, a repetition of the same study may give a similar result.

3.9 Procedure for Data Collection

Before the researcher went out to collect data for the study, she took an introductory letter from the Head of the Department of Special Education, University of Education, Winneba (APPENDIX C). The letter was shown personally to the headmistress of Akropong School for the blind for permission. After the headmistress had agreed, she informed the teachers about the intention to involve them in the study. The researcher met with the teachers and explained the purpose of the study to them. They were all assured of the necessary confidentiality on the data to be collected. The day and time of the data collection was agreed upon between the researcher and the participants.

3.9.1 Focus group interview

The researcher engaged the teachers in focus group interviews. The focus group interview involved the researcher engaging five to eight interviewees in each group. These interviews involved unstructured and generally open-ended questions that were few and intended to elicit views and opinions from the participants (Creswell, 2009). In this study, the researcher constituted a focus group of four (4) each for the interviews. The interviews were conducted by the researcher on 18th February, 2021. The interview sessions which lasted between 35 to 45 minutes each were conducted at the ICT lab. The ICT lab was chosen as the venue because it was the serene place for the data collection since it is devoid of external disruptions. The participants were given the opportunity to express their views and experiences without undue pressure on them. The interview was tape recorded with the permission of the participants and transcribed for analysis. Before analysis of the data, the researcher scheduled another meeting with the focus groups and the transcripts were presented to the participants to confirm that the transcripts actually represented the views and experiences they shared.

3.9.2 Observation schedule

The structured and non-participant method of observation schedule was employed by the researcher to observe the instructional strategies that the teachers employ in teaching braille reading to their learners who are blind. This method allowed the researcher to identify events/behaviour that she looked out for during the actual observation (Kusi, 2012). The researcher, with the help of the expert guidance from her supervisor, developed an observation grid/checklist for this purpose. This enabled the researcher to collect relatively similar data (Bell, 2008) as the purpose of developing an observational schedule is to minimize or possibly eliminate the

variations that will arise from the database on individual perceptions of events and situations. The researcher again employed the services of her classmates who are also researchers to witness the same events. This is in line with Denscombe (2008) who stated that the aim of an observation checklist is to provide a framework for observation which all observers use and which enable them to be alert to the same activities and looking out for the same things; record data systematically and thoroughly and produce data which are consistent between observers, with two or more researchers who witness same event recording the same data. The disadvantage of this method is that 'unexpected' behaviour or events (those not included in the checklist, but very usable) are often neglected or overlooked by the observer (Kusi, 2012). The observation took place during instructional hours of either braille reading or language classes where a lesson lasted for 45 minutes at the KG, 90 minutes for the primary level lessons and 2 hours for the JHS lessons to ascertain the strategies the teachers employ during lesson delivery to develop the reading skills of their learners.

3.10 Data Analysis

Data from the interview were analysed first, followed by the data from the observation for each research question. Then conclusions were drawn through comparison of the responses from the interview and the observations made by the researcher during instructional hours.

3.10.1 Analysis of interview data

The interview data were analysed using the narrative themes from the data recorded and transcribed. Transcripts of the interview were given codes as Group 1, Group 2 and Group 3 for identification purposes. Group 1 were Kindergarten teachers, Group 2 were primary school teachers, Group 3 were JHS teachers. This step was taken in

line with the assertion of Fraenkel and Wallen (2009) that assigning numbers to every group from which data is collected is the first step in coding. In order to identify the themes that emerged from the data during the interview, the researcher further coded the data using colours (Creswell, 2012). Six (6) colours comprising blue, red, green, violet, pink and orange were used to highlight, categorise and code the data from which the themes emerged. This gave the researcher the opportunity for the categories and patterns emerging from data to be decided in advance, and facilitated the interpretation of smaller units since the analysis begins with the researcher reading all of the data to gain the sense of the whole. Verbatim expressions of the teachers were used in reporting the data where necessary. The thematic contents were then formulated based on the research questions and the data gathered were put and analysed under each thematic content, and then discussed with the findings of other related studies.

3.10.2 Analysis of observation data

With the observation component, the researcher met with other two observers who were her course mates to observe the phenomenon under study. An inter-observer agreement was determined by calculating the percentage of agreement between the researcher and other observer. For instance, an option of a statement that received two (66.6%) or all three (100%) choices from the other observer was considered to have occurred as against a statement that had one (33.4%) choice of other option.

3.11 Ethical Considerations

Ethical considerations are an essential aspect of conducting research, more especially, in the aspects of the rights and health safety of the participants. The teachers who took part in this study were personally informed of the purpose and the procedures

involved in gathering the data for the study by the researcher before the study was conducted. The participants were, after the sampling, asked to voluntarily opt to accept to take part in the study, they were therefore not forced to respond to the instruments in this study. The participants were assured of confidentiality of any information they would give, and that no third party would have access to the personal information given out. The researcher also explained to the participants that they could choose to opt out of the research when they wish to discontinue the process. The researcher explained to the participants that their names will not be needed in the course of the data collection but rather their responses will be coded to ensure confidentiality and anonymity. Again, the researcher sought the permission of participants to use the tape recorder during the interview session in order to capture detailed data while concentrating on listening and prompting participants. Above all, the participants were made to know that information given out was mainly for academic purposes.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF RESULTS

4.0. Introduction

This chapter presents the results of the study. The data gathered are in two folds for each research question. The initial part is the data gathered from the interaction sessions followed by data gathered from observation during instructional periods by the participants. The analysis reflected on the themes that emerged from the data.

4.1 Presentation of Data

This section presents analyses of the focused group interview data which was done with the teachers as well as the observation schedule that was conducted. The demographic data of the participants were also captured to ascertain the nature of the participants in the study. The interview data were coded and subjected to thematic analyses and consequently, the themes and sub-themes were used in the analysis of the main variables of the research questions. The observation data on the other hand, were analysed based on an inter-observer agreement which was determined by calculating the percentage of agreement between the researcher and the other observers. For instance, an option of a statement that received two (66.6%) or all three (100%) choices from the other observer was considered to have occurred as against a statement that had one (33.4%) choice of other option.

Table 3: Demographic data of the participants

Variables	Frequency	Percent (%)
Age group		
31-40	01	14%
41-50	02	29%
51-60	04	57%
Sex		
Male	04	57%
Female	03	43%
Religion		
Christian	07	100%
Islamic	00	00%
Traditional	00	00%
Others	00	00%
Number of years in teaching		
10-20	04	57%
21-30	02	29%
31-40	01	14%

Source: Field data (2021)

Table 3 represents demographic data of the participants in the study. In total, seven teachers took part in both the interactions and the observation sessions. Out of this number, one teacher representing 14% was between the ages of 31 and 40. Also, between the ages of 41 and 50, 2 teachers out of the total number were in that age bracket representing 29% of the total sample size in the study. Again, four teachers were within the age brackets of 51 and 60 representing 57%. From the table, it is clear that most of the teachers in the school were above their prime ages. The majority of them (57) were in their last decade of going on retirement. Therefore, the majority of teachers in the school would have had enough interactions with learners in their lifetime.

Moreover, the gender distribution of the teachers in the study was not one sided. Four (4) of the teachers were males representing 57% of the participants whilst the

remaining three participants were females representing 43% of the participants. Again, all the teachers in the study were Christians; all seven teachers indicated that they were Christians. This shows that the participants in the study were religious.

Finally, on the issue of teaching experience in the classroom, it was noted that no teacher in the study had taught for less than 10 years. The majority of the teachers, 4 (57%) have taught between 10 and 20 years. It was also revealed that two teachers representing 29% had been teaching in the school between 21 and 30 years and the one teacher had taught in the school for over 30 years. The data reveal that teachers in the study were well informed about the phenomenon in the school since all of them had been teaching in the school for at least a decade.

4.3 Research question 1: What are the steps teachers follow in setting up a braille literacy programme in Akropong School for the Blind?

To answer this research question, the data collected from the focus group interview were used. Three themes emerged from the research question; the age of the onset of the disability, the use of task analysis approach, and the use of dual media (both print and braille media) to teach literacy. The participants who were teachers of languages were interviewed to describe the steps they employ in setting up a braille literacy programme. From the responses, it was noted that teachers considered the age of the onset of the disability, they also employ a lot of task analyses so that learners would learn in bits in order to grasp the concept, and finally, they also consider the nature of the impairment to ascertain if the students can interact with both braille and print or only braille. For instance,

A teacher said:

> *Okay, what I know is that it depends upon the child ability, maybe he or she was in school and because of the problem he stays in the house for a while,*

now because he doesn't know anything you need to let him know how the braille came about

Another teacher added:

We also engage the learners in the finger dexterity activities because you cannot help them to read and write without training their fingers so the first one you help them to know, you give them a lot of materials to train their fingers. The finger dexterity activities, a lot of materials are available for them. The fine motor skills and the gross motor skills allow them to be able to read and write and apart from that you help them to know the sitting position and how do you sit before you read.

Another added:

If the person has a low vision then he has to be given a different thing altogether; when the person is not partial this is what you have to do, you have to go according to the braille only.

From the responses, three themes emerged; age of onset of the disability, task analyses, and dual media learning.

Onset of the Disability

Per the age of the onset of the disability, the teachers revealed that the age of the onset of the disability determines how the programme will be set up. If the condition is congenital, then the child would have to be introduced with materials (dummy) to understand the cells of the braille. If the condition is adventitious, the child is introduced to the braille irrespective of his or her level of education. The child is made to learn the dots in the cells of the braille. So, in teaching the alphabet, punctuation and numbers of the braille, teachers consider the age of the onset of the disability and decide the approach to use. The teachers affirmed this assertion in the comments below.

A teacher said:

Okay, what I know is that it depends upon the child's ability, maybe he or she was in school and because of the problem he stays in the house for a while, now because he doesn't know anything you need to let him know how the braille came about.

Another added:

For teaching braille alphabet, normally in teaching braille alphabets to a new student from the house normally we start with the toys; we have a toy dummy, which has the point of the cells on it when you go to KG you will see it. So, the dots are arranged on the dummy one, two, three, four, five, six like the dots so, as they are playing with the dummy they are learning the positions of the dots so from there we start picking them out. So when they learn the positions of the dots the dummy you can press the button the dots is made in such a way that you can press the button in so when we are writing A assuming we are writing A or you are introducing them to write A you press the button in and that means all the buttons are up but only that one is inside representing A so we normally start from there. We don't straight forward introduce the braille with the stylus and the frame, but we start from the dummy.

Another teacher asserted:

It depends upon the ability of the child so let us say you were in JHS3 but along the line your sight became blind and maybe instead of coming here then you chose not to come but you were recommended by a doctor to come so when such a person comes this is how we start with, you first teach the child to feel the dots so you have to have time for such a person.

One of them again noted:

I will also say that it depends on how ready the child is and the materials available for them to learn.

However, another teacher asserted that there is no special step in setting up a literacy programme for learners with visual impairments, and that it is the same as that of setting up a literacy programme for all other learners in general education classrooms.

He said:

With the order at least we teach it as it is taught to the sighted, from the beginning let's say ABCD to the end so that is what I can also say.

It is evident from the responses of the participants that teachers in Akropong School for the blind take into consideration the age of the onset of the disability before they plan for a literacy programme for the individual learner. This helps them to ascertain the individual needs of the learner. A learner with congenital blindness would be admitted at the pre-school level where play materials like the dummy is used to help the learners understand the dots on the braille cells so that when they are introduced to the braille, they would be well informed with the dots and their positioning. A learner who also has an adventitious blindness gets the opportunity to be introduced to the braille irrespective of whether the learner has a prior literacy knowledge in print or not.

Task Analysis Approach

Participants in the interaction also indicated that in setting up a literacy programme for learners with visual impairments, the issue of task analysis is very key. They took into consideration the fact that learners with visual impairments could not grasp a concept as a whole once; they inculcated into the programme the use of task analysis; that is giving a whole to learners in bits.

One of the teachers said:

> *you have them go through the finger dexterity activities first because, you cannot help them to read and write without training their fingers. So, the first one you help them to know is to give them a lot of materials for them to train their fingers. By doing that you are training their fingers as well as the fine motor skills and the gross motor skills for them to be able to read and write and apart from that you help them to know the sitting position, how do you sit*

before you read, when you sit the way they are supposed to sit... The dexterity activities apart from the materials we also give them the local material. We have a lot of materials like beans, maize, and rice. All those are materials we use in their homes, so the beans are bigger and rice are smaller so we select beans, rice, maize, stones, bottle tops.

A teacher also said:

I think the training of the fingers of the individual learners is the first thing we are to do, then the oral learning of sounds is also good. After learning the sounds and training of the fingers then there should be practical meaning the material for the learner to read and we do that for the reading and writing as well, for instance in orally you say A is dot1 he should be able to use the finger to feel and tell, and the writing too which is one of the basic skills needed after knowing the sounds we need to put it on paper and it should be meaningful and presented. But we also start with scribbling in the sense that if one is being to use the writing materials that is the hand frame and know how to fix the braille sheet then the positioning the stylus so at the early stages scribbling is than that is the child is trying to pinch it may see not meaningful to you but the child will be doing great thing, so is in gradual process.

Another teacher added:

Okay we normally start with reading, and with the reading, you have to know the letters of the alphabet and teaching the letters of the alphabets, first of all I have a board called 'pin plug' braille is made up of 6 dots and out of the 6 dots, you will be able to know all the alphabet. On the board we have 6 holes that have been arranged according to the braille dots with pins. So, to start with, I will use the pin to write the letters on the board and let them feel it because that one is very bold. First of all, I will write all the dots down for them to feel it to know the arrangement of the dots, then I will start writing the words one after the other, then later we come to the sheet, so if they are able to braille, meaning they have now pictured or recognized everything in mind, then we start writing short words and start reading them.

One of the teachers said:

After teaching the letters of the alphabet I will mix them up then I let you read so if you are able to read it means that you have been able to identify all the letters, then I give them two letter words and three letter words to identify them.

Again, another teacher also stated:

Me, I will give you a word like BUTTER then I will ask you to put the full stop attach to it so after that I will let you feel it then you know how it is to know the position because in braille, full stop is almost like the letter D but the position will tell you that it is D or full stop.

A teacher also added:

After the child is able to write the 26 alphabets then you start introducing him with the numbers which go with numeral signs because we use A=J for the numbers with the help of the numeral signs. Then from there we have what is called standing alone words, because braille is bulky, and the man who invented the braille chose to make way for using the 23 letters of the alphabet to be used as standing alone words instead of the 26. A, I, and O are not among, the reason is that, for the letter A we have two words that begin with the letter A, and again the A is also used to stand as an Article so now the A is out, now the I is used as a pronoun so is out meanwhile I begins one of the words. The O also is out because it helps one of the letters to give us a complete word so O is out, from there we start with B but, C can, D do, E every, F frog, G go, H have, J just, K knowledge, L like, M more, N not, P people, Q quiet, R rather, S so, T that, U us, V very, W will, so instead of using maybe the I to stand for the word It we, represent it by X then 'as' for Z then Y for You,... so it means that this BLE when we come to mathematics it precedes numeral when we come to English it becomes a symbol.

Another teacher said:

I know of oral learning, scribbling, order of arrangement and others. We do use bottle tops to do some of the signs, playing with toys, identifying shapes from what we give them.

In line with these assertions by the teachers, others also added how they are a bit challenged with the inadequate materials such as the 'pin plug', the brollion sheets, large class sizes with inadequate teachers among others at their disposal that help them to undertake the task analysis approach. For instance,

One of the participants said;

> *Okay what you can do is for you to first get the gadgets that can help you to braille for the child to learn, so if you get the Perkins then if all go well you get Brillion sheet, when you braille on it last long than the other sheets but it is not easy to get the materials but it is a gradual process you get maybe some NGOs if they will be of help if not you cannot establish it at all.*

Another added:

> *The challenge is getting braille sheets and machines for the children to use. When you get all these items then you are good to go.*

One also added:

> *Setting up the literacy programme is not without challenge, maybe one of the challenges is that example; 'pin plug' I am talking about, we do not have enough of it, so if I have maybe 15 students, I have to go round one after the other because there is only one which make it very difficult.*

Another participant also asserted:

> *The challenge involved as I said, are a whole lot because this is a special school and the children are many and the teachers are not many, so like my class if I have to group them, I have to see those who have some books that are brailled in grade two and so to get grade one, I have to write my own stories, send it for them to braille for me in grade one before I can give it to them to get a material. So, as I give the grade two to the breast-feeding group two, I have to get material from grade one pupil and then the oral work pupil too. You have to see them at the same time and there is not enough. Maybe you are taking English, the time you realize, the period is even gone; the time is even gone.*

Another teacher again added:

> *What I have observed is not every learner is most at times able to use the fingers and I cannot tell the reason behind that, most of them are taken through the braille for very long time yet the child cannot read, so if you are teaching and the child is not getting it is a challenge it makes the work very difficult. I have also observed that at the lower level we do not have enough learning materials for training.*

From the reactions of the participating teachers, it was revealed that teachers in Akropong School for the Blind adopted the task analysis approach to plan their literacy programme for learners with visual impairments. In their view, learners with visual impairments lacked incidental learning, and therefore could not grasp a concept as a whole, so because of that, they first of all train the finger dexterity of the learners to activate their fine motor skills. They also started the literacy in bits; that is from learning the letters of the alphabet, to feeling the shape of the learners, then learning how to braille those learners before they could be introduced to complex stages like contracted forms and group words as well as numbers and punctuations. This approach helped them to be able to assist the learners to understand the basic concepts of literacy.

The use of Dual Media Approach

Students with visual impairments are a heterogenous group, therefore, one size fits all approach cannot cater for the needs of all the learners with visual impairments. Some students, despite their visual impairments, can employ print as a main or supplementary medium of literacy activities. During the interaction with the teachers in the school, it was revealed that teachers in the school employed only one medium of literacy learning; that is through the braille only.

A teacher said;

> *I am also visually impaired not even partial but total so I do not deal with print rather the braille only*

One also added;

> *Yeah they don't have the residual vision and those who have are not many but sometimes I show some pictures to them and they describe but in most cases, we don't really use the print because most of them don't have the residual vision.*

Another teacher also revealed that;

> *If the person has a low vision then he has to be given a different thing altogether when the person is a partial. This is what you have to do: you have to go according to the braille.*

Another teacher also stated that print becomes the last resort; that is a student is only introduced to print as a medium of learning literacy in that learner fails to grasp the braille concept, but as far as the learner is able to learn and pick up the skills of braille literacy, there is no need using the print.

She stated;

> *It depends on the children, you see those students who normally come here, few of them have low vision so when we see that in class one you have a problem we see if we can look at it as we are training the fingers and other things. When we see that still you have little vision and you are not able to pick up the braille concepts, then we start with the print but if we see that you don't have problem with the braille, we will allow you to continue because they brought you here to come and learn the braille, so when we see that you are okay with the braille, then no problem but when we see that even in the braille you have challenges then we introduce you to the print.*

However, participants from the Junior High School stated that they introduced dual media in their literacy lessons anytime the situation calls for it. For instance;

One of them said;

> *Me for instance I have low vision in my class so what I normally do is that, I have textbooks that I use for them, if there is a picture in the textbook I will call those strong partial to come and look at it and discuss it with their friends which make the lesson very easy for me because I don't have to braille for the other but rather their friend read for them to braille.*

Another teacher also commented;

> *Me for instance I have low vision in my class so what I normally do is that, I have textbooks that I use for them, if there is a picture in the textbook I will call those strong partial to come and look at it and discuss it with their friends which make the lesson very easy for me because I don't have to braille for the other but rather their friend read for them to braille.*

From the comments of the teachers on the theme of dual media, it is clear that teachers in the primary and the kindergarten levels did not employ the print, but rather went solely with the braille format. Their counterparts at the junior high level stated that they rather employed both braille and print in the classroom activities as the situation calls for it or it becomes the need of one student at any point in time. The teachers in the primary school stated that they themselves were visually impaired and did not use the print, so if a student could even use the print as a medium, the teacher could not help. Others also stated that the school was a special school and the purpose of their enrolment in that school was to learn braille, so the learners had no option than to do so.

4.3.1. Data collected through observation on the steps teachers follow in setting up a braille literacy programme in Akropong School for the Blind.

Table 4 steps teachers follow in setting up literacy programme in Akropong School for the Blind

S/N	Item	Number of observations made	Outcome
1	Teacher takes into consideration the sensitivity of the fingers of the learners by observing how they perceive tactile information	4	YES
2	Teacher takes learners through to name individual characters correctly at the pre reading stage to name individual characters correctly at the pre reading stage	4	YES
3	Teacher teaches learners to vocalise letter names while touching the braille stimulus	4	YES
4	Teacher asks learners to select the braille format of letters that he selects in printed format	4	NO
5	Teacher introduces dual media instruction (both braille and print)Teacher introduces dual media instruction (both braille and print)	4	NO

Source (field data 2021)

Table 4 shows the observation outcome of the steps teachers in the school follow in setting up a literacy programme for their learners with visual impairments. five variables were observed by the researchers during literacy instructional hours for four different times each. From the outcome of the observation, the observers agreed to the

statement that teachers take into consideration the need to train the finger dexterity of their learners before they are introduced to braille. Again, the observers agreed to the statement that the task analysis approach was employed by the literacy teachers in order to teach the learners in bits for them to get the concepts in whole. The teachers did this by first introducing the letter recognising technique to learners, then they went into phonemic awareness where they related the sound of the graphical representation of the letter to its associated sounds. On the issue of dual media approach to learning, observers disagreed with the statement that the teacher asks learners to select the braille format of letters that the teacher selects in print. They again disagreed with the statement that teachers introduce a dual media approach (both print and braille formats) to learners; the only medium of learning during instruction is the braille. This means that learners who had low vision and could use the residual vision for reading had no opportunity to do that.

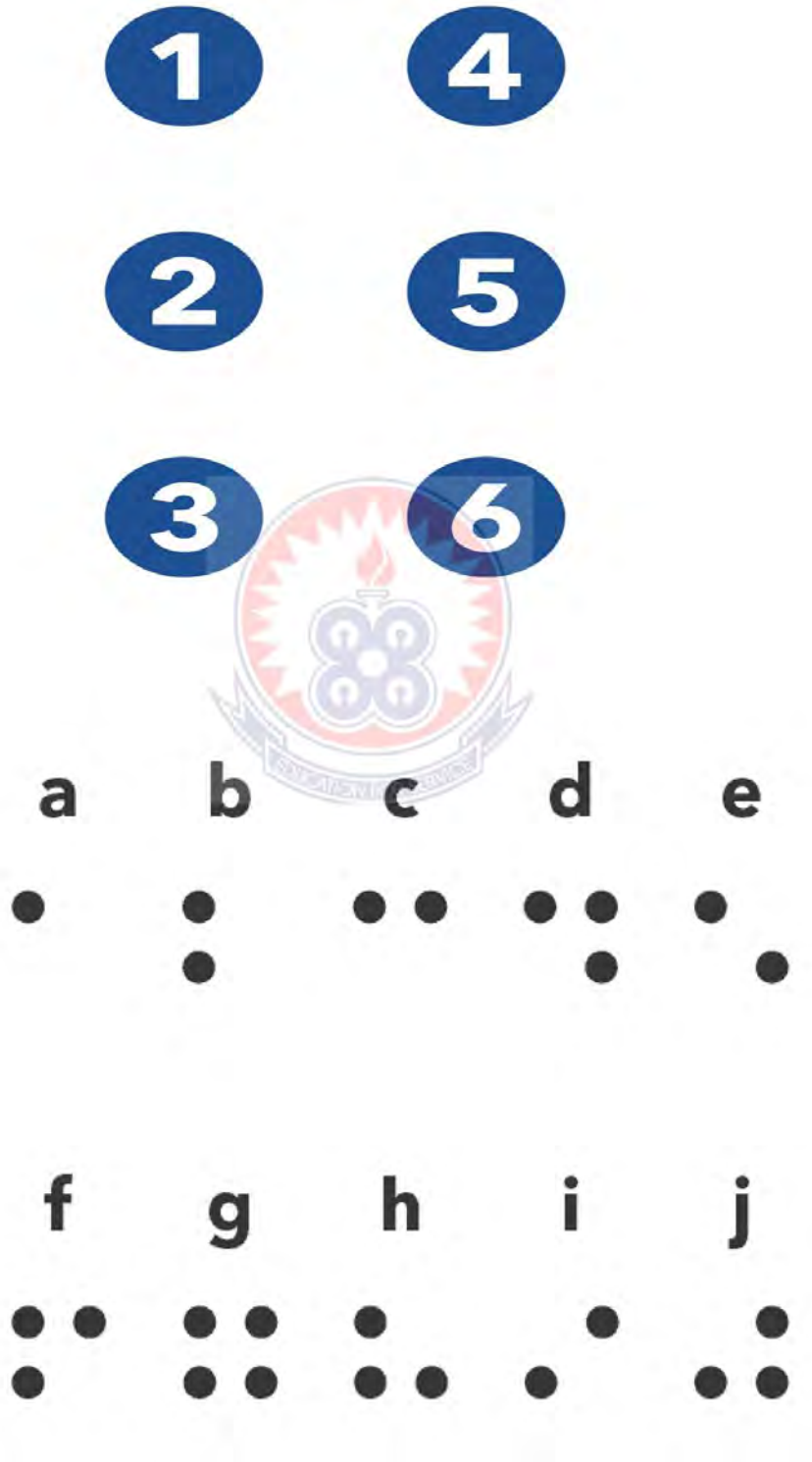
4.4 What knowledge do teachers' have on the appropriate order of teaching braille alphabet to students at Akropong School for the Blind?

Interacting with the teachers to ascertain their level of knowledge on the appropriate order of teaching the braille alphabet, two themes emerged;

Teachers' knowledge on the order of teaching the braille alphabet

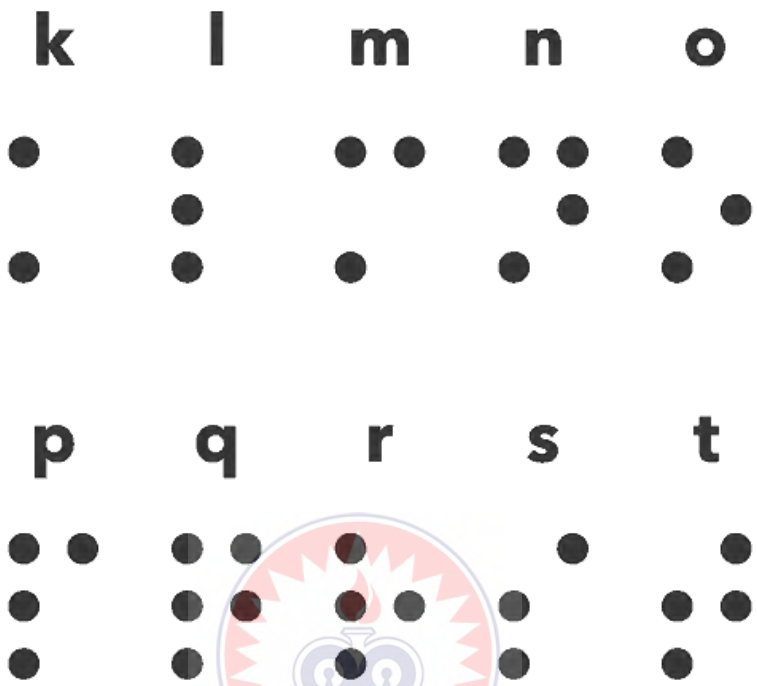
During an interaction process with the teachers, they revealed that in teaching the braille alphabet, the first thing to know is that braille is a code and not a language itself. There are different "grades" and versions of braille. The most basic is "grade one braille" in which every letter is transcribed. 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. The

braille alphabet uses a pattern throughout the alphabet. The easiest letter to learn is “a” which is dot 1. Next, the letter “b” is dot 1 and dot 2, and “c” is dot 1 and dot 4. To make it simpler, the dot configurations in the image and table below.



Braille letters k – t

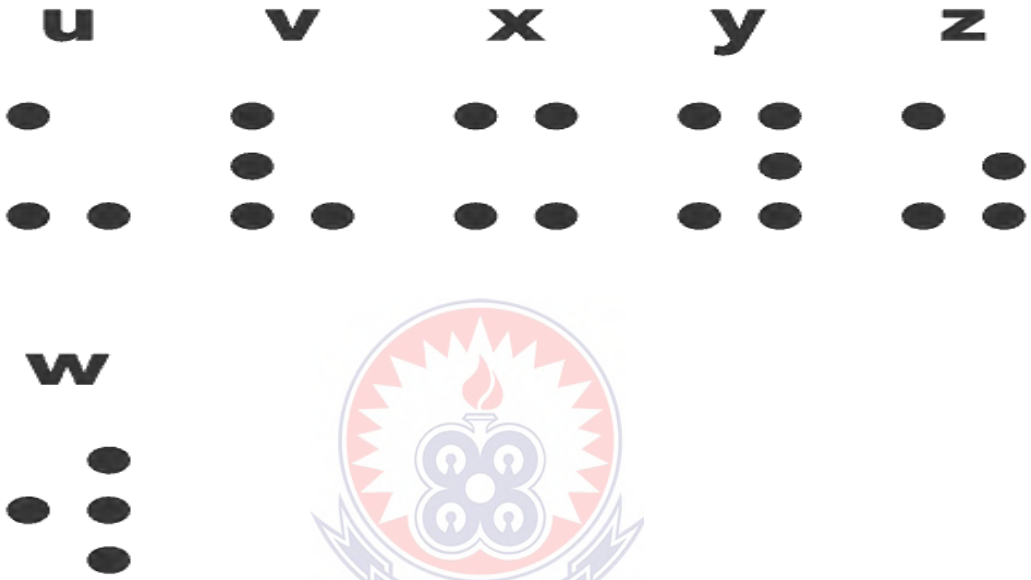
The second set of letters follow the pattern of adding a dot 3 to each character in the first set of braille letters.



Letter	Dot configuration
k	1,3
l	1,2,3
m	1,3,4
n	1,3,4,5
o	1,3,5
p	1,2,3,4
q	1,2,3,4,5
r	1,2,3,5
s	2,3,4
t	2,3,4,5

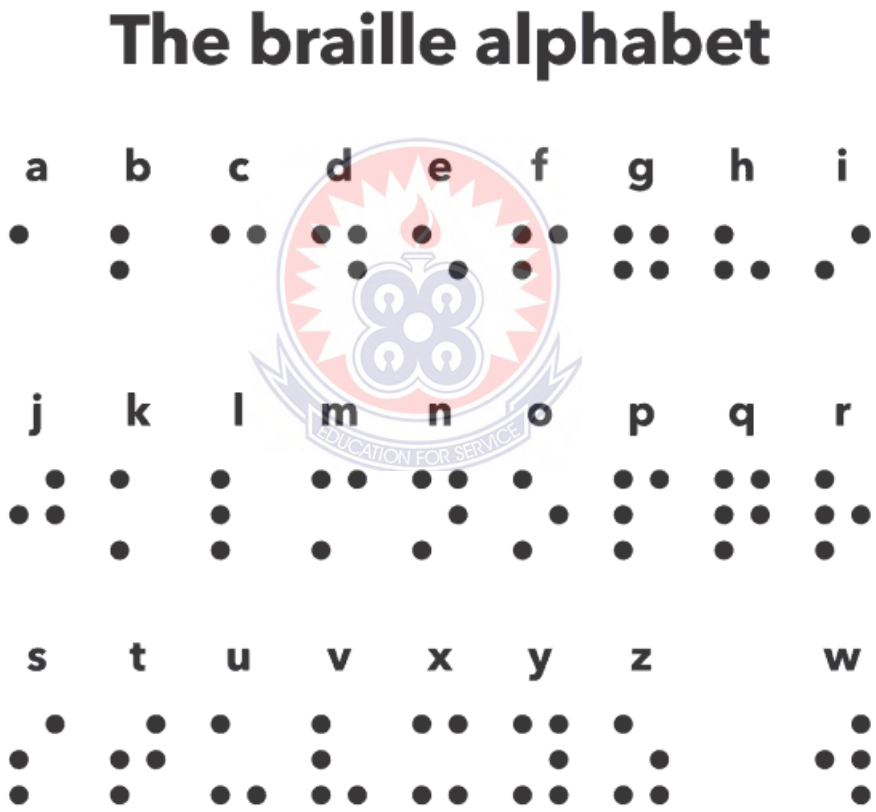
Braille letters u – z

The last set of letters continues the pattern by adding a dot 6 to the second set of letters. However, there is one exception that interrupts the pattern here. At the time Louis Braille invented the first version of the braille alphabet, the French language did not use the letter “w” so it is skipped. The braille letter “w” is instead created by dots 2, 4, 5, 6.



These are all of the lower case braille letters in the English alphabet. To form a capital letter, you must place a dot 6 before the letter. There are also braille characters for other punctuation and symbols.

Letter	Dot configuration
u	1,3,6
v	1,2,3,6
w	2,4,5,6
x	1,3,4,6
y	1,3,4,5,6
z	1,3,5,6



One of the teachers said;

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

Another teacher also said;

Okay as we have teaching and learning materials small that help us, sometimes when we take a sheet of paper we can prepare teaching and learning material, you put sand and glue and rope then you get something like map so when the children put their fingers on it they trace and feel it. We also have woods which have been putting into different shapes to learn angles.

One also added;

Yeah we have the tactile TLMs we use sea shells to draw Ghana map, we also do some with sand and glue sometime we use the coil or the wine or the thread so as they use their hands to feel the Ghana map this is cocoa, this is that and so on.

Another teacher commented;

Good, first of all, I use what is called the cubarithm boards and the quees for the letters before coming to the actual books.

A teacher also added;

We use shapes and other things to do those things.

A teacher affirmed:

It starts from the basic fundamentally if you want to teach a child how to write then you can start from sand writing, writing in the air then the 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 you know what you are doing so later when you see that the child is conversant then you introduce 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.

A teacher expressed her views as;

> *Okay, it's about the availability of the materials, so if the child is in KG with the help of the tactile pictures they learn best, you let the child have the feel of it but in this school, we are lacking a lot of tactile materials so in our own way we prepare it for them. Example if you want to teach orange you make them touch and feel if it is not matured how does it look like it looks very hard but when it is matured it looks soft and a bit juicy the child will know because you teach them how it feels.*

She further added;

> *oh okay, that is what I said they recite it; every we tell them to explain it to them and give to them to fill, maybe I will tell them I am giving you a letter to fill and the letter is A so fill it well and note the position of the dots after that I mixed it with other letters and call them they have books and pick one and identify the particular letter for me that is what we have been started doing.*

Another teacher added;

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

Another teacher also stated that apart from using the orders to introduce the braille alphabet to the learners, they equally used them to teach learners shapes and geometric figures. She stated that more especially those at the lower level since those orders helped both the teacher and the learner to bring the world into the classroom.

The respondent added:

> *We equally use these materials to introduce them to shapes, and we start with circles, triangle, square and rectangle. So, we have some shapes here, we will mention the shape and tell them we have some different types of shapes so when we describe a particular shape then we give it to them what shape do you think looks like this shape and they mention it. So, we 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, we ask them how many sizes they think this shape has? Some will say different numbers, then after that then we tell them it has this number. Triangle has three sizes then we help them to identify the size and give examples of objects that look like or the same as triangle. We do the same thing to square and rectangle too.

From the comments the teachers gave, it was clear that the teachers demonstrated fair knowledge on the appropriate order of teaching the braille alphabet. They mentioned among other orders which include the stand alone words B for But, C for Can These orders made it easier for the learners to grasp the concepts presented to them.

4.4.1. Data collected from observation session on teachers' knowledge on the appropriate order of teaching braille alphabet?

Table 5: Teachers' knowledge on the appropriate order of teaching braille alphabet.

S/N	ITEM	NUMBER OF OBSERVATIONS MADE	OUTCOME
1	teachers teach tactile perception, recognition of symbols, surfaces, geometric shapes and braille alphabet to learners	4	Yes
2	teacher first introduces the letters of the alphabet before teaching learners to read	4	Yes
3	teacher first introduces the letters of the alphabet before teaching the learner how to write	4	Yes
4	teacher gives opportunities to learners to access information on the internet through mobile devices via adaptive hardware and software	4	No

5	teacher demonstrates enough skills in the use of technology in teaching literacy	4	No
6	teacher demonstrate more knowledge in the use of technology in teaching literacy	4	No
7	The teacher employs technology practice that begins with low technology tools, moving to increasingly higher technology tools as the learner's skills increase with age and practice.	4	No

Source (Field data 2021)

Table 5 shows data gathered during instructional sessions on teachers' knowledge on the appropriate order of teaching the braille alphabet. From the data, it is explicit to the observer that teachers gave opportunities to learners to learn shapes and tactile perceptions which would help them develop vocabulary and also would have mental imagery of objects. Through the use of phonemic awareness, the observer agreed that teachers in the school also introduced reading and writing by first introducing them to individual letters and their sounds. However, when it comes to the use of technology in learning literacy, it was revealed to the observer that teachers did not give opportunities to learners to demonstrate learning in technology because the teachers themselves stated that they had limited knowledge in technology, especially, the use of the high technology devices. The teachers did not also demonstrate enough skills in the use of electronic technology as observed by the observer, because they did not even employ them in their literacy instructions. observer also disagreed with the statement that teachers demonstrate enough knowledge in the use of technology in literacy as they clearly stated to their learners that the learning of ICT was in the hands of teachers in that department.

4.5: What are the resources available to support teachers in developing braille reading skills in Akropong School for the Blind?

In response to research question three, participants elicited their views on the resources available for developing braille reading skills among students with visual impairments in the school. Even though majority of the participants mentioned inadequate resources in the school to support braille reading, a number of resources were described. These include braille alphabet or printed materials, tactile reading tools, optical devices (magnifiers and lenses) to read braille books, talking calculators, talking computers with print out, braille printers, braille computers, readers, cassette recorded books, diagrams, schemes, pictures, embossed maps. Individual participants were asked to describe the aforementioned resources available in their school.

Braille alphabet and printed materials

Braille code is a writing system which enables students with low vision or visual impairment to read and write through touch. As a result, it is a basic requirement for non-sighted students to learn how to read using braille. The following explanations were given by the teacher-interviewees about the use of braille alphabet and other printed materials.

> *The braille alphabet enables students with visual impairment or low vision to learn how to read and write…so they need printed materials containing braille alphabet for them to learn (Teacher response).*

When asked to describe what the braille alphabet is, one of the interviewees 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 (Teacher response).*

Another teacher explained that:

> *The braille codes are in versions of grade 1, 2 and 3. Accordingly, grade 1 has 26 letters of the alphabet and punctuations 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 (Teacher response).*

The above verbatim quotations support the claim that braille alphabet and printed materials were some of the resources that teachers used in teaching braille reading to the students. This is what form the basis of reading for learning in the later school years. Learning the braille alphabet as the foundation of reading also gives the students kuiiiiadvantage of knowing how the letters and words are pronounced.

Slate and Stylus

The slate and stylus were mentioned as some of the materials available for teaching reading to the students. According to the teacher-interviewees, these materials were adequate due to the fact that people supplied them to the school and since it is one of the basic materials needed for teaching and learning. They described what the materials were, and their availability in the school. Some of the interviewees have these to say when asked to describe the materials she was referring to:

> *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 (Teacher Interviewee)*

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 (Teacher Interviewee)*

According to one teacher:

> *The slate and stylus are adequate since it is one of the basic tools need for teaching braille reading so every student has enough for use (Teacher Interviewee).*

A teacher also commented that:

> *It is not easy to teach students how to use slate and stylus even though they are quite ideal for writing…in using them (slate and stylus), the students write from right to left, thereby contradicting the left to right eye orientation…that's because the paper is turned when reading what has been written… (Teacher response).*

It was clear from the responses of the teacher-interviewees that, the use of slate and stylus was one of the materials they depended on in teaching braille reading to students with visual impairments. That is, they were able to describe what the material is and its usage.

Tactile Resources

Tactile resources were mentioned as some of the reading tools that teachers used to develop the students' braille reading.

One of the teachers explained that:

> *Tactile reading provides connection with the text than visual reading or listening... (Teacher response)*

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... (Teacher response).*

One of the interviewees reiterated the following tactile materials:

Food, sand, water, play dough, among other natural materials

Proficiency at tactile reading increases the reading skills of students with visual impairments. It can also help the sighted peers to appreciate the challenges that their peers with visual impairments experience.

Optical devices (magnifiers and lenses) to read braille books

The teachers complained about the lack of enough optical devices such as magnifiers and lenses to read braille books. The optical magnifiers, according to them, will enable the students to read text and view photos with magnification. This helps them to read easier at home and in school.

A teacher said that:

The optical devices will enable those with low vision to develop their reading skills but in our school currently, we don't have enough of that (Teacher response).

Another also said:

We don't 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 (Teacher response).

One teacher opined that:

I believe that we will need some students only need lenses or magnifying glasses for reading. Students with such devices will help reduce the workload of the teacher that includes paying individual attention to the students…some students only need this kind of support to go through school (Teacher response).

It is evident that optical devices had been mentioned as one of the resources that could support students with visual impairments to develop their reading skills. However, in terms of availability, these devices were no readily adequate for the number of

students with low vision in the school. Students with low vision could equally enroll in the general education setting if they had the said materials to support their reading.

Tape recorders and note taking devices

Some teachers during the interview also 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 (Teacher response).*

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 (Teacher response).*

It important to note that materials such as tape-recorders and other note-taking devices can facilitate the students reading skills since they would want to transcribe the recorded lessons by using slate and stylus. That is, reading and writing are both literacy skills that go together, so learning to write complements learning to read and vice versa.

Braille computers and printers

It also emerged from interaction with the teachers that braille computers and printers could also be useful in teaching braille reading. According to the teacher-interviewees, a braille display device connects to a standard computer with a special cable. It takes information appearing on the computer screen, translates it and displays it in braille, a line at a time. A few teachers commented 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 (Teacher response).

Another teacher commented that:

With the advent of computer and other technological devices, it is important students with visual impairments are introduced and encouraged to learn how to use the computer (Teacher response).

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.

4.6. What instructional strategies do teachers employ to influence the development of braille reading skills in students at Akropong School for the Blind?

During an interaction session with the teachers on the instructional strategies they employ to influence literacy development in their learners, they stated among other things that they engaged learners in a lot of child centred instructional strategies, motivation, and learning from simple to complex (task analysis). They stated among others as follows;

You let them do sorting, scribbling also, your braille some on small papers for them pick and read

Another teacher added;

Sometimes we use role play in the class, we dramatize, role play is an instructional way of communicating to them to know that this is Ananse and the pot the black pot the wisdom pot we do role play in the class sometimes we go on field trip take them out to feel the pains and see then sometimes too the oral presentation the whole class presentation.

Three themes emerged from this interaction; the use of a child centred approach, the use of motivation to reinforce the desired behaviour in the learner, and the use of a simple to complex approach in presenting concepts.

The use of a child centred approach to influence braille skill development in learners

On the child centred approach that emerged as a theme, teachers indicated during the interaction sessions, they employed a lot of activity methods, practical lesson delivery carried out by the learner, and role plays to make sure that learners were able to understand concepts taught. In short, teachers indicated that they only facilitate skill development, but they did not teach.

One of the teachers said:

> *oh okay I use a hand on hand approach, it means they need one on one assistance before they can perform well, one on one approach is what we employ so that the child will learn by doing the activity.*

Another teacher added:

> *Generally it is not all about talking. Teaching braille too deals with hand on hand, because if you want to teach them braille and they cannot see you need to hold their hands to help the position of how to hold the stylus.*

One commented as follows:

> *instructional approaches sometimes we use role play in the class I don't know if that is one that sometimes we dramatize, we do role play too is an instructional material way of communicating to them to know that this is Ananse and the pot the black pot the wisdom pot we do role play in the class sometimes we go on field trip take them out to feel the pains and see then sometimes too the oral presentation the whole class presentation.*

Another said:

> *As I said, you first allow the child to play with it sometime then you let the child know that now you are going to braille in a straight line, use a tread to tie a knot or rosary. Later you let the child know that the braille will be like this and will be space same way.*

Another teacher commented:

> *We normally read stories to them. They also retell the story that we have reflected to them story sharing, we do story telling.*

From the comments above, it is clear that learners were engaged in a lot of activities which were child-centred to ensure their progress in literacy skill development. The teachers took them through dramatisations, roleplays, and hands-on activities to make sure they had a good hand dexterity among others. According to them, these activities helped the learners to be able to undertake literacy activities independently or with little support.

Learning from simple to complex

during the interaction with the interviewees, they stated that the psychological level of the child was very keen when introducing concepts to them, so for them to encourage the learners to develop likeness for literacy activities, they presented concepts to them from simple to complex so that the learners would not be scared about the complex nature of the concepts in order to shy away from it or become timid. For instance, most of the participants stated that they taught the learners to understand the letters of the alphabet first, learn how to read them in full words before they were introduced to contracted forms of the braille.

They commented:

> *Every learner beginning with braille if you train the child on that tactile, and sorting to differentiate maybe beads and maize. Before you let them observe*

the contraction the child need to know spellings so from class six going the child will be able to know the full contraction like SH, WH, ST signs.

One said:

You let them do sorting, scribbling also you braille some on small papers for them pick and read

Another also expressed that:

In braille we have grade one; you don't normally show the contraction example, CAN you spell it out, but from grade one and half that is when the contraction comes in so CAN which stands for C must be observed.

Another teacher expressed:

Teaching phonological awareness for instance appears sometimes complex at the basic level we usually use the rhyming method to teach them sounds of letters. For example, A for APPLE. So for them to begin to understand the properties of the vowels and the consonants which is a bit complex, we introduce that when they get to the junior high stage.

One of them added:

In fact, to add to what my colleagues said, we those teaching at the KG level do not even use contractions at all. We do just grade one braille, and even with the grade one braille, not all of us can do it so we do not contract here.

A teacher also said:

the instructional approach is the reading, first the child has to know how the dots are before he can also put on paper, so we don't start with the writing because of the feeling of the dots, the reason is that some of the letters have 2,3,4,5 dots so that the child maybe well equipped of the feeling of the dots.

One also said:

After the child now knows the letter signs then I start introducing the contraction signs that we have, example letter B stands for BUT the uncontracted one too we do same.

A participant explained this:

> *you know contracted signs as I told you we have two different ways so me I introduce them to the simple upper case, we have lower contraction at the begging of the words we have lower contraction in any part of a word then we have final contraction in a way that will also reduce the number of the words but for maybe mathematical aspect and the integrated signs unless you go to the teachers. The uncontracted approach is you know in braille not all words can be contracted, example WOMAN, you spell it out, but if I take something like ABILITY I will braille ABILdot5, 6Y the dot5,6i is taking the letters ITY.*

From the interactions, it was clear that most of the teachers, even though they were literacy teachers, shied away from teaching phonological awareness to learners because they expressed their views that it was technical and difficult to do.

One of them said:

> *Teaching phonological awareness or phonemes is a bit difficult because we do not have those sounds in braille but sometimes we use other things to represent them.*

One added:

> *With the phonemes, you have to say it for them to listen. Let's say you want to mention 'honey' unless you pronounce the word they wouldn't know how the sounds are combined to produce that word. so we demonstrate for them to hear and they also pronounce so.*

From the data gathered from the participants, it is clear that teachers did not present complex concepts to learners at a go. They presented knowledge to learners from simple to complex. They considered the stage of the learner, what he needed to learn and present age appropriate literacy activities to them. For instance, the teachers admitted that braille was a complex communication medium where new things were learnt and old learned things were unlearned. So after teaching them letters of the alphabet, teaching them to braille them, they introduced uncontracted and contracted

signs to the learners so that they moved gradually. It was however clear from the submissions by the interviewees that teaching phonemes and phonemic awareness was a complex structure since there were no braille representations of transcribed symbols of sounds.

Motivation

Teachers also indicated that they motivated their learners in literacy activities in order to influence their participation and skill development. They engaged at by either using tangible gifts, or positive words to reinforce the behaviour of the learner. They also ignited the intrinsic motivation in the learners by encouraging them to compete in some activities.

One of them opined:

> *Okay I portion time and give them passages to read, also I will ask you on your way to class what did you hear then they will narrate through that then I encourage them to say more those who don't say some to I motivate them next time they should do that, after talking too we clap for them or give them high five.*

Another teacher said:

> *Okay we also motivate them through awards. For example, braille sheets, text books, drinks, biscuits and also award them before their parents on speech and prize giving days. All these make them develop interest in succeeding in literacy.*

One also said:

> *We give them story books to read, braille a passage they want, then they come to class to read. Also they bring their own stories then we all listen, after that we ask ourselves questions to entertain them.*

A teacher commented:

> *I always give them reading and also, be by their side so if the person is reading I don't say NO or YES; I just encourage the person to continue to read but if you discourage him he will not want to read again.*

A teacher said:

> *I have been telling my students that in reading if they want to gain more knowledge they need to study more, so I try my best to give them passages to read and encourage them when they are reading.*

Another said:

> *I motivate them, I give them marks, I give them small, small points and I record them down for the exams. I will then add it to their marks. You can even ask them I give them money like 50p, some I give them GH₵ 1, some I give them toffee. I give them something.*

Another teacher opined:

> *motivate them? Sometimes they clap for them, I give them hi, tap them. If you do well I will buy this, when you come here I tell them I have something special, so if they listen to the story I am going to tell them, if you are going to narrate a story, and perform well I am going to give you something, so we motivate them through tokens or body language, yeah clapping and other things.*

From the data, it is clear from the submissions of the teachers that learners were well motivated by their teachers in order to influence their literacy development. Teachers indicated that they incorporated this technique into their teaching because they know that it was very impactful in teaching and learning. Teachers motivated their learners with tangible gifts, positive words of encouragement, and even encourage the learners to ignite their own intrinsic motivation in order to influence their own literacy skill development

4.6.1 Data collected from observation session on how teachers' instructional strategies influence the development of braille reading skills for students

Table 6: Teachers' instructional strategies that influence the development of braille reading skills

S/N	ITEM	NUMBER OF OBSERVATIONS	OUTCOMES
1	Teacher employs both uncontracted and uncontracted approaches in teaching braille	4	yes
2	Teacher engages learners more frequently on reading activities	4	yes
3	Teacher motivates learners to read frequently	4	yes
4	teacher employs the phonological awareness in teaching literacy to learners with visual impairments	4	No
5	teacher engages learners in singing and listening to songs, nursery rhymes and chants reading stories etc.	4	yes

Source (Field data, 2021)

Table 6 represents data gathered during the observation schedules on how the instructional strategies employed by the teachers influence the braille reading skill development of their learners. From the data presented in Table 6, it is clear that teachers engaged their learners in both contracted and uncontracted approaches in

teaching braille. They did this based on the level of that learner. It was again observed that teachers engaged their learners frequently in reading activities. The observers also noticed that learners were always being motivated by their teachers either with tangible gifts, words or encouragement and counseling to ensure that their desired behaviour was well reinforced. it was however uncertain as to whether the teachers employed the phonological awareness in teaching their learners as one of their approaches. It was again revealed from the observation that teachers engaged their learners in a lot of literacy activities that encouraged reading skill development in their learners; such activities included storytelling, rhymes, singing, and oral reading in class.

CHAPTER FIVE

DISCUSSION OF RESULTS AND FINDINGS

5.0 Introduction

This chapter presents the findings and discussions of results for the study. The results are discussed in line with the research questions raised to guide the study.

5.1 What are the steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind?

The analysis of the data collected from the interview as well as the observation schedule revealed the steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind. Three themes emerged from the discussions; onset of the disability of the learner, task analysis approach, and the use of dual media approach in setting up a braille literacy programme for learners in Akropong School for the Blind. From the discussions, it was evident that teachers first of all introduce the cells of the braille to learners before they learned to read or write. They also engage learners who are congenitally blind in dummies to train their finger dexterities. This approach by the teachers is in line with the assertion of Millar (2020) which states that learning to write and read braille is difficult because of the cells involved; Each letter of the English alphabet is represented by a unique dot configuration represented by the presence or absence of six dots, each approximately 1 mm in diameter, within a matrix of two columns and three rows, with 1.5 mm between the midpoints of each adjacent dot. These small patterns differ only by the presence or absence of dots, making braille alphabet learning difficult (Millar, 2020).

Onset of the Disability

With regards to the theme of the onset of the disability, teachers indicated that the onset of the disability of the learner would inform the needs of the learner and where they have to start with the programme setting. They stated that training of the finger dexterity was very key to the development of the literacy of the learner since braille is a tactile medium of learning. This assertion of the learners confirms Millar (2020) that braille reading constitutes a highly specific and active tactile process, in which fingers, arms, and even elbows are involved. The findings again are in line with Lorimer (2012), who states that appropriate hand movements for reading braille depend on (a) brain asymmetry, (b) the sensitivity of each finger, and (c) training received at an early stage of learning. Vakali and Evans (2014) assert that braille reading presupposes effective tactile spatial acuity, so that the reader will be able to identify the relative spatial position of the braille dots and eventually acquire the maximal amount of information from each braille character, also falls in line with the findings from the study.

Task Analysis

Again, under the theme of task analysis, the study revealed that teachers did not teach concepts of literacy in a whole, but in bits so that learners could grasp concepts clearly. They stated that the reason for that is that learners with visual impairments lacked incidental learning, and for that matter, could not take concepts as a whole. This revelation is in line with the theory that guided this study; Kohler and Mishra's theory of Technological, Pedagogical and Content Knowledge (TPACK) of 2009. The theory stated that pedagogical knowledge is a teacher's knowledge of teaching and learning methods, practices and processes that are used to construct knowledge (Ball, Thames & Phelps, 2008; Mzimela, 2012; Shulman, 1986). They further stated that

teachers needed to be knowledgeable of the diverse learning styles of the learners in their classrooms, and they needed to be able to design teaching strategies that will enhance their teaching. Knowing that learners are from diverse cultural and linguistic backgrounds will enable teachers to employ various teaching strategies. Such strategies should be included in their planning (Koehler & Mishra, 2009). Moreover, knowing learners' diverse learning styles enabled teachers to plan differentiated lessons (i.e. instruction) that should consider individual learners' readiness, interests and profile. Findings from this study again agree with that of Mangold (2011) and Crawford and Elliott (2014). They both evaluated steps for teaching braille-letter identification. Both studies shared the approach of establishing a novel relation between the tactile stimulus (i.e., a braille symbol) and an auditory or vocal stimulus (i.e., the spoken letter name). The activities of the teachers, as one of them stated below align with the strategies opined by Mangold, and that of Crawford and Elliott

> *I know of oral learning, scribbling, order of arrangement and others. We do use bottle tops to do some of the signs, playing with toys, identifying shapes from what we give them.*

Dual Media Approach

The third theme that emerged from this strand was the use of dual media approach in literacy instruction and learning. Most of the teachers stated that they did not use dual media and that they relied only on braille medium in teaching literacy. Some of them stated their reasons that the learners had come to the special school to learn braille and that should be their medium of instruction. Others also stated that they as facilitators were visually impaired and could not introduce braille to their learners. These assertions by the teachers disagree with the study of Rogers (2014) who suggested that because teachers often see visual processing being faster and more efficient than

tactual processing, print initially may be viewed as the preferred format for children with very low vision, especially in lower primary classes, where children are not required to process large amounts of information. Almost all the children (86%) in her sample had begun by learning print in kindergarten, but by age seven, 54% had been introduced to braille. However, in this study, it was clear that teachers did not introduce print to learners irrespective of their cognitive level or the quantum of work involved. Rogers further opined in her study that dual media users were grouped in three categories namely; the predominantly braille users, the predominantly print users and the successful braille and print users. In view of this study, learners involved in this study would be viewed as predominantly braille users. Additionally, the findings from this study conducted in Akropong School for the Blind also confirms that of Lusk and Corn (2006a) who stated that a single-medium policy was common in the United States in the 1970s but currently, dual media is regarded as a positive advantage for some children.

5.2. What knowledge do teachers' on the appropriate order of teaching braille alphabet to students in Akropong School for the Blind?

Data gathered from the teachers during interactions and observation schedules indicate that teachers used adapted instructional materials to facilitate the teaching of literacy to learners with visual impairments. They however expressed little knowledge in the use of high technology devices in teaching literacy.

The 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 assertion of the teachers 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". Struggle

in learning this foundational skill hinders the acquisition of learning more complex braille-reading skills later on, such as producing and joining the letter sounds. The researcher further highlights the significance of naming braille letters correctly as an antecedent for braille reading. However, not enough research is available on effective methods for teaching this skill and it is rarely incorporated in the braille curriculum. Swenson (2008) stated that as soon as they learn a few alphabets and words, they start to read and write sentences about people, places and activities that they understand. The activities engaged by the teachers in the school align with the statement of Swenson (2008) as they stated that learners were taught the letters of the alphabet and familiar words before they started to braille letters, words, and sentences. The data is also in line with what McCall, McLinden and Douglas (2011) stressed about that the importance of the order in which braille symbols are taught to minimize the confusion of reversals and inversions.

On the theme of using adapted instructional materials, teachers demonstrated enough knowledge in employing the instructional materials in teaching braille literacy. This revelation confirms Kohler and Mishra's theory of Technological, Pedagogical and Content Knowledge (TPACK) of 2009 which states that Content knowledge is knowledge of the subject matter that has to be taught or learnt in a particular grade (Mishra & Koehler, 2006; Shulman 1986). In this study, it is revealed that the teachers had knowledge of important concepts, skills and facts of literacy as a fundamental subject in the foundation phase, particularly emergent literacy skills. The data also revealed that teachers used adapted instructional materials such as the dummies, replica, braille and stylus to teach literacy to learners with visual impairments in the school. The instructors mentioned among other things that those activities they engaged the learners in, helped to minimise confusion, train them in

tactile perception, and also help them to learn braille tracking and beginning. The revelations of the teachers confirm what McCall, McLinden and Douglas (2011) opined on the importance of the order in which braille symbols are taught to minimize the confusion of reversals and inversions etc. (McCall et. al., 2011). Mangold (2015), designed "The Mangold Braille Programme of Tactile Perception and Braille Letter Recognition," which are used to teach tracking and beginning braille. It teaches the tactile perception, recognition of symbols, surfaces, geometric shapes and braille alphabet to children. The students gain the ability of recognizing tactile symbols by touch and reading letters, in the right way without any confusion. The purpose of Mangold (2015) fits into the activities of what teachers did in this school in teaching literacy. D'Andrea (2009) further stipulated the importance of "The Mangold Braille Programme of Tactile Perception and Braille Letter Recognition as he describes the programme created by Mangold as a series of 29 lessons to improve braille reading habits and letter recognition, which indicated that 90% of braille readers in Mangold's study benefited from this approach.

Furthermore, the theme of the use of technology in teaching literacy also came up during the interaction with the interviewees. It was evident that teachers had little knowledg in technology, especially the electronic or high technology assistive devices. This assertion of the teachers confirms Zhou, Parker, Smith and Griffen-Shirley (2011) who reported that the lack of skills and knowledge by teachers of pupils with visual impairment was a main barrier hindering the use of technology in schools. This is a call for concern because the relevance of braille in the modern technological era has become a heated debate among educators of learners with visual impairment. In the USA, controversy surrounded the publication of an article in the New York Times Magazine in December 2009 when a successful business executive

who is blind questioned the continuing relevance of braille in the new information technology era, describing braille as "an outdated means of communication which for the most part should be abolished" (Aviv, 2009). The article prompted a strong defense for braille in publications such as the NFB's Braille Monitor. Some of them stated that the teaching of technology is in the hands of the ICT teachers. That could be as a result of lack of self-competencies in the use of assistive technology devices as was surveyed by Zhou, Parker, Smith and Griffen-Shirley (2011) to ascertain the 74 competencies for teachers of pupils with visual impairment related to assistive technology as defined by Smith et al. (2009). Among the competencies where teachers felt they were lacking were: assistive devices relating to braille literacy and its application, use of screen reading software, use of braille translation software, electronic braille devices and sourcing funds for technology devices. The survey conducted by Zhou et. al (2011) confirms what teachers in Akropong School for the Blind said about their competencies in assistive technology devices. Others also indicated that they were visually impaired and could not manipulate the devices themselves to teach literacy; this falls in line with what Kelly and Smith (2008). They found that young people with visual impairment used computers and telephones for social purpose not only less often than sighted children, but also less often than some other disability groups. This study again agrees with that of Kelly (2009) confirming that between 59% and 71% of the students with visual impairment in the USA were most likely to benefit from assistive technology but did not have the opportunity to use it.

The study again revealed that teachers only attempt to introduce technology in teaching literacy at the junior high level, but those at the primary and pre-school had no access to such devices. This again confirms what Murphy, Hatton and Erickson

(2008) surveyed using specialist visiting teachers of pupils with visual impairment who work with preschool children in the USA. They found that most preschool children with visual impairment were not given access to assistive technology devices that may potentially facilitate literacy development, with only 3% always, providing access to electronic text from the internet.

5.3: What are the resources available to support teachers in developing braille reading skills for students in Akropong School for the Blind?

There are many tactile reading tools, devices and materials that could be used to support the reading skills development of students with visual impairments or low vision. Results from this study showed the available materials to support the braille reading development of students with visual impairment at Akropong school for the Blind. A considerable number of resources emerged, including braille alphabet and printed materials, slate and stylus, tactile resources, optical devices, and braille computers and printers. The braille alphabet and printed materials were developed for students with visual impairment to have access to information in print. Many applications are being developed in order to simplify lives of individuals with visual impairment, thanks to this alphabet. In light with the description of the braille alphabet, Wetzel and Knowlton (2000) explained that braille symbols are created in field units known as braille cells. A braille cell is made of six points of different combinations consisting of three points and two parallel vertical columns. It is possible to generate 63 combinations by using one or more of these six points. The dots represent a letter, number, punctuation and a part of a word or even the entire word.

The slate and stylus were mentioned as some of the resources needed to develop braille reading among students. This was emphasized in literature as one of the main media of communication for persons with visual impairments. The evidence given by the teacher-interviewees corroborate with findings by Bardin and Lewis (2008) who added that educational adaptations required for students with visual impairment focus generally on education of their reading and writing skills, daily life skills, independent movement skills and relaxation skills. Students with visual impairment use their reading and writing skills and braille alphabet or printed material alternatives. Students with visual impairment may develop reading and writing skills in the level of their peers through appropriate teaching and assessment activities.

Emphasis was laid on the use of tactile resources in supporting students with visual impairments in braille reading. Proficiency at tactile reading increases the reading skills of students with visual impairments. It can also help the sighted peers to appreciate the challenges that their peers with visual impairments experience. These teaching materials used by teachers are partly consistent with Efstathiou and Polichronopoulou's (2015) study which concluded that most teachers use tactile objects frequently.

Optical devices such as magnifiers and lenses emerged as some of the resources available to support students to read braille books. These materials were mentioned in literature that teachers face more difficulties in using tactile materials, braille materials, tactile books and magnifiers (Topor & Rosenblum, 2013); that is, the use of these materials as said by interviewees of this study could support the development of reading skills among the students. However, the materials were not readily adequate for the increasing number of students being enrolled every year.

Among the resources mentioned included braille computers and printers to facilitate independent reading skills development among students with visual impairments. The results indicated that the computer could translate information it displayed into braille when connected to the braille display device printed in the braille form. This technology could help students develop their reading and writing skills in the absence of slate and stylus.

5.4. What instructional strategies do teachers employ to influence the development of braille reading skills for students at Akropong School for the Blind?

Data gathered from the participants indicated that teachers engaged their learners in a child-centred approach to facilitate their acquisition of braille reading skills. The instructional approach used by the teachers agrees with the findings of D'Andrea (2009) who opined that a variety of approaches exist for providing braille literacy instruction, including beginning with uncontracted or contracted braille; using a basal reading approach; implementing a whole-language approach; using an individualized, student-centered approach; or utilizing a combination of two or more of these. Prior to the ABC braille study, a clear consensus could not be reached on the most effective strategies for teaching braille reading skills. It was again revealed from the data that teachers engaged their learners frequently in reading activities to help develop their acquired skills in reading. In line with this study, Morgan, Fuchs, Compton, Cordray, and Fuchs (2008) stated that students who are less engaged in reading are at risk of failing to learn to read proficiently. If students lack the literacy skills to obtain meaning from what they read, their motivation for reading decreases or fails to develop altogether.

Furthermore, it was revealed from the study that apart from engaging the learners frequently in reading activities, the teachers also motivated their learners during literacy activities in order to reinforce the desired behaviours. This study agrees with Melekoglu and Wilkerson (2013) who reported that a lack of reading motivation limited students' willingness to improve critical reading skills and strategies necessary for academic success. In contrast, Naeghel, Keer, Vansteenkiste, and Rosseel (2012) revealed that students with higher levels of motivation for recreational reading were characterized by increased academic performance and positive reading behaviors such as engagement and comprehension. It is therefore eminent that students' motivation to engage in reading activities increases their willingness to read and the lack of motivation brings otherwise. It was in view of this that one of the teachers stated:

> "*We give them story books to read, braille a passage they want, then they come to class to read. Also, they bring their own stories then we all listen, after that we ask ourselves questions to entertain them.*"

It was however revealed from the study that teachers did not engage their learners in phonological awareness in facilitating the literacy skill acquisition of their learners. Monson and Bowen (2008) found that research evidence concerning the relationship between phonological awareness and braille was uncertain because of: the lack of commonality among the studies; the extent of contradictory findings; and the small number of studies involving beginning braille readers. Greaney and Reason (2021) found that braille readers outperformed sighted readers in phonological tests, which may be in contradiction with the revelation in this study; Gillon and Young (2002) and Dodd and Conn (2000) opined delays in phonological development compared to fully sighted children. The later finding may be in line with this study because

teachers of the school expressed difficulty in teaching phonological awareness to the learners. One of them stated below:

> *"teaching phonological awareness or phonemes is a bit difficult because we do not have those sounds in braille but sometimes we use other thing to represent them."*

She further added that:

> *"with the phonemes, you have to say it for them to listen. Let's say you want to mention 'honey' unless you pronounce the word they wouldn't know how the sounds are combined to produce that word, so, we demonstrate for them to hear and they also pronounce so."*

Further research works have been carried out in comparing the phonemic awareness between sighted students and the blind, and Dodd and Conn (2000) found that braillists performed below the level of sighted children on reading measures, but also found that they performed relatively poorly on phonological awareness skills in comparison with a matched group of sighted children. In particular, they found that the participants who were blind scored lower on segmenting words that contained braille contractions, concluding that the logographic nature of braille (the fact that contracted braille symbols such as 'the' in the word 'further' can cut across phonological boundaries) affects a reader's ability to segment words phonemically and that some phonological difficulties might be related to 'the nature of contractions in braille orthography'. (p9).

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The purpose of the study was to investigate teachers' instructional strategies teachers' use in developing braille reading skills of students at Akropong School for the Blind in the Eastern Region of Ghana. it specifically sought to:

1. Examine steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind.
2. Investigate knowledge teachers' have on the appropriate order of teaching the braille alphabet to students in Akropong School for the Blind.
3. Identify resources available to support teachers in developing braille reading skills for students in Akropong School for the Blind.
4. Examine the instructional strategies teachers employ to influence the development of braille reading skills for students in Akropong School for the Blind.

The four research questions raised during the study were guided by Kohler and Mishra's theory of Technological, Pedagogical and Content Knowledge (TPACK) of 2009. The qualitative approach using the case study design was adopted for the study. The researcher used semi-structured interview and observation schedules to gather the data from twelve (12) teachers in the KG, the primary and the junior high school. The interview data were analysed using the themes that emerged from the responses of the participants. The observation schedules were carried out in the natural setting during literacy instructions to triangulate the comments of the teachers during the interaction

sessions. The behaviour was observed four times on each participant to confirm the behaviour.

6.1 Summary of Major Findings

The major findings are summarised below:

6.1.1 The steps teachers follow in setting up a braille literacy programme for students in Akropong School for the Blind

Data from the study revealed that teachers in Akropong School for the Blind consider three main things when setting up a literacy programme for their learners with visual impairments. These include the age of the onset of the disability, the task analysis approach, and the dual media approach.

On the theme of the age of onset, the data revealed that before setting up a literacy programme, they considered the age of the onset of the disability and try to either incorporate dummies to the learner, train the finger dexterity of the learner among others. The child was made to learn the dots in the cells of the braille. So in teaching the alphabet, punctuation and numbers of the braille, teachers considered the age of the onset of the disability and decided the approach to use.

Another theme that emerged from this research question was the task analysis approach as a way of setting up a literacy programme. The study revealed that teachers took into consideration the fact that learners with visual impairments could not grasp a concept as a whole once; they inculcated into the programme the use of task analysis; that is giving a whole to learners in bits. The study again revealed that teachers were a bit challenged with the inadequate materials such as the 'pin plug', the brillion sheets, large class sizes with inadequate teachers among others that made it very difficult for them to undertake the task analysis approach.

The third theme that emerged from the study in this research question was the dual media approach in setting up a literacy programme. Even though students with visual impairments are a heterogeneous group, and some students, despite their visual impairments, can employ print as a main or supplementary medium of literacy activities, it was revealed that teachers in the school employed only one medium of literacy learning; that is through the braille only.

6.1.2 The knowledge of teachers' on the appropriate order of teaching braille alphabet in Akropon g School for the Blind

The study revealed that the teachers demonstrated fair knowledge on the appropriate order of teaching the braille alphabet. They mentioned among other steps which included scribbling, the use of the dummies or replicas to learn the alphabet at the lower level, among others. These steps made it easier for the learners to grasp the concepts presented to them. In teaching the braille alphabet, teachers in the school used adapted instructional materials like dummies, the cubarithm board, the braille and stylus, the playground among others. They argued that these materials helped the learners to have enough practice of whatever they wanted to learn before they were given the opportunity to engage in that.

The study further revealed that teachers had little knowledge in the use of electronic technology in teaching literacy. Some said they have visual impairments and for that matter they had no access to electronic gadgets. They however stated that the department of ICT was responsible for imparting knowledge on technology, and for that matter, they as teachers of literacy did not engage in technological knowledge.

6.1.3 Resources available to support teachers in developing braille reading skills of students in Akropong School for the Blind

The study revealed the resources available to support teachers in developing braille reading skills for students with visual impairments. These resources ranged from braille alphabet and printed materials, slate and stylus, tactile resources, optical devices, to braille computers and printers. The braille alphabet and printed materials enabled the students to have access to information in print, starting from braille symbols. The braille symbols are created in field units known as braille cells. Cells are used to represent a letter, number, punctuation and a part of a word or even the entire word. The slate and stylus were mentioned as some of the resources needed to develop braille reading among students. This was emphasised as one of the main mediums of communication for persons with visual impairments. The use of tactile resources in supporting students with visual impairments in braille reading was also highlighted. It emerged that proficiency at tactile reading increases the reading skills of students with visual impairments. It could also help the sighted peers to appreciate the challenges that their peers with visual impairments experience. Optical devices such as magnifiers and lenses emerged as some of the resources available to support students to read braille books; that is, the use of these materials could support the development of reading skills among the students. It was also revealed that braille computers and printers could facilitate independent reading skills among students with visual impairments.

6.1.4 Instructional strategies teachers employ to influence the development of braille reading skills in students in Akropong School for the Blind

In the research question which sought to ascertain the instructional strategies teachers employ to influence the development of braille reading skills in their learners, it was

revealed that they engaged learners in a lot of children centred instructional strategies, motivation, and learning from simple to complex.

On the subject of child-centred approach strategy, the teachers indicated during the interaction sessions they employed a lot of activity methods, practical lesson delivery carried out by the learner, and role plays to make sure that learners were able to understand concepts taught. In short, teachers indicated that they only facilitated skill development, but they did not teach. According to the teachers, these activities they engage the learners in helped them to be able to undertake literacy activities independently or with little support.

The study further revealed that teachers employed the simple to complex approach in presenting literacy concepts to their learners. They presented concepts to them from simple to complex so that the learners did not get scared about the complex nature of the concepts in order to shy away from it or become timid. For instance, most of the participants stated that they taught the learners to understand the letters of the alphabet first, learn how to read them in full words before they were introduced to contracted forms of the braille. It was however revealed from the study that teachers skipped some concepts they deemed to be difficult to instruct; that was, they avoided teaching phonological awareness to learners because they expressed their views that it is technical and difficult to do.

The study further revealed that teaching phonemes and phonemic awareness is a complex structure to the teachers of literacy since there were no braille representations of transcribed symbols of sounds.

6.2 Conclusion

The study drew the conclusion that teachers of Akropong School for the Blind employed a lot of instructional strategies including motivation, child-centred approach in teaching literacy, and teaching concepts from simple to complex in developing braille literacy skills in their learners with visual impairments. The teachers further demonstrated fair knowledge in setting up a braille literacy programme, they further demonstrated adequate knowledge on the order of teaching the letters of the braille alphabet. However, teachers had little or no knowledge in teaching literacy using technological devices.

6.3 Recommendations

Based on the findings from this study, the researcher made the following recommendations:

a) Management of the school should liaise with circuit supervisors to supply learning materials such to improve on the steps teachers in the school use in setting up braille literacy programmes

b) The Ghana Education Service should also post braille literacy teachers to the school to augment the effort of the few teachers who are overwhelmed by the large class sizes.

c) The school should organise regular in-service training for braille literacy teachers on how to employ electronic technological devices in teaching braille literacy.

d) Management of the school should periodically organise in-service training for literacy teachers on how to teach phonological and phonemic awareness to their learners.

REFERENCES

Allman, C. B. (1998). Braille communication skills: What teachers teach and visually impaired adults use. *Journal of Visual Impairment & Blindness, 92*, 331–338.

Alumode, B. E. (2011). Population and sampling techniques in research in education and social science. In B. Ezeliora, J. O. Ezeokana, H. Inyega & Co (Eds. P 163- 186), *Principles of research in education and social science. Enugu*: Fourth Dimension Publishing Co., Ltd

Amato, S. (2002). Challenges and solutions in teaching braille in an online education model. *Journal of Visual Impairments and Blindness. 103*, 78-80

Amato, S. (2002). Standards for competence in braille literacy skills in teacher preparation programmes. *Journal of Visual Impairment & Blindness, 96,* 143–154.

Argyropoulos, V. (2002). Tactual shape perception in relation to learning and using print and braille: A study of dual-media learners, Part 2 - JVIB -13-17 http://www.afb.org/jvib/jvib001106.asp 3/8/2007 the understanding of geometrical concepts by blind students. *British Journal of Visual Impairment, 20*, 7–16.

Avoke, M. (2005). *Special educational needs in Ghana: Policy, practice and research*: Special Educational Books. Winneba.

Ball, L. D., Thames, H. M., & Phelps, G. (2008). Content knowledge for teaching. *Journal of Teacher Education, 59*(5), 389–407.

Bell E. C., & Silverman, A. M. (2018.) Rehabilitation and employment outcomes for adults who are blind or visually impaired: *An updated report, J. Blind. Innov. Res., 8* (1) 123-140

Bryman, A. (2005). *Social research methods. Canada*: Oxford University Press.

Bush, K. M. (2013). Stimulus equivalence and cross-modal transfer. *The Psychological Record. 43*(4), 567–584.

Cohen, L. Manion, L., & Morrison, K. (2004). *Research methods in education*. (6th Ed.). Routledge: New York.

Connell, J. E., & Witt, J. C. (2004). Applications of computer-based instruction: Using specialized software to aid letter-name and letter-sound recognition. *Journal of Applied Behavior Analysis, 37(*1), 67–71.

Corn, A. L. & Koenig, A. J. (2002). Literacy for students with low vision: A framework for delivering instruction. *Journal of Visual Impairment and Blindness, 96*(5), 305-321.

Crawford, S. & Elliott, R. T. (2007). Analysis of phonemes, graphemes, onset-rimes, and words with braille-learning children. *Journal of Visual Impairment & Blindness, 101*(9), 534–544.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. Thousand Oaks, California: Sage Publications Inc.

Creswell, J. W. (2012). *Educational research: Planning, conducting and evaluating quantitative and qualitative research (4th Ed.)*. Boston: Pearson Education.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative and mixed methods approach (5th Ed.). Los Angeles*: Sage Publications, Inc

D'Andrea, F. M. (2009). A history of instructional methods in uncontracted and contracted braille. *Journal of Visual Impairment & Blindness, 103*(10), 585-594.

De Rose, J. C., de Souza, D. G., & Hanna, E. S. (2006). Teaching reading and spelling: Exclusion and stimulus equivalence. *Journal of Applied Behavior Analysis, 29*(4), 451–469.

Dogbe, D. (2020). Braille reading proficiency among learners with visual impairments: Teachers' strategies and learners' readiness in Akropong School for the Blind, Ghana. *European Journal of Special Education Research, 5*(4) 89-101.

Douglas, G., Grimley, M., Hill, E., Long, R., & Tobin, M. J. (2002). The use of the NARA for assessing the reading ability of children with low vision. *British Journal of Visual Impairment 20*(1), 68-75.

Douglas, G., Weston, A., Franks, J., & Clements, B. (2009). *Braille in the 21st century: Opportunities, benefits, and challenges for adults with acquired sight loss*. Report for RNIB; http://www.rnib.org.uk/aboutus/Research/reports/inclusive/Pages/Braille_21_century.aspx

Emerson, R. W., Holbrook, M. C., & D'Andrea, F. M. (2009). Acquisition of literacy skills by young children who are blind: Results from the ABC Braille Study. *Journal of Visual Impairment and Blindness, 103*(10), 610-624.

Ertmer, A. P. & Ottenbreit-Leftwich, T. A. (2010). Teacher technology change. *Journal of Research on Technology in Education, 42*(3), 255–284.

Fienup, D. M., Covey, D. P., & Critchfield, T. S. (2010). Teaching brain–behavior relations economically with stimulus equivalence technology. *Journal of Applied Behavior Analysis, 43*(1), 19–33.

Foulke, E. (2021). "Increasing the braille reading rate," J. Vis. *Impair. Blind., 73*(8)

Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education (5th ed.).* New York: McGraw-Hill Publishing Co.

Fraenkel, J. R., & Wallen, N. E. (2009). *How to design and evaluate research in education (7th ed.*). New York: McGraw-Hill.

Frieman, B. B. (2006). State braille standards for teachers of students who are blind or visually impaired: A national survey. Braille Monitor, 47. Retrieved from http://www.nfb.org/Images/nfb/Publications/bm/ bm04/bm0401/bm0401.htm

Gadagbui, G. Y. (2012). Home-school partnership and counseling for families. Winneba: Department of Special Education: UEW.

Grace, D. (2005). *Teaching braille reading to adventitious blind.* Napier Publishers.

Gerrish, K., & Lacey, A. (2010). The research process in nursing. Chichester, West Sussex, U.K.: Wiley- Blackwell

Greaney, J., Hill, E., Mason, H., McCall, S., & Stone, J. (2021). Neale analysis of reading ability – University of Birmingham Braille Version. Windsor, RNIB -NFER/Nelson.

Green, G. & Saunders, R. (2016). Stimulus equivalence. In Lattal K.A, Perone M, editors. Handbook of research methods in human operant behavior. New York: Plenum; pp. 229–262.

Hampshire, B. E. (2002). Tactile and visual reading. *New Outlook for the Blind, 69*(2), 145–154.http://snow.utoronto.ca/best/special/OneIsFun/ chapter_001.htm

Kao, M. & Mzimela, J. (2019). 'They are visually impaired, not blind … teach them!':Grade R in-service teachers' knowledge of teaching pre-reading skills to visually impaired learners. *South African Journal of Childhood Education, 9(1), 651.*

Kelly*, S.* M. & Smith, D. W. (2008). Digital social interactions in students with visual impairment: Findings from two national surveys. *Journal of Visual Impairment and Blindness, 102*(9), 528-539.

Kelly, S. M. & Smith, D. W. (2011). The impact of assistive technology on the educational performance of students with visual impairment: A synthesis of research. *Journal of Visual Impairment and Blindness, 105*(2), 73-83.

Kelly, S. M. (2009). Use of assistive technology by students with visual impairment: Findings from a national survey. *Journal of Visual Impairment and Blindness, 103*(8), 470-480.

Knowlton, M., & Berger, K. (2000). Competencies required of braille teachers. *Review, 30*, 151–160.

Koehler, J. M. & Mishra, P. (2009*). Technological pedagogical content knowledge: A framework for teacher knowledge.* Teachers College Record,108(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Koenig, A. J. & Holbrook, M. C. (2010). *Learning media assessment of students with visual impairment*: *A resource guide for teachers* (2nd ed.). Austin, Texas: School for the Blind and Visually Impaired.

Koenig, A. J., & Holbrook, M. C. (2010). Literacy skills. In A. J. Koenig & M. C. Holbrook (Eds.), *Foundations of education. Vol. II: Instructional strategies for teaching children and youths with visual impairments* (pp. 265–329). New York: AFB Press.

Kusi, H. (2012). *Doing qualitative research: A guide for researchers*. Accra: Emmpong Press.

Lane, S. D, & Critchfield, T. S. (2016). Classification of vowels and consonants by individuals with moderate mental retardation: Development of arbitrary relations via match-to-sample training with compound stimuli. *Journal of Applied Behavior Analysis, 31*(1), 21–41.

Lorimer, P. (2002). Hand techniques in reading braille: Synthesis of spatial and verbal elements of reading. *British Journal of Visual Impairment, 20*(2), 76 79.

Lusk, K. E., & Corn, A. L. (2006a). Learning and using print and braille: A study of dual- media learners, Part 1. *Journal of Visual Impairment and Blindness, 100*(10), 606-619.

Lusk, K. E., & Corn, A. L. (2006b). Learning and using print and braille: A study of Dual-media learners, Part 2. *Journal of Visual Impairment and Blindness 100*(10), 653-665.

Maneki, A. P. (1989*). Blindness and the use of partial vision*. Braille Monitor. 444-446

Mangold, S. (2015). Tactile perception and braille letter recognition: Effects of developmental teaching. *Journal of Visual Impairment and Blindness, 72*(7), 259-266.

Maree, K. (2007). *First steps in research*. Pretoria: Van Schaik.

McCall, S., McLinden, M, & Douglas, G. A. (2015). Review of the literature into effective practice in teaching through braille. Visual Impairment Centre for Teaching and Research-University of Birmingham. Retrieved from <https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&v=0CB0QF

McCall, S., McLinden, M., & Douglas, G. (2011). *A review of the literature into effective practice in teaching literacy through braille*. VICTAR, University of Birmingham; published by RNIB.

Millar, S. (2011). Aspects of memory for information from touch and movement. In: Gordon G, editor. Active touch: *The mechanism of recognition of objects by manipulation*: A multidisciplinary approach. Oxford, UK: Pergamon Press; pp. 215–227.

Millar, S. (2020). *Reading by touch*. London: Routledge.

Murphy, J. L. Hatton, D. & Erickson, K. A. (2008). Exploring the early literacy practices of teachers of infants, toddlers, and preschoolers with visual impairment. *Journal of Visual Impairment and Blindness 102*(3), 133-146.

Musgrove, M., & Yudin, M. K. (2013). "*Dear colleague letter on braille*," Washington, DC

Mzimela, P. J. (2012). *An exploration of foundation phase teachers' pedagogical content knowledge (PCK) for teaching literacy in a multi-graded classroom in the rural context*. Unpublished Master's dissertation, University of KwaZulu-Natal, Durban.

National Federation of the blind (2010). Teaching early braille literacy skills within a stimulus equivalence paradigm to children with degenerative visual impairments. *Journal of Applied Behavior Analysis, 43*(2), 181-94.

National Institute of Child Health and Human Development (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769)*. Washington, DC: U.S. Government Printing Office.

Perkin school for the blind (2022). *How the braille alphabet works*. Retrieved from https://www.perkin.org/how-the-braille.alphabet-works/

Presley, I., & D'Andrea, M. F. (2008). *Assistive technology for students who are blind or visually impaired*. American Foundation for the Blind.

Rogers, S. (2007). Learning braille and print together –the mainstream issues. *British Journal of Visual Impairment 25*(2), 120-112.

Rosales, R. & Rehfeldt, R. A. (2007). Contriving transitive conditioned establishing operations to establish derived manding skills in adults with severe developmental disabilities. *Journal of Applied Behavior Analysis, 40*(1), 105 121.

Russomanno, A. et al., (2015). Refreshing refreshable braille displays, *IEEE Trans. Haptics, 8(*3) pp. 287–297,

Shenton, A. K. (2004). *Strategies for ensuring trustworthiness in qualitative research projects. Education for Information 22*(2), 63-75.

Shulman, L. S. (2022). *Those who understand: Knowledge growth in teaching', Educational Researcher 15*(2), 4–14.

Sidman, M. & Tailby, W. (2021). Conditional discrimination vs. matching to sample: An expansion of the testing paradigm. *Journal of the Experimental Analysis of Behavior, 37*(1), 5–13.

Silverman, A. M., & Bell, E. C. (2018). "The Association between Braille Reading History and Well-being for Blind Adults," *J. Blind. Innov. Res.,* 8(1) 115-130.

Smith, D., Kelley, P., Maushak, N., Griffin-Shirley, N., & Lan, W. (2009). Assistive technology competencies for teachers of students with visual impairment. *Journal of Visual Impairment & Blindness, 103*(8),457-469.

Swenson, A. M. (2008). Reflections on teaching reading in braille. *Journal of Visual Impairment & Blindness, 102*(4), 206-209.

Swenson, A. M., & Cozart, N. (2010). Six sensational dots: Braille literacy for sighted classmates. *Journal of Visual Impairment & Blindness, 104*(2), 119-123.

Toussaint, K. A., & Tiger, J. H. (2010). Teaching early braille literacy skills within a stimulus equivalence paradigm to children with degenerative visual impairments. *Journal of applied behavior analysis,* 43(2), 181-194

Troughton, M. (2022). Research and experience. *In one is fun* [Online]. Retrieved August 29, 2021, from

Vakali, A., & Evans, R. (2007). Reading strategies employed by Greek braille readers: Miscue analysis. *Early Child Development and Care, 177*(3), 321–335.

Vanderstoep, S. W., & Johnston, D. D. (2009). *Research methods for everyday life: Blending qualitative and quantitative approaches*. San Francisco, SF: John Wiley & Sons, Inc.

Veispak, A., Boets, B., & Ghesquiere, P. (2013). Differential cognitive and perceptual correlates of print reading versus braille reading. *Research in Developmental Disabilities, 34*(1), 372–385.

Wiid, J., & Diggines, C. (2010). *Marketing research*. Cape Town: Juta & Company.

Wormsley, D. P. & D'Andrea F. M. (Eds) (2011). *Instructional strategies for Braille literacy*. New York: AFB Press

Yin, R. K. (2014). *Case study research: Design and methods*. (5th ed.) Thousand Oaks, CA: Sage.

Zhou, L., Parker, A. T., Smith D. W., & Griffen-Shirley, N. (2011). Assistive technology for students with visual impairment: Challenges and needs in teachers' preparation programmes and practice. *Journal of Visual Impairment and Blindness, 105*(4), 197-210.

APPENDICES

APPENDIX A

Letter of Introduction

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF SPECIAL EDUCATION
P. O. Box 25, Winneba, Ghana
sped@uew.edu.gh
+233 (020) 2041069

7th July, 2021

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION: MS. JUSTINA BIRI

I write to introduce to you, **Ms. Justina Biri** an M.Phil. Student of the Department of Special Education with index number **200022628**.

She is currently working on her thesis on the topic: **"Teachers' Instructional Strategies used in Developing Braille Reading Skills of Students at Akropong School for the Blind"**. She needs to interview and observe the teachers in your school.

I would be grateful if you could give her the needed assistance to enable her collect the data.

Thank you for the consideration and assistance.

Yours faithfully,

DR. DANIEL S. Q. DOGBE
Ag. Head of Department

HEAD
DEPARTMENT OF SPECIAL EDUCATION
UNIVERSITY OF EDUCATION
P. O. BOX 25, WINNEBA

APPENDIX B

INTERVIEW GUIDE FOR TEACHERS

RQ1: What are the steps teachers follow in setting up a braille literacy programme in Akropong School for the Blind?

1. Please describe the recommended order of teaching braille alphabet, numbers and punctuation signs in literacy

Probes;

A) Explain the steps in setting up a braille literacy programme

B) What are the challenges involved in setting up a braille literacy programme in your school?

C) How do you assess the reading of your learners?

D) How frequently do you introduce dual media (print and braille) instructions to your learners?

E) At what level do you introduce dual media (print and braille) instructions to your learners?

RQ2: What is the teachers' knowledge on the appropriate order of teaching braille alphabet?

1). How do you introduce the letters of the braille alphabet?

2). How do you teach tactile perception, recognition of symbols, surfaces, and geometric shapes to your learners?

Probes:

A). How do you employ technology practice; both low tech and high tech in teaching braille literacy?

B). What opportunities do you offer your learners to access information and social networking websites through electronic devices on braille literacy?

C). What is your level of skills and knowledge in the use of technology in teaching literacy?

RQ3: What are the resources available to support teachers in developing braille reading skills for students?

1. What resources do you use in teaching braille to students?

Probes;

A) What material resources improvised by you?

B) What Equipment do you use?

C) Briefly explain the challenges involved, if any, in accessing the resources for developing braille literacy programme.

RQ4: How would teachers' instructional strategies influence the development of braille reading skills for students who are blind?

1. What instructional approaches do you use to introduce braille to your learners?

Probes:

How do you employ contracted signs approach?

What of the uncontracted approach?

A) How do you employ the phonological awareness in teaching literacy to learners with visual impairments?

B) How do you motivate your learners to engage more in reading activities?

C) What reading activities do you engage your learners in?

Probes;

Singing and listening to songs, nursery rhymes and chants

Reading stories with interesting sounds/rhythms etc

APPENDIX C

OBSERVATION CHECKLIST

Place a check (√) where applicable to confirm or otherwise the teachers' interview responses.

RQ 1: What are the steps teachers follow in setting up a braille literacy programme in Akropong School for the Blind?

S/N	ITEM	YES	NO
1	Teachers take into consideration the sensitivity of the fingers of the learner by observing how they perceive tactile information.		
2	Teacher takes learners through to name individual characters correctly at the pre reading stage.		
3	Teacher teaches students to vocalize letter names while touching the braille stimulus.		
4	Teacher asks learners to select the braille format of letters that he selects in printed format		
5	Teacher introduces dual media instruction (both braille and print)		

2. What is the teachers' knowledge on the appropriate order of teaching braille alphabet?

S/N	ITEM	YES	NO
1	Teacher teaches the tactile perception, recognition of symbols, surfaces, geometric shapes and braille alphabet to children.		
2	Teacher first introduces the letters of the alphabet before teaching the learner how to read.		
3	Teacher first introduces the letters of the alphabet before teaching the learner how to write.		
4	Teacher gives opportunities to learners to access to information and social networking websites through mobile devices, via adaptive hardware and software		
5	Teacher demonstrates enough skills in the use of technology in teaching literacy.		
6	Teacher demonstrates and knowledge in the use of technology in teaching literacy.		
	Teacher employs technology practice that begins with low tech tools, moving to increasingly higher tech tools as children's skills increase with age.		

3. What are the resources available to support teachers in developing braille reading skills for students?

S/N	ITEM	YES	NO
1	There are available reading books produced by using embossed letters printed by using thick ink print method.		
2	Students with low vision have access to large font books		
3	Text magnifying devices are the means in the teaching of reading and writing to students with low vision		
4	Students are provided braille readers with access to electronic text through the use of a refreshable braille display		
5	Both mechanical and electronic assistive devices available are functional.		
6	Students have access to braille computer with no paper		
7	Students have access to braille printers,		
8	Students have access to talking computers with print out		
9	Students have access to talking calculators,		