筑波大学
University of Tsukuba

Assessing the Impact of Inconsistency in Using Braille as the Primary Method in the Education of Students with Visual Impairment in the Republic of Sudan

By

Hisham Elser Bilal Salih

A Dissertation

Submitted in partial fulfillment of the requirements to be awarded the degree of PHD of Disability Sciences

Doctoral Program in Disability Sciences, Graduate School of Comprehensive Human Sciences, Degree Programs in Comprehensive Human Sciences,

University of Tsukuba, Japan, 2022

(スーダン共和国の視覚障害教育において点字を主要文字として利用することの不整合に対する影響評価)

Supervisor: **Professor Toshibumi Kakizawa**

DEDICATION:

My personal experience and my visual disability as a totally blind person who struggled to complete all the education stages in an environment with no solid disability support system is perhaps the most personal motivation for carrying out my PhD in the education of those who are with visual impairment. The enjoyment and the sense of fulfilment that I get from researching a subject that I personally want to enrich my knowledge about is immense. Through this research, I hope to raise awareness among non-disabled people towards the special needs of people who are visually impaired and to eliminate barriers for prospective students so they do not face the same challenges that I have experienced.

…I dedicated this dissertation to all teachers, personnel and other services providers who are currently working or have worked in the field of education for people with visual impairment in Sudan…

DECLARATION:

This dissertation is submitted in part candidacy for the degree of Doctor of Philosophy from the Degree Programs in Comprehensive Human Sciences, Department of Disability Studies of the University of Tsukuba Japan

The views expressed in this dissertation engage the author solely, thus no liability of the mentioned University or its staff shall be taken in account.

The candidate acknowledges also giving appropriate credit in regard of citations and references of others previous work.

Finally, this work has not been submitted either in whole or in part, for any other degree at this or any other university.

Hisham Elser Bilal Salih

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to all those who in one way or another helped me in completing this thesis. First, my sincere thanks and appreciation to my academic adviser, Professor Toshibumi Kakizawa. He is the person whom I cannot thank enough for his invaluable guidance and direction throughout the different stages of this research, and for his generous and unlimited offer of time and resources. His wide knowledge, logical thinking, deep understanding, encouragement and personal support have been the driving force that led me to completing this thesis. I gained a lot from his vast knowledge and I greatly benefited from his keen scientific insight and his ability to put complex ideas into simple terms. He also expand my academic network by supporting my attendance at various conferences, even provided much needed assistance with administrative tasks, reminding me and other students of impending deadlines. I want to extend my thanks to my committee advisors Dr. Hisae Miyauchi , Professor Oka Noriko and Professor Iketani Naotake. My thanks go to prof. Esam Alhadi for his helpful guidance, valuable comments and technical assistance during the different stages of this study. I want to express my deepest gratitude for the staff at Khartoum University for facilitating my work throughout the data collection process and for providing me with the rooms to conduct the interviews. I would like to extend my sincere thanks to the library staff for their assistance to facilitate contact with the students who are visually impaired. Special thanks should be given to the teachers of El-Nour Institute in the Sudan Republic for their unlimited assistance in collecting the data from their students. Also, I would like to acknowledge their great effort in assisting me to test, evaluate and select the reading and recording materials used in the experimental tests. Furthermore, their invaluable assistance to facilitate communication with

the students have accelerated my work. Correspondingly, their supervision and their presence during the experiments kept normal atmosphere among the students which is necessary to obtain real data. I am truly fortunate to have such supportive teachers like the staff of Elnour institute in Khartoum. My thanks also go to the Sudanese National Association for the Blind (SNAB), for facilitating my contacts with braille readers and for providing me with a room to collect the data. I am deeply thankful to the tutors and personnel of the Support Office for the Blind at the University of Tsukuba for their courteous and friendly attitudes when socializing with me and for their great assistance in finding all the publications and references that I needed. Words are not enough to express my gratitude to them for providing me with access to the written materials either by reading them or via converting them into digital format. I also wish to acknowledge the help and support of all the participants who enthusiastically participated in the various stages of the study, without whom my study would not have been possible. Last, but not least, my warm and heartfelt thanks go to my family for their unwavering support and encouragement they had given to me especially my mother for her faithful prayers and my wife Asmaa Siddig for her firm devotion, support and for doing whatever it took to provide me with a relaxed atmosphere at home. This work would have not been possible without their love, support and encouragement. My dearest thanks to my daughter Mariam who joined us at the time of finishing the thesis. Her birth has provided me with unlimited happiness, optimism and pleasure.

To all of those and many other, I will remain indebted forever. Needless to say, any mistakes or misinterpretation of their comments and responses remain my sole responsibility.

ABSTRACT

Blind education in Sudan started with the inauguration of El-nour Institute for Those Who are Blind (EITWAB) in 1961 in the Capital city Khartoum as the first national school specialized in providing education for the visually impaired in the country. The students who are enrolled in this school use braille as the main method of reading and writing. However, the most serious obstacle facing the school is the shortage of the braille printed materials. This shortage left a negative impact on the selection of the study medium for the students who graduated and moved on to their subsequent educational stages. Another vital factor related to inefficiency in braille competency for student with visual impairment in Sudanese schools is that these schools teach only the Basic education, and the students who wish to complete their education have to join the regular higher secondary schools. With lack of the assistive technology and braille printed books, the students depend mainly on auditory mediums to study such as tape recorder, MP3 player, get reading out by assistant and memorizing the class contents. Thus, the first study attempted to find out whether placement of visually impaired students in specialized schools for the blind in Sudan (henceforth specialized schools) is the most ideal option for their education. It also focused on figuring out the advantages and the disadvantages of integrating them in regular schools versus specialized schools.

A group of 20 individuals participated in an intensive discussion about the issues mentioned above. The participant's views showed notable variation between those who support education of students with visual impairment at specialized school and those who support their integration at regular schools. The views and experiences of a number of students who are visually impaired and teachers working in specialized schools and officials in the special education departments of some states of Sudan suggested that the students with visual impairment should be integrated

into regular schools. At the same time, they proposed that the institutes specialized in the education of the visually impaired must be strengthen and supported. Also, other noteworthy solutions and strategies have been recommended to enhance the education of the people with visual impairment in Sudan.

This study was followed by the second study at EITWAB to conduct an intensive investigation for the braille literacy among visually impaired Sudanese students during their elementary school education. Furthermore, to explore the inconsistency of utilization of braille as main method to access written information via assessing the impact of using auditory media on braille-related skills. Three sets of braille-related skills were evaluated: 6-dot braille writing, Arabic Braille alphabet writing, and Arabic text Braille reading. The purpose of testing full cells of braille writing was to determine writing speed, while testing Arabic braille alphabet writing was to examine students' accuracy and proficiency. In addition, Arabic text reading was tested to determine braille reading speed. The participants were divided into 2 groups. The first group included the students at grade 3 and 4 and from grade 5 to 8 who were enrolled at the school for the academic year 2014. The second group consisted of students who enrolled at grades 5 to 8 for the same academic year. Tests for 6-dot braille writing, Arabic alphabet writing, and Arabic text reading were conducted for the first group. The listening speed test was conducted only for the second group of the participants for the purpose of this study. The results were then compared with the students' ability to acquire information via auditory means by determining the appropriate listening speed. The braille-related skill results were compared with the listening speed results to determine whether braille-related skills were affected by the use of auditory media when accessing school curricula in the earlier stages of education. The statistical results indicate that there are significant differences between the two groups in 6-dot

writing and Arabic Braille text reading, while there is no significant difference in Arabic Braille alphabet writing. These results indicate that the ratio of working time devoted to listening skills instructions compared to time devoted to teaching braille-related skills may require adjustment, since mastery of braille is an integrated process that requires instructional work to develop all braille-related skills. This may be accomplished by monitoring the student's development of the equivalent use of different braille-related skills to ensure the comprehensive mastery of braille.

The incompetency of the students to utilize braille as main method and its impact on the selection of study method has appeared in the result of the last study which had been conducted at the University of Khartoum. The data was obtained through an interview of 20 students who are visually impaired. The interview questions were designed to acquire information relating to the type of support the university staff is offering in order to help those students handle their study and overcome the problems they encounter during the course of their studies. The participants' situation before joining the university was also researched to understand the impact of support that they may have had on their study during the university period. The results indicated the participants' poor level of knowledge of braille method was related to their dependency on auditory media. The study also exposed that the participants usually choose a study method based on the assistive technology they applied prior to their pre-college education.

TABLE OF CONTENTS

List of Tables and Figures

TERMINOLOGY AND ABBREVIATION

CRPD: Convention on the Rights of Persons with Disabilities

CPA: Comprehensive Peace Agreement

DAISY: Digital accessible information system

DPA: Darfur peace agreement

ICC: the International Criminal Court

IEP: Individualized Education Program

IMF: International Monetary Fund

EITWAB: El-Nour Institute for Those Who are Blind

NRPB: the National Rehabilitation Project for the Blind

SNAB: Sudanese National Association for the Blind

SNCPD: the Sudan National Council for Persons with Disabilities

Specialized schools: specialized schools for the blind in Sudan

CHAPTER 1: INTRODUCTION

1.1- Research Problem and Background

Education for the blind in Sudan began after the first national school, El-Nour Institute for Those Who are Blind (EITWAB), was opened in 1961 in the capital city of Khartoum. Ten years later, the Sudan National Association for the Blind (SNAB) was founded by the graduates of this school. This association has branches in a number of prominent cities in Sudan. In 1987, the National Rehabilitation Project for the Blind (NRPB) was established with the purpose of facilitating education of visually impaired youngsters who did not have the chance to enroll in the blind school. In 1986, another school for the blind was opened in northern Sudan followed by two more schools in eastern Sudan, in 2005 and 2010. Some of the graduates from these schools continued with their education, and proceeded to higher education institutions.

The structure of the Sudanese pre-college educational system consists of an 8-years phase of basic education followed by a 3-years phase of high school. The four schools for the blind in Sudan operate within the basic education phase. The only option for students who wish to continue their education, is to join the regular high schools. The options for those who get the chance to proceed to high school, and want to keep up with the school curriculum, are auditory mediums such as tape recorders, MP3 players, reading aloud by assistants and memorization of class content Salih & Kakizawa, (2016).

Taking oral examinations is the standard practice among students who are visually impaired and attend regular high schools in Sudan. They take exams by having the questions read out to them by appointed individuals, who then help with writing down the students' answers. Salih & Kakizawa (2016) conclude that relying on readers and scribes causes several problems. For

instance, their handwriting may, in some cases, be illegible. They may be inadequately qualified to precisely transcribe all the answers as the examinees want. Additionally, they may lack experience in dealing with students who are visually impaired and may not have attended any relevant professional training. The study conducted by Salih & Kakizawa (2016) shows that braille literacy is common among blind students who previously attended or currently attend universities in Sudan. This includes the two categories of students who graduated either from a blind school or from regular schools. The participants in the above-mentioned study relied completely on auditory study tools such as tape recorders or being read to by other assistants. Access to books or other written materials using auditory means is a technique used by those with visual impairment to obtain information. The DAISY technology (Digital Accessible Information System), for instance, is an internationally recognized tool used by the visually impaired people to read recorded books (Kerscher, 2001; Kimbrough, 2001; Leas et al., 2008). This technology is, unfortunately, not commonly used in Sudan.

Due to shortage in standard recorded book services at the educational institutions in Sudan, it is up to the students to create their own. They do so by asking their sighted classmates to help with recording the textbooks for them, or by recording class notes or summaries. It became evident that the students never receive instructions on the use of more advanced tools that accurately record and retrieve data. This situation brought to the fore, the problem of depending only on listening mediums to access school curriculum, which has not been without negative impact on other braille-related skills such as writing and reading. This background is necessary to fully grasp the situation of education for visually impaired students in Sudan. It has thus become vitally important to investigate the students' use of braille and auditory media to access school curriculum during elementary education. This research was complemented by an

exploratory study of the issues related to inclusive education in students who graduated from elementary education and moved on to high school.

1.2- The Purpose of the Study

This study was conducted in order to investigate the impact of accessing information through audio mediums on the braille education of students who are visually impaired in Sudan. The study objectives are as follow:

- To understand the views of those who are or have been involved in the field of education of people with visual impairment in Sudan regarding their placement in specialized schools or integrating them in regular ones.
- To identify the competencies required for Sudanese mainstream basic schools' teachers to fulfill the needs of the visually impaired students who are being integrated in regular schools.
- To address the research hypothesis by investigating the impact of the use of audio media on braille reading and writing skills.
- To define the effect of auditory media that the participants have previously used on selecting the means of accessing information at their college education.

Research questions

This study poses the following questions:

- What are the advantages and disadvantages of integrating students with visual impairment into regular schools as opposed to separating them in specialized schools?

- In what way does accessing school curriculum through only auditory mediums affect braille-related skills such as writing and reading?
- What are the difficulties that visually impaired students encounter when accessing information for their academic requirements at a higher education stage?
- What type of assistive technology did the participants know of or previously use? How did it contribute to shaping their college education experience?

1.3- Significance of the Study

Unlike the situation in several neighboring countries, studies in the field of education of the visually impaired in Sudan are notably scarce. This gap becomes more pronounced in the case of studies focusing on the various reading and writing mediums used by people with visual impairment. For this reason, the current study has the advantage of being a pioneer in the field of the use of various reading and writing mediums by the students with visual impairment attending specialized schools, or regular schools in Sudan. The significance of this study, therefore, is as follows:

1. It fills a gap in the field of education of visually impaired students in Sudan.
2. It offers a comprehensive approach, addressing all issues relating to braille education in Sudan, including speed reading and writing of Arabic braille.
3. It presents data and information that have been collected from multiple sources, using diverse methods, to enhance the credibility of the study.

4. It tracks the visually impaired students at all school levels in Sudan to determine the methods they use to access the school curriculum, and evaluates their effectiveness.
5. It offers a thorough and detailed analysis of the impact of using auditory mediums to access school curriculum on the improvement of braille reading and writing, given the fast-growing field of auditory media, and the growing numbers of users of audio devices compared to the users of braille as a primary means of study.

1.4- The Structure of the Research Studies

The present research involves three studies which have been sequentially conducted at different educational stages with students who are visually impaired in Sudan. The first study aimed to assess the inclusion approach used in the Sudanese school to teach the students with visual impairment. This approach is based on including blind students at the nearby schools without giving them any sort of assistive technology to access the school curriculum. Thus, students at the lower classes mainly depend on oral memorization of class contents and assistance to read the school material. Additionally, they often take oral exam for academic evaluation. Thus, the current study was conducted to scrutinize the impact of including the students who are visually impaired in regular schools, and how this situation may have contributed towards the inconsistent use of braille as a primary method of accessing the written text. The reluctance to use of braille to access written text is common even among students who found the opportunity to learn it at the specialized schools and the rehabilitation centers. This causes inconsistent use of braille as the primary method to access written materials, since students may be forced to shift to auditory media use at advance stages of education.

Study 1 was conducted to identify the effect of audio media that the students were urged to use when being included in regular schools, and how the lack of preparation, including the securing of braille textbooks, may affect the future use of braille as the primary medium to access the school curriculum. Moreover, this study aimed to gauge the readiness of regular schools, as well as the mainstream teachers, to accommodate the special needs of the visually impaired students. Furthermore, we compare the pros and cons of integrating students with visual impairment in regular schools versus their education at specialized schools in Sudan.

Study 2 was conducted at the El-Nour Institution for the visually impaired, which is the only national school for the blind. Since the schools for the blind in Sudan provide only elementary education, the students enrolled at regular schools to complete their secondary education. Therefore, this research concluded by conducting the third study at the University of Khartoum. This study intended to investigate the study methods used to access written information, by the students who had attended the specialized schools and those who had attended the regular ones.

1.5- Political and Economic Overview

Sudan has been faced with the challenge of civil wars, and building and sustaining peace in many of its parts where fighting has been raging for decades. The first civil war broke out in Southern Sudan in 1956 and lasted until 1972. Less than a decade later, the agreement that ended the fighting in 1972 collapsed and the fighting fractions went to war again. This war, which is the longest civil war in Africa, ended in 2005 after another Comprehensive Peace Agreement (CPA) was signed. The two fighting parties agreed to a referendum that eventually led to South Sudan becoming an independent state in 2011.

The Darfur conflict is another chapter in the Sudan civil wars, in the western part of the country, and began in 2003. The fighting resulted in a major humanitarian crisis, with hundreds of

thousands of citizens displaced from their homes and becoming refugees. As a result, one of the world's largest international humanitarian operations commenced and continues to operate till present day (Daly & Martin, 2007). In May 2006 and 2011, agreements between the government and anti-government powers (Darfur peace agreement, DPA) were signed to no avail. In March 2009, the International Criminal Court (ICC) issued arrest warrants for many of the Sudanese military regime commanders and charged them with crimes against humanity and war crimes in Darfur. The region still experiences intermittent fighting, tribal conflicts, and cases of kidnapping and robbing of humanitarian workers. Enhancing humanitarian efforts, stabilizing peace, and improving security are top priorities for the new government in the country.

The economic situation is as unstable as the political one. The Sudan government is heavily indebted to international creditors, and does not meet the International Monetary Fund (IMF) criteria to receive financial aid because the country has neither implemented economic reforms, not set solid strategies. The conditions for economic reforms in compliance with the World Bank financing criteria are not yet in place and the debt relief process has not been progressing. These conflicts and economic crises have created a new social atmosphere with different priorities, where the needs of people with disabilities in general, and particularly the visually impaired, are almost totally neglected.

1.6- Social Conditions of People with Disability

The communal prejudices towards visual impairment and other disabilities among Sudanese societies are similar to those of other developing countries (Agbenyega, 2007; Chitereka, 2010). According to Baldo Mohamed (2011), the Sudanese traditional perceptions of children with

special educational needs are still a major obstacle to their education and social integration. Several children and adults with disabilities are still being kept hidden in back rooms and prevented from seeing or contacting other people. This can be attributed to the lack of education and family awareness about the rights of children with disability, as well as social embarrassment. Some families and communities believe that disability is a divine punishment or a sign of God's curse or displeasure, while others fear that they may be shamed because of their children's disabilities. In addition, the view of some communities toward disability as a genetic disease makes them fear that future generations will be rejected as marital partners by other families. As a result, children with disabilities are increasingly segregated. They are deprived of education, rehabilitation services, and participation in community activities. They are regarded as helpless individuals without power, knowledge, and intelligence, which adds a heavier burden to their families. Another social view justifies the exclusion and segregation of people with disabilities as being a sign of extreme care and sympathy. Accordingly, people with disabilities in Sudan find themselves with no means of acquiring the advice they need or the power to decide how they could best be assisted. Additionally, they have come to believe that they are incapable of experiencing life as their peers do. Furthermore, services are designed and delivered to them, perhaps with the best of intentions, but with insufficient consultation, since the caregivers exercise control over these services and make decisions on their behalf.

People with visual impairment pay the heaviest price from these communal views because they are considered unable to move independently and incapable of performing any hands-on task. Because of this, people with visual impairment rarely live a normal life in Sudan or contribute to the wellbeing of the family or community. The feeling of shame from having a family member with disability is common in many of developing countries (Banks, 2003; Green, 2003;

Lansdown et al., 2013; McCabe, 2007; Rohwerder, 2018; Wang, Michaels & Day, 2011). As a result of families hiding children with disabilities, the population estimates of this group are considered largely inaccurate in the recent national census. The table below shows statistical data indicating the total number of people with disability in Sudan, including South Sudan before secession.

Table 1. **Total number of people with disability (Disb. pop.) based on disability data obtained from the national census report of the Republic of Sudan 2008**

	Total population			Male population			Female population		
Area	**Total**	**Disb. pop.**	**Ratio (%)**	**Total**	**Disb. pop.**	**Ratio (%)**	**Total**	**Disb. pop.**	**Ratio (%)**
All Sudan	38205000	1855000	4.9	19322000	968000	5.0	18833000	887000	4.7
North Sudan	30504000	1463000	4.8	15413000	767000	5.0	15090000	695000	4.6
South Sudan	7700000	391000	5.1	3908000	200000	5.1	3792000	190000	5.0

According to the 2008 census (including the country of South Sudan before secession), the number of people with disabilities in both parts of Sudan is estimated to be about 1,865,000 (4.9% of the population), including 584,000 people with low vision (31.5% of all disabilities), and 92,000 people with blindness (5.0% of all disabilities). The percentage of the visually impaired is high compared to all other disabilities as detailed in Table 2.

For this group of people, it is not just about the numbers, but also the opportunities they have lost for medical, social, and educational services (Rowland, 2004). Several cases have been reported about people with disabilities suffering from malnutrition and other health problems. Such a dismal situation makes blind people experience poverty and lack hope for the future. A

small change for the better has recently been noticed in urban areas and big cities. However, remote areas are still living with the same traditional attitudes towards disability and people who are disabled. Another social factor that deserves attention is the practice of consanguineous marriage. The practice of marrying relatives is a common tradition in Sudan, as well as in other Muslim countries. This tradition is reported as one of the main causes of mental retardation in Jordan, as reported in Khoury (1992). Since the number of people who are visually impaired in Sudan is more than 30 percent compared to the other disabilities, marriage within relatives seems to be a reason in addition to the other causes of blindness.

Table 2. Total disability numbers and percentage of disability type based on disability data obtained from the national census report of the Republic of Sudan 2008

disability type	Population	Ratio (%)
All disabilities	1,854,985	100.0
lower limb disability	336,517	18.1
lower limb defect	61,476	3.3
upper limb disability	105,989	5.7
upper limb defect	25,848	1.4
hard of hearing	244,462	13.2
Deaf	63,034	3.4
partially sighted	583,715	31.5
total blindness	92,468	5.0
Speech difficulty	73,328	4.0
dumb person	43,825	2.4
mental retardation	448,451	24.2

Social, religious, and tribal traditions encourage people to build strong bonds with extended family members, support each other and live close to each other in one area. The advantage of this lifestyle is that it motivates the extended family members to help care for their disabled relatives. Consequently, people who are visually impaired were kept in their homes and mainly

sponsored by their close family members. This attitude resulted again in a “positive isolation” and hindered their admission to educational and rehabilitation institutions. Another religious factor is the Islamic obligatory financial aid (Zakat system) which urges all Muslims who meet the required criteria of wealth to pay a fixed percentage to the needy. This system has compensated for the absence of a nationalized social welfare scheme for the disabled in Sudan. Criticisms of this system are based on the view that this system may hinder the independence of the blind and other disability members, since they may rely on the financial assistance that they obtained. However, another view thinks that this system allows people with disability to recognize the sympathy of the community and promotes a sense of belonging to this community, thus reducing the stress originating from their disability.

1.7- Education System for People who are Visually Impaired in Sudan

The following section outlines statistical data on visually impaired students’ school attendance. This is followed by a detailed explanation on the institutions that provide education for the visually impaired students in Sudan, including the basic, secondary levels, higher education and vocational educational institutions. In conclusion, factors relating to information accessibility for blind people in Sudan is presented, in addition to a description on the laws regulating education, employment, and social welfare services.

1.7.1. General Outline of the Education System in Sudan

The education system in Sudan consists of three main phases; basic, secondary, and higher education. The basic (elementary) education lasts for eight years and is compulsory, followed

by a 3-year high school. The high school system requires every student to study the same courses during the first 2 years. In their last and third year, students choose between art or science fields. After completion of basic education, there is also an option to enroll in vocational training schools for 2 years, in addition to technical high schools, which include industrial, commercial, agricultural and women studies. This is a 4-year high school system that leads to the Sudan Secondary School Certificate.

Education for the blind in Sudan began after the El-Nour Institute was opened in 1961 in the capital city Khartoum as the first national school of its kind. A decade later, the SNAB was founded by students who graduated from this school. This association also has offices in major cities in Sudan. In 1986, another school for the blind opened its doors in northern Sudan. The following year, the NRPB was established which accepted young children who did not have the opportunity to enroll in the blind school. In 2005 and 2010, two other schools were founded in eastern Sudan. Some students who graduated from these schools continued their education till university level. These schools offer only the basic education, and the students who wish to continue with their education must join the regular higher secondary schools.

The students who could join the regular school depend mainly on the auditory mediums to study, such as cellphone, MP3 players, being read out to by an assistant, in addition to memorization. The students who attend regular schools in Sudan take only oral examinations. They do so by having an assistant to read the exam questions aloud and write down their answers. This method of taking examination can be problematic because the assistants are often sighted students from lower grades in high school or from a different college than those who are attending universities. The assistants are not trained to carry out this task, and have no experience or prior knowledge in dealing with students with visual impairment. They may not have legible handwriting or be

qualified enough to accurately write down all the response details in the way the examinees want.

1.7.2. Statistics of Students with Visual Impairment's School Attendance

As mentioned above, education for the visually impaired in Sudan is offered by the schools for the blind at the basic level. Visually impaired students who do not have the opportunity to enroll at blind schools, may join regular schools as listeners (because they depend on oral learning) with their sighted peers. The fulfillment of their special educational needs and the special accommodations they require to be able to grasp the class content, are issues that need to be addressed.

Data on an Integrated National Disability Strategy estimates that almost 70% of children with disabilities of school-going age, including the visually impaired, are currently out of the school system. The statistical data collection system relating to the education of disabled people in Sudan is of questionable accuracy. The data related to the education of people with visual impairment is not systematically documented. Another factor is related to family attitudes of blocking blind members from going to school, as discussed earlier. Table 3 summarizes the numbers of the students with disability who attended school in the academic year 2009/2010 according to the national report on education.

Children with visual impairment account for 69% of the total number of disabled children who do not get the opportunity to enroll in schools. Only 26.5% or one of four totally blind persons between the age of 6-24 years get the chance to enroll in school, and 35% of the partially sighted do not have school experience.

Table 3. **School attendance of people with disability in Sudan (2009/2010) According to the Statistical Data of the Federal Ministry of Public Education of the Republic of Sudan.**

Disability type	Male	Female	Total number
Visual impairment	1,994	2,702	4,696
Hearing impairment	13,799	3,812	17,611
Mental retardation	2,629	2,126	4,755
Physical impairment	3,727	2,767	6,494
Total	22,149	11,407	33,556

According to the statistical data on the special education school attendance of 2009/2010, the total number of students with visual impairment who attended schools was 4696, 2702 of whom were female. The capacity of the schools for the blind in Sudan is insufficient to account for the total number reported. Therefore, it is reasonable to assume that these numbers include the students who attend regular schools.

The 2008 National Census provides no statistics on the visually impaired people who can read and write braille in Sudan. Globally, the proportion of braille users among the visually impaired is relatively small. This is due to several factors. The visually impaired are divided according to the degree of their disability, as partially sighted and totally blind. People who are partially sighted may use their residual vision to read, write, and access information, and therefore will not need to use braille. On the other hand, the totally blind depend on the use of braille. There is also the group of people who accidentally became blind, who may find it difficult to be efficient braille users. Instead, they depend on other assistive technologies such as screen reading software to access information.

Another specific factor that contributes to the small number of braille users in Sudan is the limited number of schools for the blind in the country. This situation has resulted in a small number graduates from these schools and explains the limited number of people who can read and write braille in the country.

Some positive changes to enhance the environment of special education in general, and particularly for students with visual impairment took place recently. Some of these positive changes are within the area of legislation and regulation of social work in the country. As a result, the Sudan National Council for Persons with Disabilities (SNCPD) and a department of special education have been established. The department of special education works under the umbrella of the Federal Ministry of General Education and has many regional offices in the states and municipalities. Visually impaired people who graduate from the blind schools have the opportunity to work in the special education department regional offices. This is an important achievement of the 2009 disability law which mandated 2% of the jobs in the governmental institutions and private companies to be reserved for the people with disability. Among those who benefited from this are the visually impaired students who, after graduated from the national school for the blind, could return to their hometowns to work. Their activities included engaging the cooperation of local blind unions, individuals, and voluntary organizations to establish new schools for the visually impaired. These efforts bore fruit when one school was opened in the city of Kasala in the eastern part of the country. Another school is currently under construction in Kordofan state, in the western part of the country.

1.7.3. Educational and Rehabilitation Institutions for People With Visual Impairment in Sudan

There are few academic institutions designed to offer education to the people with visual impairment in Sudan. These institutions receive support from the public, voluntary organizations and the government. The curriculum taught at these institutions is geared toward the needs and abilities of the learners. It aims to integrate the visually impaired into society and to provide them with the necessary skills. In this research, particular attention will be given to the national institutions that provide education and training to those who are with visual impairment.

Sudan has four schools that specialize in providing education for those who are visually impaired. There is also one national rehabilitation center (the NRPB in Khartoum) and a provincial one in Aljazeera state. EITWAB is the first and only national school that specializes in the education of the blind in Sudan. It has a dormitory for students and accepts blind learners from all over the country. The second school is Aldiah Waal-Amal Institute which was established in the year 1986 at the city of Atbara in northern Sudan. This school adopts a partially integrated system, that is, the affiliated students attend regular schools to receive their education with their sighted peers and join the institute after-school to receive additional extra curriculum courses such as braille, mathematics, and mobility. There are also specialized institutes newly established in Gedaref in 2005, and in Kassala in 2010.

El-Nour Institute for Those Who are Blind in Khartoum

The following sections will shed light on El-Nour Institute for the blind. It is the oldest educational institution for learners with visual impairment and has been offering basic education since 1961. This institute was established by the Lions Club organization with the

help of many Ophthalmologists and other civilians. The institute is currently under the administration and support of the federal government of Sudan. It began as a voluntary school until it was annexed, first to the ministry of social welfare in 1968, and later to the Federal Ministry of General Education in 1993. It is the only school that provides education for male and female children who are visually impaired at the national level in Sudan. It first adopted a system of 6 years for elementary and 3 years for junior high, and later, with the introduction of a new educational system in Sudan in 1992, shifted to 8 years of basic education. By the year 2022, the system has been altered to the old education system of 6 year of elementary followed by 3 year of junior high school. El-nour institute is on the way to adapt to the new system.

The conditions for being admitted into this institute is that the child must be between 6 and 10 years of age. It accepts totally visually impaired students as well as slightly partially sighted. The main method of teaching is the use of the braille system. The school neither provides instruction on the use of visual aids for the partially sighted, nor does it provide enlarged prints. Prior to admission, an interview is usually conducted for the applicants, with the intention of examining their ability to communicate and to check if other disabilities exist. This is to ensure that the student will be able learn using the braille system and will not require help to move independently. The institute has a boarding house for male students with a capacity of 40, while 80 pupils get transported daily from home to school by the institute minibuses. The current building was a gift from the Lions Clubs and, because of its limited capacity, it is difficult to accept all applicants. Thus, the school is adopting a dual track for each class, in order to increase its capacity to accept more students, since applicants are from all parts of the country.

a) Curriculum and Teaching Materials

This school uses the same curriculum used in the schools for sighted children. Additionally, a special curriculum is adopted to meet the specific needs of visually impaired students, such as independent living and mobility training. The teaching materials and the machines which are in use, have been obtained through contributions from individuals' voluntary organizations. The school solicits contributions through its board counsel because government support has never been adequate. The Federal Ministry of General Education secures only the teachers' salary, gasoline fees for the school bus, dormitory food costs, and various bonuses for the teachers.

b) Teachers

Most of the school personnel are visually impaired. There are only a few sighted teachers in addition to technicians, drivers, and food serving staff, besides many volunteers. Teachers who work at schools for the sighted children are not interested in working at El-Nour Institute because of the unattractive financial packages offered. Therefore, the teachers who have visual impairments spend their personal time to meet the demands of teaching braille, as volunteers, for their students and for those who were unable to secure admission.

c) The Technical Team

The technical team of the braille printing department consists mainly of visually impaired teachers. They receive training in operating the printer and use of the Duxbury braille translator program. They are assisted by a team of sighted volunteer teachers from regular schools, who help with tasks such as book packaging, document scanning, and entry of the curriculum into the computer.

d) Problems Facing the School

The limited school space has always been a serious problem. In 1992, the school administration planned to add new buildings and units including classrooms, a dormitory for girls, and a playground. The plan was not implemented because of a lack of funds. This project would have helped overcome many of the problems the school is facing. With these new additions, it would have been possible to accept larger numbers of students. The school is also facing the problem of preparing the textbooks in braille. According to the school principal, most of the teaching materials are prepared by the teachers through their own initiatives and personal efforts. The school has suffered from a shortage in teaching books due to lack of printing facilities, for a long time. The curricula were printed in Egypt in the 1970s and 1980s, but this cooperative project was discontinued due to unidentified reasons. Teachers moved to print books manually using Perkins machines due to the unavailability of braille printing machines.

In 2012, the institute received a modern braille embosser (Braille Box V4) through a donation from a not-for-profit organization. This was a major breakthrough in braille printing in Sudan. For the first time, the curriculum was completely printed, as well as the teachers' notes and handouts, the monthly examinations, and tests. The printed braille books also covered the needs of the students who received braille training and integrated into regular schools in other states of Sudan. Also, the technical personnel were able to secure braille printed materials for various centers such as the NRPB in Khartoum and the Khartoum State Union for the Blind. However, lack of regular maintenance of the printer and heavy-duty operations caused it to break down many times.

Another serious problem is that teachers do not have any opportunities for professional development and training. This problem made the teachers unable to keep pace with modern

technology or new teaching techniques. In the past, teachers used to be trained in Egypt and Tunisia, but this protocol ended in 1990. Sometimes, the teachers join workshops organized by the department of special education at the Ministry of Education. These are neither adequate nor technically up to date. The school also faces a transportation problem. The school has few small and old buses of 25 passenger capacity. These buses were acquired through private donation. The budget provided by the Ministry of Education covers maintenance only.

e) School Activities

The school used to have a musical education program and art activities. These programs no longer exist as the instruments are worn out and have become dysfunctional. Also, the school is unable to hire a new music teacher. Games and toys are also getting old and damaged. There is one person volunteering to coach those interested to play football in the evenings, but the school lacks teachers for physical education and other sport activities.

f) Admission to Regular School for Sighted Students

Those who finish their basic education at El-Nour Institute and wish to join a high school can do so by joining a school for sighted students. This requires them to obtain the Sudan basic education certificate, after passing a national basic examination. They take this exam at the same time as their sighted peers. Because examination in braille is not allowed, the visually impaired students have to ask another student from a lower level to write for them. These students usually come from the nearest school to El-Nour Institute through a coordination agreement between the two schools. They are also not allowed extra time, and do not have the test questions in an accessible format. Also, they are penalized for the mistakes made by the students who assist them. Despite all these difficulties, all those who finish their education at El-Nour Institute continue with their high school education. The records are not clear on the

subject of the total number of graduates from El-Nour since its foundation, but the estimates point to approximately 500 students.

g) Role and Expectations

El-Nour Institute aims to assist its visually impaired students to attain basic daily life skills and the academic knowledge, essential to become competitive and ready for their future academic and employed life. Another objective is to teach the students cultural and art subjects including music, drama, and sports, to enrich their personal experience and develop their hobbies. The institute works on the psychological support as well. It helps the students with basic character development skills that help them trust in themselves and overcome difficulties that are part of visual disability. El-Nour Institute not only provides education for students who are enrolled, but also dispatches braille trainers to other institutions and offers braille lessons for university students who are blind. It also provides consultation for families on how to instruct their blind children. Despite the recent efforts to solve the problem of shortage in braille printed books, it remains to be the primary problem that hinders the institute from offering education at the quality and level it aspires to.

h) Vision and Mission:

In addition functioning as an elementary school, El-Nour Institute also plays an effective role as a training center for those who plan to work as teachers at other schools for the visually impaired. It also offers guidance to its graduates, and students with visual impairment from regular schools, regarding braille, mobility, and the use of assistive devices. Despite the dearth in braille tools and other teaching materials, the institute helps other schools and visually impaired students when needed.

The National Rehabilitation Project for the Blind

This is the only national center in the country that provides rehabilitation and educational services for blind individuals. It is mainly intended to help those who are unable to join schools for the blind, or are above the age of admission required for regular schools. It also offers service to those who lose their vision at a later stage. The center provides rehabilitation and various vocational courses to its members aiming to promote their self-reliance. The center also provides learners with the necessary skills to improve their communication, in an effort to fully integrate them with their local communities. These services are provided free of charge for all its affiliates. The center has four main sections: braille system learning, mathematics learning, department of everyday life, and the department of Islamic Education, in addition to three subsidiary vocational sections of carpentry, handicrafts, and computer use.

This center was established in cooperation with a Dutch organization and the SNAB, and inaugurated in 1986, although the actual activities and admission of students began in 1987. The Dutch organization provided support for seven years. With the departure of the Dutch organization, the center began to deteriorate.

The center has various departments teaching the necessary skills to the visually impaired learners. The courses include mathematics, braille, mobility, and computer skills. There is also an optional section teaching crafts. The center teaches braille for blind students of all ages, and uses abacus to teach mathematics to its affiliated learners. Each class accommodates five to seven students.

The programs are taught in short and long courses. The short training courses are often designed for university students and last between 2-3 months, with 100-120 students attending. As for the computer classes, the center includes a classroom that contains 30 devices and two screens

with magnifiers for partially blind students, and one section for training courses that accommodates about 16 students.

1.7.4. Information Access for People with Visual Impairment in Sudan

The main points to be discussed in this regard are the methods to access written material and the devices used to access information.

Method of accessing written information

People with visual impairment in Sudan can access printed material as follows:

a) Braille

As discussed earlier, there is a shortage of braille printed books at the schools for the visually impaired because of limited financial resources. In addition, braille textbooks used to come from Egypt and other countries, but this has now stopped for unidentified reasons. With this shortage in braille textbooks, the students are left with the option of copying what the teachers read out loud, use the manually written teachers' class material, or form small groups in order to share books. This harsh situation makes it impossible for the teachers to complete the year's curriculum in time, eventually slowing down the learning process, as stated by one of the teachers when interviewed for the purpose of this research.

In 2012, a new braille printer was installed at El-Nour School for the Blind to print the school curriculum textbooks. This new printer made notable positive changes through the production of textbooks in schools, to the quality of education for students with visual impairment in Sudan. This has been confirmed in an interview conducted after the distribution of the braille textbooks;

one of the teachers expressed the feeling that the classes progressed seven times faster than before, as reported in Abdin & Fukuchi (2015).

b) Access to Written Information Using Oral Reading and Recorded Material

Most people with visual impairment who attend regular schools in Sudan do not have access to braille textbooks. Consequently, in order to access the school curriculum, they have to rely on friends and family members to read for them. Another way to access written information is by recording the notes of their peers. The braille users sometimes transcribe these notes into braille. These techniques are widely used among students with visual impairment to access printed text. Also, the SNAB lends out recorded academic textbooks. The disadvantage of this method is that these audiobooks are not standardized, such as with DAISY books, so they are of varying quality and not completely practical. Another disadvantage for this method is that it becomes more problematic for the students who are attending universities. The reason being, the number of textbooks during primary and secondary education is relatively small, and peers who used to assist in reading also study the same textbooks, whereas study at universities requires reading a large number of textbooks which depend on the students' major of study. During primary and secondary education, all students have the test at the same time so it is easy for the students with visual impairment to arrange with their peers for a reading assistant. However, during higher education, the reading planning will be more difficult to adjust with the assistants', and should be according to the students' own pace.

c) Electronic Textbooks

Various books are available online in the form of electronic data and frequently shared among people with visual impairment via the Arabic blind network, as in the case of al-maktaba.org

(2020; Miller et al., 2018). These books can be accessed via computers or other smart devices. They include ancient and modern literature, history, Islamic religious studies, Arabic language, etc. On the other hand, electronic learning materials in other fields such as economics, law, and political science seem to be quite limited, but the number of articles available online is systematically increasing. This is rather promising resource for access to more learning materials. One of the advantages of electronic content is that it is possible to convert them into braille and audio format and if the text data is available, it is relatively easy to create DAISY books.

Information access devices

Computer education has recently expanded in Sudan. Noticeable contribution in this field was accomplished by a Japanese not-for-profit organization which established a computer center equipped with five computers at the University of Khartoum with screen readers, as reported in Committee for Assisting and Promoting Education for the Disabled in Sudan (CAPEDS) report (2008). Training on the use of computers and screen readers, specifically the widely used freeware, Non-Visual Desktop Access (NVDA), was conducted subsequent to the establishment of the computer center. More than 80 visually impaired people have received basic training so far. Many of the trainees became proficient, mastered the various computer related skills, and have helped other users who are visually impaired to install and use NVDA; they have also played a vital role in converting scanned books into braille textbooks.

Accessing printed materials using smart phones

The rapid spread and growth of smartphones usage in Sudan has favorably affected access to information for people with visual impairment. Previously, many students who are visually

impaired used pirated versions of voice software for cell phones. Now, the number of users in Sudan who use voice software built into their smartphones to communicate with each other is steadily increasing. Users utilize these assistive devices to access newspapers, electronic books, social networking sites, and language learning sites.

To summarize the points highlighted, various challenges with regards to information access for the visually impaired in Sudan are discussed. At the same time, there are a growing number of legal actions and technological improvements attempting to ease access to information, such as the Marrakesh Treaty, NVDA, and smartphones that have the potential to bring about significant change in the future. In addition, improved access to information will not be achieved without addressing the most important and complex issue of improving basic education.

1.7.5. The legislative framework concerning laws regulating disability issues in Sudan

The legislative framework regarding laws regulating disability issues in Sudan is extremely influenced by the surrounding African and Arabic region. Sudan is also committed to international treaties and other actions relating to disability, such as the African and Arab decade for persons with disability and Convention on the Rights of Persons with Disabilities (CRPD). Sudan is affected by political, economic, social conditions prevailing in the Arab world, as well as African legislative movements concerning disability, since Sudan is located in Africa and shares mutual cultural, religious, linguistic, and historical connection with the Arab region. The guidelines that have been designed to regulate laws toward people with

disabilities correspond to the common instructions stated in international and regional legislations. Additionally, as previously described, Sudan has its own circumstances of wars and natural disasters which have led to an increase in the numbers of people with disabilities. Consequently, this factor has intensified the need to regulate legislation that can consolidate efforts toward supporting, rehabilitating, developing, and integrating people with disabilities into society. Therefore, Sudan has adopted the general principles that are approved by the surrounding regional disability regulations, such as the Arab Decade for Persons with Disabilities, and its various laws and legislations, regulating services and support for persons with disabilities. The declaration of the Arab Decade for Persons with Disability has focused on the following guidelines: health; education; rehabilitation and employment; facilities and transportation; children, women, and older adults with disability; media and raising public awareness; globalization and poverty; sports and recreation. Thus, the Sudanese disability legislation was intended to agree with these general principles, that is, to enhance the self-image of persons with disabilities, to work on changing the social attitudes towards them, to ensure issues relating to disabilities are situated as priorities on government agendas, and to provide the necessary funds for the improvement of their quality of life. Improving legislation and implementation strategies has been identified as one of the main issues to be tackled in the African Decade of Disabled Persons 1999-2009. The effectiveness of laws in improving quality of life and offering equal opportunities for disabled persons, whether they are vocational rehabilitation laws, legislation or anti-discrimination legislation, is vital not only in terms of the economic prosperity of disabled people, but also their broader social and political rights, which are directly linked to economic empowerment (Cornell University ILR School Year 2004).

Viewing disability provision in Sudanese laws during the past 40 years, from 1980 to 2020, it can be declared that Sudanese legislators have not only acknowledged the rights of the disabled in a number of laws, but also had enacted three specific laws in favor of disabled persons, which are: the Act on Welfare and Rehabilitation of Disabled Persons, 1984, a Law Concerning the Privilege for War-Disabled, 1998 and Persons with Disabilities Act, 2009, which had been modified to the Persons with Disabilities Act, 2017. The Act on the Welfare and Rehabilitation of Disabled Persons 1984 listed various provisions to guarantee subsidizing of activities for people with disability, promoting employment, and establishing institutions to provide various services. Article 12 of the act provides for the establishment of a fund for the welfare and rehabilitation of persons with disability, to finance the activities undertaken in this regard. It also provides for the setting up of a national council to lay down general policies for the welfare of persons with disability, and to supervise regional councils in Sudan. The act makes provision for measures to promote employment for persons with disability. Specifically, it states that, once this body has been established, on the basis of a recommendation from the National Council for the Welfare and Rehabilitation of Persons with Disability, persons who are disabled may benefit from fiscal exemption measures when purchasing equipment for their work, as well as exemption from income tax. In addition, the act provides for financial benefits and facilities in such fields as education, hobbies, communication, and health. Sudan is reported to have passed a Law of Privileges for War-disabled in 1998, concerning persons with disabilities that resulted from military combat.

The Persons with Disabilities Act 2017 was preceded by various attempts to include disability-related provisions in several laws. For instance, various laws were enacted concerning regulations pertinent to the education of people with disability, since improving legislation and

implementation strategies has been identified as one of the main issues to be tackled in the country (Ministry of Education, 2004). These regulations were intended to secure equal opportunities for the education for people with disabilities from early childhood within mainstream institutions, in regular classes or in specialized institutions when integration is not possible. The education of persons with disabilities also represents a major challenge and is therefore a priority in the State's disability action strategy, as well as in its laws and legislation. The 1992 General Education Act provides for equal opportunity in education for people with disabilities. To shed light on other regulations and governmental action towards promoting education of persons with disabilities, there is the 2001 Education Act for planning and organization of general education, which ensured the right to education for all children of eligible school age without discrimination of any kind (National Report of Sudan by the Federal Ministry of Education General Directorate of Educational Planning August 2004). Article 13 of the 2001 Public Education Planning Act also stipulates that children's education is compulsory, while article 14 (b) recognizes centers for the education of persons with disabilities as part of the public education system. Article 13 (1) of Sudan Transitional Constitution (2005) states that primary education and literacy programs are both obligatory and free of charge. After effective lobbying by disability organizations, the government decided that all children with disabilities would be entitled to free education starting from the year 2002, and also included in the recent Persons with Disabilities Act 2017. In addition to the above-mentioned laws, there are many bylaws and regulations that have been passed by the legislative and executive bodies of the Sudanese government. These regulations were intended to legalize the support and care of disabled individuals. Among them is the 1991 code governing the special exemptions and facilities accorded to disabled persons. Another is the 1991 law that regulates the establishment

and organization of centers for the rehabilitation of disabled persons. A third law in 1991 concerned the funding for disabled persons' welfare and rehabilitation. This is in addition to other regulations such as the law concerning the organization of the National Council of Disabled Persons, and the Act of Associations Registration which outlines the rules of establishing any association of a cultural or social nature, including disabled persons associations. The Act of Sport and Youth Organization of 1990 included an article about sport activities for the disabled persons; moreover, the rights of people with disability were indicated in the 1998 and 2005 Transitional Constitutions of the Republic of Sudan.

Also, Sudan have signed various international treaties promoting support for people with disabilities, such as the UNESCO Salamanca Statement (1994), CRPD, and the Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled which Sudan signed in 2013. The movement has continued to regularly evaluate regulations that govern the legal rights of people with disabilities in Sudan, and to assure compliance with the international treaties which Sudan has signed. Consequently, a general conference was held in November 2016, based on instruction from the Meeting of Federal education Ministers, to discuss how to incorporate disability issues into governmental planning. The main outcomes were the recommendations to the presidency of Sudan to commemorate the International Day of Persons with Disabilities on 3 December 2016, and the passage of the modified Persons with Disabilities Act in 2017. The 2017 Persons with Disabilities Act defines a person with disability as: a person who was born or later became unable due to permanent physical, emotional, visual, or hearing impairment that totally or partially affected their life. This definition was criticized by the report of the Committee on the Rights of Persons with Disabilities, which examined Sudan, on the grounds that this definition

excluded mental disability. The act also provided for education without discrimination for disability, with focus on integration into public schools, and for the exemption from tuition fees for all levels from elementary until higher education. Moreover, the act directed for the provision of appropriate technical devices and educational aids, besides the creation of different curricula that correspond to each disability, and states that persons with disabilities are to be integrated with their peers at all levels and in all forms of education (part II, art. 4 (a), (c) and (d)). The act also provides for the right to employment for persons with disability at the different governmental institutions. The act has also established various broad instructions such as exemption of assistive devices from custom tax, early intervention to prevent disabilities, raising awareness about disability, and ensuring that all buildings are accessible and ready for use by persons with disabilities. Part III of the act includes provision for the creation of the National Council for Persons with Disabilities under the supervision of the President of Sudan or his delegate. Accordingly, the National Council for Persons with Disabilities was set up under the control of the Minister of Social Welfare, with the supervision of the presidency of Sudan. Furthermore, 18 provinces have set up provincial councils to cover their geographical areas. The secretaries of the National Council and of the provincial councils are all persons with disabilities.

Although Sudan has made progress in enacting disability-related legislations, however, most of these laws should be monitored to ensure that they are fully implemented. Thus, existing national laws need to be periodically revised in order to achieve equalization of opportunities for persons with disabilities. Furthermore, there is a pressing need for these laws to be reviewed, in order to adopt the new changes in international legislations concerning disability.

1.7.6. History of blind education in the Arab countries

Religious education

People with disabilities experienced neglect and deprivation of basic rights since the dawn of history (Selway & Ashman, 1998; Thornberry & Olson, 2005). With the spread of religious teachings, values of justice, love and brotherhood began to dominate. People with disabilities began to receive care and compassion from their communities. With the help and supervision of churches, early Christian communities established shelters and hospitals to care for orphans, beggars, and people with disability. Furthermore, people with visual impairment were offered private residences Selway & Ashman (1998). All these shelters were only for accommodation and nutrition. No educational or rehabilitation services were among the services offered at these shelters.

With the prevailing Islamic teachings in Arabia and the surrounding region, people became more open to accepting those with disabilities and included them in society. The Islamic way of dealing with vulnerable people in general, including those with disabilities such as the visually impaired, is three fold. The first one is the clear instruction not to oppress and harm people with disability. This is followed by the encouragement to socialize with people with disability. The third one is emphasizing the importance of offering education to people with visually impairment.

Education of the visually impaired in the Arab countries

Education of the visually impaired in the Arab world has remained limited to religious studies offered by mosques and Koranic schools for too long. Academic studies for the visually impaired in the Arab region was unheard of until the 1940s.

A report published by the Regional Bureau for the Middle East Committee for the Affairs of the Blind in 1984, point to three educational institutions that were established in the 1940s to teach the blind. As reported in Sisalem (1997 pp. 90-95), these institutions were the Christian Charity institution for the blind women in Cairo (1941), the Vocational Center for Blind Development in Aleppo (1947), and Institute for the Care and Rehabilitation of the Blind in Baghdad (1949).

The number of these schools continued to rise. According to a report published by the Foundation for the people with disability, their number reached 52 in 1984. These institutions provide academic education for the visually impaired as well as vocational training programs involving handicrafts, housework, and recreational activities, in addition to training on answering the phone. They operated under the supervision of various organizations including the ministries of education, social affairs, and endowments and religious affairs, as well as some non-governmental organizations.

Several private special education schools and centers in Arab countries were opened. They continued to face difficulties obtaining sufficient subsidies, and were dependent on governments, voluntary bodies, international development agencies, parents, and non-governmental organizations. According to Hadidi & Al Khateeb (2015), this is the reason most of these schools remained under the administration of the ministries of social development for decades, instead of the ministries of education or government special education services.

In addition to the general education and vocational education for the visually impaired, in most of the Arab countries, they can also continue with their education to university and graduate studies. Those who go to universities study literature, linguistics, economy, law and other social sciences.

To further promote, develop, and improve educational services for the visually impaired, the Arab countries agreed to work together and exchange knowledge in this field, and consequently, two centers were established for this purpose. One of them is the Model Center for the Care and Guidance of the Blind in Cairo, Egypt and the other one is the Regional Bureau for the Middle East Committee for the Affairs of the Blind in Riyadh, the capital of Saudi Arabia.

The history of the Arabic braille

Braille plays a major role in the advancement of the education of the visually impaired in the Arab world. It has a remarkable contribution toward the shift in visually impaired education, from only being confined to religious studies to academic education in the broadest sense. Consequently, the visually impaired became able to compete for a variety of employment that they could not attempt before. Also, the unification of Arabic braille has opened new opportunities for knowledge exchange as well as regional cooperation in the field of visually impaired education.

The history of the introduction of braille to the Arab world is not well documented. This could possibly be attributed to the fact that it started as a non-governmental initiative with minimum documentation al-Sharkawi (1997). Braille first became known in the Arabic countries in the early 1870s, with the arrival of Christian missionaries in Egypt. This was followed, according to UNESCO reports, by various versions of Arabic braille, some of which used the international numbering and punctuation systems, and sound standards.

Experts interpreted the presence of many braille versions in the region to be the cause of confusion as to which one is the most reliable one. They recommended that this is a serious impediment and should be resolved in order to achieve a real progress in the field of Arabic braille as reported by Mackenzie (1954). This was the driving force behind developing a

uniform Arabic braille that matches the international formation. The first step in this direction was taken when a gathering arranged by the International Meeting on Braille Uniformity in 1950, recommended that the Special Committee on Problems of braille in the Middle East must lead the efforts to study the braille situation in the Middle East. This wasn't an easy task to accomplish. The committee was confronted by a series of difficulties in carrying out the mandate. One of these was the complexity of the Arabic language which, unlike the braille default system, reads and writes from right to the left. The committee with the help of the Arab delegations managed to work out a technical compromise. A draft Arabic-Persian-Urdu chart was prepared and presented by UNESCO and received the approval of Arabic delegations. According to a 1953 UNESCO Report, by the end of 1951, Perso-Arabic braille had been officially accepted by various governments and institutions.

CHAPTER 2: LITERATURE REVIEW PERTAINING TO THE IMPACT OF ACCESSING WRITTEN INFORMATION VIA BRAILLE AND AUDITORY FORMATS DURING THE EDUCATION PROCESS

The literature in this chapter is pertinent to the study's statement of the problem and includes the factors involved in the formulation of the research questions and hypotheses. In this way, this chapter sets out the background for the theoretical and experimental consideration of relevant braille competencies in later chapters. The discussion is presented in two main sections. In the first section, the interrelated areas in literature on the utilization of braille by people with visual impairment in their educational process are reviewed.

The second part of the chapter provides an overview of the impact of accessing printed information via braille and auditory formats on reading comprehension.

2.1- Utilization of Various Techniques to Teach Braille During Educational Progress

2.1.1. Introduction

The sense of familiarity from braille for those students who must learn it appears remarkably when they actually start reading and writing using braille. When the students who are blind are admitted to school, they first strive to adapt to new attitudes and familiarize with the new school environment. Besides the psychological burden on account of their disability, many reasons seem to be behind this trend of students' behavior, such as feeling of isolation, overprotection

of their parents, scarcity of encouragement for voluntary displays of initiative, and lack of appropriate assistance. However, when those students start the process of learning braille, they will be granted a great opportunity to touch things that are new to them, would stimulate and expand their curiosity, thereby increasing their inclination to learn. Through braille, the visually impaired can also learn information related to their daily activities and natural phenomena, besides communicating with others, building ideas regarding their communities, and enriching their knowledge about their social life. Braille is also important for the adventitiously blind (including those who lose their vision during schooling) and persons who become unable to use their vision and forcibly find themselves shifting to use other senses to gain information. Learning braille for such a person can be a difficult task, since various psychological barriers need to be considered, such as accepting the fact that it has become impossible for them to read and write using their vision, the irritation and vexation they feel when starting the process of learning braille, compared to their position before losing their vision, as it was possible for them to read any book at their own pace. However, when students who become blind start the process of learning braille as an alternative method to acquire information, they will gradually begin to restore their confidence. Acquiring the knowledge of reading and writing using braille also appeared to generate new self-confidence that led to an increase in the students' enthusiasm to learn. Engaging in the process of studying braille is thought to assist in overcoming the various difficulties related to visual disability, boost self-motivation to study, expand independent ways of thinking, and improve judgement as well.

With the aim of understanding how braille is utilized by people with visual impairment in their educational process, the following interrelated areas of the literature are being reviewed to construct a more comprehensive framework for understanding the current effect of braille usage

on learners who are visually impaired. In addition, selecting these areas to be reviewed is in line with the framework of this study, which is concerned with assessing the progress of using braille through the education stages, from the elementary to the higher education level. Thus, these areas are:

- Acquisition of braille literacy at pre-school education
- Learning braille at elementary school
- Learning braille at intermediate and higher secondary school

2.1.2. Acquisition of Braille at Pre-school Education

Function of braille and language usage

Learning of braille is composed of two main components, active movement and passive touch (Hampshire, 1981). Braille is a medium by which language activities are performed extensively and thus, it has two main functions. The first function is used as a system of communication, and the second one enhances the way of thinking or the system of handling things, in another words, it is a non-visual means to assist the blind individual to convey their thoughts and feelings to others (McCall, McLinden & Douglas, 2011). Therefore, acquiring braille knowledge is a comprehensive process that requires not only teaching students the braille symbols, but also paying particular attention to the information processing and developing an alternate way of thinking (Edmonds & Pring, 2006; Toussaint & Tiger, 2010; Veispak, Poets, & Ghesquiere, 2012). To accomplish these goals, it is crucial to promote the process of braille learning using comprehension passages and composition topics (Lamp, 1996). Students who are blind should gain sufficient skill to be able to accurately select and process the necessary

information from a variety of complicated contents, as pointed out in earlier studies (Carreiras & Alvarez, 1999; Emerson, Sitar, Erin, Wormsley & Herlich, 2009). Accordingly, people who are blind may attain very important skills that will enable them to overcome their disability and become more confidence, thereby improving their participation in different social activities.

Learning braille and the Language Ability

Language is the intermediary means by which people convey knowledge, emotion, willingness, and expand their recognition thinking. Therefore, it is necessary to make special considerations in language teaching through the educational process, especially for people with disability, as they may encounter difficulties in understanding and expression, as stated in prior papers (Ozkubat & Ozdemir, 2014; Paugh & Dudley-Marling, 2011). Students with visual impairment may be confronted with some restrictions in language activities that require visual interaction such as reading and writing, while there is no vital effect in the non-visual activities such as speaking and listening, as stated by Lowenfeld (1973). Still, it is difficult for visually impaired students to understand the other person's attitudes or facial expression, in addition to other restrictions with regards to movement and behavior. Therefore, it becomes difficult for them to connect between things around, and recognize and manipulate other items using their body or senses, as mentioned by Rex, Koenig, and Baker (1994). Although the interest and the inclination to acquire braille increase through the haptic sense, at the beginning of the educational process of teaching braille, attention should be given to the response to the action and language used for facilitating the development of an accurate concept (Greaney & Reason, 2000). In the developmental stages of human beings, language is the acquired skill which can be most affected by the surrounding environment. For example, in the case of over protected

children, parents can decipher and respond to their children's request immediately based on their movement and expression (Mann, 2006). Unfortunately, this kind of action can eventually diminish the children's ability to accurately express themselves (Brambring, 2007; Stone, 1997 p. 93). On the other hand, not talking or listening to children sufficiently can make them fall behind in language acquisition, hampering language development. Consequently, these children cannot gauge visual information and stimuli, possibly delaying their motivation to strengthen language activities, as discussed by Warren, (1977, p.154-156). For these reasons, it is preferable to take into consideration the various factors and relationships that affect language activities and development, when designing Individualized Education Programs (IEP) to teach students braille, both in the beginning of the teaching process and in the developmental stage of learning. Furthermore, during the process of teaching braille, focus should not only be on the writing, but also on speaking, understanding, and expression of the language, in order to avoid partial progress in one sense compared with the others.

The Learning of braille and Education Progression

In general, the purpose of the educational process is to accomplish the educational goal of the school in compliance with the national curriculum. Therefore, the contents of the study materials for students who are visually impaired also should contribute to the overall development of the child within the study time, which can be accomplished via comprehensive learning, according to the school system. To design a plan to appropriately teach braille, it is important to connect the process with the academic curriculum, without neglecting the fact that extra time and attention is required to teach students who are blind the special skills related to braille, using other assistive technologies, and other related abilities (Ferrell et al., 2006;

Spungin & Ferrell, 2007; Vik & Fellenius, 2007). Designing an efficient instruction plan for teaching braille requires that special attention be paid to the following elements: student development; disability condition; learning environment; teaching goal; teaching contents; and teaching time (Arter, 1997 p.97-99; Warren, 1977 pp. 56-57). Other components proffered by Lowenfeld, Abel, and Hatlen, (1968 pp. 16-20) are worthy of further attention:

- Body condition and psychological stability
- The ability to develop, control, and measure the active touch movement
- The ability and recognition of haptic ability
- The measurement of language behavior
- Teaching using the appropriate study materials

Based on these components, it is possible for teachers to understand the condition of the students properly, and to undertake the necessary preparations to design a teaching plan, thereby increasing the students' inclination toward education. Studies conducted by several groups (Arnold, 2004; Douglas et al. 2011; Lamb, 1998; Lorimer, 1990; McConachie, 2016; Stone, 1988) have provided thorough descriptions of the way to design braille teaching plans, adjusted to the developmental stage and disability condition. It is necessary to design contents that aim to develop children's mobility in the pre-school stage, the manipulation of their upper limb and hand, wordplay, common lifestyle, and social activities. These studies also confirmed that when learning braille, the skills of hand manipulation and the promotion of haptic recognition ability are of fundamental importance. In the case of children who are braille learners, if they do not have enough opportunity to receive appropriate guidance at home, schools, or kindergartens, a significant delay may occur in these skills. Therefore, the initial elements of teaching braille are

using appropriate study materials to increase the natural haptic movement and connect them with the directions. Through increasing the skillfulness and control of the haptic movements, systematic guidance should be given to promote the recognition of the various shapes (Arnold, 2004). Furthermore, when comparing the development of the spoken language to haptic skill in children who are blind, there are slight delays in the development of item recognition. In another words, despite development of the spoken language, it does not reflect on the haptic skill. Therefore, it is necessary to assess haptic movement skills regularly, and to design targeted teaching plans that develop this skill. Thus, when teaching children who are blind to control haptic movement, Roberts and Wing (2001) stated that it is preferable to use study materials that stimulate position, directions, order, and to manipulate the upper limbs. It is not a precondition for children who are blind to read and write braille during kindergarten or before starting schools; rather it is necessary to encourage their desire and interest to acquire partial knowledge about braille. For example, by learning their own names as written in braille, their interest in braille words will increase, and thus, the word will connect to letters, and the voice saying their name will correspond to the braille word as well, such that the relation between spoken and written language will be established. This will motivate them to use braille in their daily life, which will eventually expand the utilization to other language activities. As pointed out by several researchers (Arter & Layton, 2000; Coppins & Barlow-Brown, 2006; Lamb, 1998; Stone, 1988), during the kindergarten period, some children are very interesting in developing their language ability, by listening to the language being spoken or engaging in conversations in their daily life, while others are interested in compensating their missing senses with words. It is necessary then, to help the children experience the excitement and enjoyment of using the letters in their daily life, to convey their feelings or ideas to others through braille.

Control of Haptic movement and the relation of learning of dissimilarity of objects to braille acquisition

Braille is read and written using both hands or, in other words, through the haptic perceptions of the hands. Through the hands, it is possible to acquire information from the outside world; however, if the haptic or the touch sense is in a passive mode, it is challenging to acquire more information. It is necessary to encourage active movement, and establish an equilibrium position, to utilize the haptic sense to the maximum extent, so as to gain adequate information from outside environment (Ittyerah, 2010). In other words, if a child does not move their hand of their own initiative looking for items around them, they cannot develop the ability of acquiring knowledge as the other sighted children in their age (Warren, 1977 pp. 60-65).

Some children may acquire the behavior of initiating exploration to find items during their infancy, while others may build such skill through comprehensive purposeful action in their daily life. However, for the kindergarten and school children who did not sufficiently develop their initiating exploration to find items, encouragement to develop this skill should be given at the beginning of the educational process (Ferrell, 2000). For example, skill development can be promoted within the daily behavior of playing, either alone or with groups of children. This can be accomplished by giving the child instructions to look for their toys, chasing a ball, pointing with sticks, or using toys that have different voices. Additionally, anticipating the direction of a particular voice by pointing his hand toward the voice, besides recognizing the shape of different toys' haptic, can encourage the child to be more active in gaining different information through haptic movement (Argyropoulos & Argyropoulos, 2002).

Since the reading and writing of braille depend on the smart movements of both hands, the key point is the comprehensive movement of the shoulder, upper limbs, hand, and fingers. Thus to

enable a child to smoothly move both arms, requires the accumulation of experience in order to control his movements. In this case, not only monitoring the contraction of the most strength condition, but also testing the ability of the fingers' sense to gain information from the surrounding environment is worthy of attention (Steinman, LeJeune, & Kimbrough, 2006). In the learning process, controlling the movement of both the hand and the finger is performed through the sensory and movement system, or the haptic movement. The control of the haptic movement of the finger is necessarily for the child to learn things and it must be developed gradually, by making the child hold his hand out to everyday life items, toys, and study material (Warren, 1977 pp. 70-72). Such tasks can be performed actively through hitting, grasping, picking, catching, pushing, pulling, or by performing different actions in order to encourage the habit of using finger movements. In this case, it is important to design toys, special materials, and everyday life items that enable the instructor to assess the different results when the child manipulates these things, as well as to assess the relation between voice reaction and haptic response, which are important components that expedite the recognition ability in children (Harley, Truan, & Sanford, 1997 pp. 263-276). We then consider the problem of work division between the two hands. Sighted students can use both hand and eye to perform different tasks, however, those who cannot use their vision have to depend on one hand to perform the task while using the other to follow the progress toward task completion. Therefore, task division between the two hands means, not only performing separate tasks simultaneously with both hands or using both hands smartly to complete one task, but also by following the progress of previous actions. As mentioned by Greaney and Reason (2000), the movement of both hands is based on set of circular movement of different joints; thus, exclusive movement and circular

movement cannot be smoothly performed. Therefore, it is vital to use the slide block technique to enable the vertical, horizontal, and diagonal exclusive movements, smoothly.

In combination with the previously mentioned movements, it is important for learners who are blind to know how to trace the outlines of the square and triangle, to be aware of how to control such movements, as well as controlling the circular movement through knowledge of the principle of revolution movement. However, the final goal is not to teach the student to be efficient in understanding such movement, but rather understanding the principle of such movement should be substituted later, to be the base in understanding the principle of maps, diagrams, and different spaces. Moreover, study of such principles is a basic component of learning braille, since reading braille depends on tracing lines. Hall (1982) indicated the need for learners who are blind to comprehend different concepts that are naturally acquired via vision for sighted children, and also stated that children who are blind need to be given instruction to touch different toys during their infancy, alongside everyday living items, in order to know their names and functions. Additionally, studying the features of such objects can be effective in learning other principles related to braille reading, since items can be categorized according to their features, such as size, length, thickness, weight, and hardness. Those items can be categorized into three levels: big, medium, and small. Learning this principle of categories can enable students to differentiate these items according to their size until they are able to distinguish small things, such as grains or buttons, and this should eventually lead to learning of the existence of braille dots.

Development of cognitive skills

Roberts & Wing (2001) stated that the haptic sense is seldom used alone, and normally human beings use several types of sensory information to construct knowledge, through the processes of acting upon and interacting with the surrounding environment. In infancy, this encompasses the examining of an object, distinguishing the essential features, understanding the relationship between the environmental components, and then integrating the acquired information into meaningful enactments. A succession of such processes move through a sequence or series of progressions starting from early childhood up to the maturity period for the visually impaired. This progress has been reported in Fazzi & Klein (2002 pp. 109-111), with the details of activities accompanying each phase of development. The progress starts from birth to approximately 2 years of age, when the child starts to respond and interact with the world that they attains via the senses. The next phase is the preoperational stage, from approximately 2 to 7 years of age, when the child starts to demonstrate their mental ability, express themselves through language use, and starts real interactions, solitarily or via participating in group playing. During the last two phases, the child transfers from single thinking to thinking logically and extensively, and thus, will be able to engage in theoretical thinking and abstract anticipations. As stated by Barraga (1973 pp. 117 120) along these lines, cognition, concept development, and language development cannot easily be separated. The development of these skills is interrelated with others, such as active exploration of the environment. Thus, delays in one or more will affect the rate at which an infant's intellectual capacity develops.

There is a consensus among educators and researchers, that the development of the cognitive skills associated with the capability to build awareness and interpret information regarding the surrounding environment, is an ongoing process that begins in early infancy.

Millar (2003 pp. 14-55) acknowledged that children who are blind may start learning about a part of an object, then tend to slowly integrate the pieces of information they acquire into a whole picture of the object. Other aspects related to cognitive skills have been stated by Steinman, LeJeune, & Kimbrough (2006), which are problem solving, reasoning, and the ability to interpret, transfer, and apply recent information to new conditions. The latter process can be challenging for children who are blind or visually impaired, due to their inability to gain information via the visual channel. As asserted by Warren (1977 pp. 65-70), this process can be compensated by creating various opportunities for the child to learn and experience things, in addition to allowing the child to experience dealing with various objects with different shapes and size. Such practice will allow the child to have a memory full of rich imageries regarding various objects, and then they may be able to understand the differences between things.

The next step, after the child is able to understand the similarities and differences among objects, is to gain the ability to organize and label this information according to specific characteristics, such as size, shape, color, and function. One way this skill can be developed, as suggested by Millar (2003 pp. 61-21), is through tracking the sequence of steps for a particular task. The child can learn a sequence of simple tasks starting with any simple activity of daily life, by using words like first, next, or before. Another useful way is via sorting objects from biggest to smallest or from tallest to shortest.

Link Between Learning braille and Readiness

Starting to teach reading and writing braille to children at six years of age will be difficult if their readiness to learn has not been cultivated from the infancy period, as emphasized by Lowenfeld, Abel, and Hatlen (1969), and Stone (1988). The learning discussed here, is the

learning process that the child has experienced in their kindergarten or blind school. If, because of a lack of experience and delay in development, readiness to learn has not yet been formed, instruction aiming to strengthen this point should be completed before teaching braille. However, for children who have already acquired the readiness to learn, it is possible to start teaching them reading and writing braille. Ensuring this position of readiness before commencing braille lessons, applies to all preschoolers and children of school age. Steinman, LeJeune, & Kimbrough (2006) highlighted the basic skills required to distinguish the different braille dots, such as the smooth movement of both hand when learning, writing, and reading braille, to measure the formation of textual space through the concept learning, to develop the ability to understand the relation between the dots, to build the ability in deciphering the spoken language according to the level of voice, and to explore the relation between learning braille and the use of different symbols with regard to their symbolic function. Harley (1987) highlighted the various components that may affect the reading speed for braille users when performing normal reading tasks, such as direction and location of the braille book toward the table, relative to the sitting position and the of braille reader. Other factors exclusive to techniques of writing and reading braille, is that braille is written backwards, which adds the extra burden on braille users to learn the reverse images of all letters, doubling the learning task and creating a disparity between the written and read form of each letter (Kway, Salleh, & Majid, 2010). While these components have no effect on the average reader, it will certainly decrease reading speed for braille users. In other words, relative location of the six dots within the braille cell and the order of braille dots, direction, tactile techniques and position of the braille reader, all have considerable effect on braille letter recognition and deserve more attention when providing instructions for students with visual impairment during the beginning of braille

learning. As explained by Arter (1997 pp. 99-101) and McCall (1997 pp. 51-55), being familiar with the concept of order is not an aptitude that is impossible to acquire at early stages of education, since it is possible for children who are blind, and who do not have the opportunity to use visual imagery to access information, to learn various abilities such as the order of room layouts, school songs, and the order of manipulating objects or small machines. As highlighted by several studies (Lahav & Mioduser, 2000; Lewis & Tolla, 2003; Stangl, Kim, & Yeh, 2014; Withagen et al., 2010), the fact that the ability to remember and learn many skills simultaneously, which is truly of assistance during the learning process for braille readers, occurs only during early ages should be utilized to the optimal extent, by providing more instructions related to the initial concepts that are known to promote children's readiness to understand the characteristics of braille. Therefore, the imparting of braille-related skills at earlier stages of education, should be encouraged. An example of this, is to teach children the technique of determining a starting point when learning to recognize objects through haptic sense, that is, instruct the learner to put one hand at the starting point and then use the other hand to explore the object, and to move the hand at the starting point accordingly (Millar, 2003 pp. 14-55). The purpose of this simultaneous task is to allow children to learn the start and end concept, and to imagine the arrangement, order and layout of various objects. Learning about direction is also required, to attain a complete image of the surrounding objects via haptic sense. When learning direction, the link between one's body location and the surrounding objects is necessary. Children will be able to learn the directions of up and down while experiencing normal activities like jumping, sitting, standing and crouching (Lowenfeld, Abel, & Hatlen, 1969 pp. 20-25; Ungar, Blades, & Spencer, 1995). Furthermore, by walking they can learn front and back, however, there is no absolute way to learn left and right. Therefore, an effective way

to teach children who are visually impaired, the concept of left and right is via the hearing sense or by auditory means, such as using different blocks that generate different left and right reaction sounds (Fazzi & Klein, 2002 pp. 15-35). After being able to completely distinguish the left and right sounds, and understanding the left and right concept, subsequent words can be used in place of these sounds. The next step is to locate the study tools in a table and to teach children the various directional concepts based on the location of the study tool, such as horizontal, vertical and diagonal relationships (Fazzi & Klein, 2002 pp. 15-35). Afterward, based on the study tools location, it may be beneficial for the child to learn some orientation skills, to complete learning the direction concept comprehensively, and to accurately determine the location of objects, such as upper right, lower right, and upper left, lower left, as explained by Anthony et al., (2002 pp. 330-335). As detailed by Fazzi & Klein (2002 pp. 15-35), when learning relations of space and object location, it is vital to make the child recognize the difference of inside and outside the box, middle and corner of the room, as well as the principles of lists and orders. In the context of direction, the next step is to test the child's ability to determine the starting and arrival point. Additionally, learning to dismantle and assemble objects is not an overlooked skill, since such skills are aimed at educating children on the concept of the shapes, and the relation of the parts that create the form of each object in combination with space, order, and location Efron & DuBoff (1975). Using models of various objects promotes children's inclination to enthusiastically learn shapes and formation of various icons. It is vital however to teach the child that the same object may have the same shape with different sizes. In other words, if a given model is magnified or minimized, that the basic shape will not change is an important realization that children with visual impairment should completely understand and recognize.

Summary

Braille knowledge is a comprehensive process that not only requires teaching students the braille symbols, but also through paying particular attention to the disability condition and the learning environment, as well as using the appropriate study materials to assess the relation between different abilities, such as voice reaction and the haptic response, and haptic and movement response. Accordingly, various skills need to be acquired by a child with visual impairment before being introduced to braille, as the development of this skill is interrelated with others. For instance, when learning braille, the fundamental skills are hand manipulation and the promotion of haptic recognition ability. Such skills ought to facilitate the link to the surrounding environment, and the recognition and manipulation of the various objects through the body or haptic sense. Additionally, verbal interaction with children with visual impairment would possibly motivate them to strengthen language activities

As inferred from the reviewed studies, instead of teaching children readiness to read and write braille at an early stage of education, it is best to teach them the relation of space, order and location concepts, magnifying and minimizing relationship, and assembling and dismantling object, which acquaint children with the relationship of the part of the object with regard to the entire object. This technique has a direct and intense link to braille understanding. After making sure that children have a complete understanding of the basic of spatial relationship, teachers can gradually start instructing them on braille's dots, starting from one dot until the horizontal, vertical and diagonal relationship of the six dots. By using the direction concept that the child has already learned, the teacher can make them distinguish the relation of the left and right of the three vertical dots within one braille cell. The children should have already learned the concept of shape formation and dismantling as well, so the teachers can utilize this knowledge

to train them, using a detachable model of a braille cell that allows the children to create different braille letters.

2.1.3 Learning Braille in the Elementary, Junior, and Higher Secondary School

The teaching of braille during elementary and junior high school should be performed based on the skills which have already been acquired during the kindergarten period. Furthermore, braille learning may be facilitated by home-school partnerships that are responsive to individual differences among learners (Coppins & Barlow-Brown, 2006; Craig, 1999). Certain consideration should be given to the teaching of the language skill which, besides compensating for the reading and writing skills, should be the main goal of teaching braille because of its special characteristics, that require systematic guidance and a customized teaching plan. It was stated by Emerson, Holbrook and D'Andrea (2009) that the custom of basic manipulation for braille users should be acquired approximately when they reach the third level of elementary school, and that they should be able to read accurately when they reach the sixth level, as reported by McCall (1997 pp. 51-52). Regarding reading speeds, significant development may be observed from the first year of elementary up to the second year of junior high school. In other words, the first ten years after commencing braille education would involve constant development of the reading and writing skills (McCall, 1997 pp. 51-54). Also Brennan, Luze and Peterson (2009) reported that the development of word description is obvious during the third and fourth year of elementary school, and the fundamental word differentiation development is conspicuous until the third year of the elementary school. However, since the condition of recently blinded children is different, this information may not always hold true.

The development of the braille reading skill is different from one student to another. Thus, it is difficult to estimate an achievement goal for all students at an educational institution. When teaching braille, it is important to pay special attention to the fact that when the students had acquired the basic skills of writing and reading braille at the lower grade of elementary school, there is a trend among teachers to stop giving them further instruction, and focus more on observation to assist their development in other braille literacy areas, such as reading and writing, word-recognition skills, vocabulary skills, comprehension skills, study skills, and literature skills as stressed by (Lorimer, 1990; Rex, Koenig & Baker, 1994pp. 63-66; Swenson, 1999 pp. 16-19). When the students have been given enough instruction concerning braille reading and writing as well as the basic skills of braille use, it is also important to follow the students' progress through successive instructions and assessments, to ensure their ability to use braille more efficiently in their next educational stage. As declared by Sacks, Hannan, and Erin (2011), students' proficiency in reading braille increases their inclination towards reading more braille books, hence, the teachers regularly have to examine the reading and writing ability of each student to check for the important instruction components required in designing individualized teaching plans. Adequate knowledge of braille and teacher competency are required for an efficient teaching process (Amato, 2002; Argyropoulos, Sideridis & Katsoulis, 2008; Isave, Uplane & Isave, 2011). The instruction of braille during the elementary school period should not only focus on writing and reading, but also on braille contraction, and the special signs and symbols of braille which are vital for the efficient utilization in many academic subjects, such as mathematics, science, and music (Clark & Murphy, 1998; Greaney et al. 1994; Hartley, 1987; Towles-Reeves et al., 2009). Moreover, in intermediate schooling, further knowledge of braille symbols is required to understand the additional mathematic content.

Besides mathematics, the content of science subjects, such as Biology, Chemistry, and Physics in addition to computers, music, and foreign language and spelling require competent teaching plans and follow-up processes (Grenier & Giroux, 1997; Rapp & Rapp, 1992; Simon & Huertas, 1998; Stephens, 1989). Subsequent to acquiring knowledge of special braille signs and symbols, the students are given instructions regarding writing and using such symbols, how to distinguish between the symbols and the normal letters, how to locate these symbols in sentences, and the relation between the symbols and letters, according to the needs of each student (Koenig & Ashcroft, 1993; Swenson, 1991). Providing students with comprehensive knowledge with regards to special braille symbols, should make them efficient braille users with the capability to read and understand the braille books that use such symbols. Such tactics ought to make them more connected to the academic goals of their school and, by instilling understanding of the comprehensive relationship between the letter and symbols, facilitate communication between the students who are blind and their sighted counterparts in regular schools. As many have pointed out (Farnsworth & Luckner, 2008; Jeong, 2006; Kipke, 2008; Michaelson, Matz, &d Morgan, 2015), with the recent technological progress, it has become possible for people who are blind to gain information via multiple methods, other than braille. For this reason, there is a great concern regarding the reading speed of braille, since depending on other information sources has decreased the frequency of reading braille. Direct reading is extremely important in the development and promotion of different ways of thinking, and is also desirable for the stability of feeling (Mousty & Bertelson, 1985; Ringlein, 1998). Thus, special attention should be paid to increasing the reading speed of braille gradually, through the teaching process. This should be done by providing more opportunities for students to spend time in reading different

materials written in braille such as book stories, novels, etc. (Eldridge, 1979; Michaelson, Matz & Morgan, 2015).

2.1.3. Summary

There is no one absolute way to teach braille; however, a teaching plan should be appropriately constructed according to the circumstances of each student, with attention to individual factors such as language ability, haptic recognition, intellectual ability, psychological condition, and readiness to learn braille, in order to determine the order of teaching, starting time, and material contents, so as to make the necessary adjustment in accordance to the student's level.

2.2. The Impact of Accessing Printed Information via Braille and Auditory Formats on Comprehension of Reading Text

2.2.1. Introduction

Various researches have revealed that regardless of the existence or absence of disability, students acquire reading skills using the appropriate methods until third grade; then they start to utilize their preferred medium of reading as a means to access school curriculum and other learning content (Good III, Simmons, & Kame'enui, 2001; Paris, Cross & Lipson, 1984). Additionally, reading requirements increase in the beginning of fourth grade, since students with visual impairment have acquired the basic reading by the end of the third grade, as reported in results of the alphabetic braille and contracted braille study (ABC braille Study) (Emerson, Holbrook, & D'Andrea, 2009). Once students who are blind or visually impaired develop

literacy skills in the early grades, it is important that a wide variety of reading and other text-based materials are made available to them for practice and expanding their capabilities. Thus, the educational stages following the third grade, before completing the elementary phase, are worthy of special attention and accurate evaluation from educators. The reasons this period of education is critical to selection of the appropriate method of study, especially for students with visual impairment who have problems to access normal print, have also been emphasized in previous work (Douglas et al., 2011; Greaney & Reason, 2000; Lamb, 1998). Thus, the reviewed literature in this section will include factors that have a direct effect on the comprehension of reading text, whether they have been accessed via braille or auditory mediums, thoroughly exploration of the factors related to techniques, the variance of mediums of accessing information, as well as, a comparison of reading speed in braille and auditory mediums. The importance of teachers' awareness of assistive technology for students with visual impairments is highlighted because the technologies related to braille will facilitate the production of materials in accessible formats. The section concludes by investigating the impact of screen readers to access written text

The section will be divided as follows:

1. Techniques to access information for people who are visually impaired
2. Difference in accessing information via braille and auditory mediums
3. Comparison of reading speed via braille and auditory mediums
4. Importance of teachers' awareness of assistive technology for students with visual impairments
5. Producing materials in accessible formats

6. The impact of screen readers to access written text

2.2.2. Techniques to Access Information for People Who Are Visually Impaired

Studies that have highlighted the value of both braille and technology on the educational process for persons who are blind, have underlined various methods used to access information. Prior to the advent of tactile reading systems and the magnification devices, auditory access was the only method by which people who were blind or visually impaired could gain access to printed materials (Wormsley, 2004). Tools that support auditory access to information or printed materials are often referred to as auditory access tools, and have progressed rapidly. However, the first traditional method used to access written information for the visually impaired was by having another person read the information aloud (Hatlen, 2000). Various occasions frequently force persons who are blind or visually impaired, to partially or entirely rely on human readers for their reading and writing requirements (de Verdier & Ek, 2014; Kim 2012; Posey & Henderson, 2012), as their inaccuracy in reading and writing to cope with the demand of a particular task may oblige the need for human readers. Moreover, the need arises when the materials, for instance, may not be available in an alternative format, or when it is not possible for the materials to be accessed using assistive technologies, such as when dealing with reading diagrams, maps, charts, graphs, and hand-written material (Pillai & Deshpande, 2012; Trief & Feeney, 2005). Furthermore, they may prefer a human reader for the opportunity of social interaction, as stated by Julia Todaro (2005). There are various conditions which, if being satisfied, will enable visually impaired listeners to fully benefit from using such techniques to access the printed information indispensable to tasks in the areas of education, work, recreation, and activities of daily living. Goodman & Wittenstein, (2003) mention that responsibility

towards these cautions falls upon instructors, who should teach blind listeners that knowing how to work with a reader efficiently can be extremely important in more worthwhile reading tasks. Thus, the bases to efficiently working with a reader are to make sure that the reader is well trained and has some knowledge of dealing with visually impaired listeners (Herrington & Simpson, 2002; Sinead, 1996; Thomsen, 1985). Various tips have been published (Aldrich & Parkin, 1988; Lewin-Jones & Hodgson, 2006; Rowland, 2008) for the visually impaired to have better access to information when receiving reading assistance. For instance, while receiving reader services, listeners will need to make notes by writing a notation in braille, printing, or making an audio recording. Hence, the listener is required to focus during reading, to be well prepared, and to know how to instruct the reader in an uninterrupted, polite and efficient manner.

The use of human reader assistants, one of the first technologies used to enable people who are blind or visually impaired to access printed information through the auditory sense, is being replaced by wide variety of media and technologies, during the new era of transition to digital media. Various tools have been developed, such as tape recorders, digital recorders, digital talking books, e-book readers, MP3 players, talking computers, accessible personal digital assistants [PDAs], smart cellphones and tablets, and specialized scanning systems with speech, up to the various talking devices, such as talking calculators, dictionaries, compasses, and global positioning system devices (see for example, Beal & Rosenblum, 2015; Cole & Slavin, 2013; D'Andrea, 2012; Griffin-Shirley et al., 2017; Helps & Herzberg, 2013; Kelly & Wolffe, 2012; Lancioni et al., 2017; Rosner & Perlman, 2018; Sodnik, Jakus, & Tomažič, 2012; Wong & Tan, 2012).

2.2.3. Differences in Accessing Information via Braille and Auditory Mediums

Since the advent of the braille reading and writing system in the 18th century, as a haptic method to access written information, it has become the official tool for literacy of students who are blind or visually impaired. Further, it became the dominant educational tool at institutions that provide educational services for the congenitally blind, for those who use their tactile sense as the primary way to acquire information, and for those whose visual abilities may not sustain visual reading efficiently or for prolonged periods without fatigue (Hatlen, 2000; Lowenfeld, Abel, & Hatlen, 1969, p. 6; Rex, Koenig, & Baker, 1994, p. 17).

Various studies have argued the different issues related to the types of information that can be acquired via each sense, and their impact on comprehension have been widely debated. The discussions have been meticulously triggered due to the difference of the unique contexts of haptic and audio sense. Differences also occur throughout information acquisition processes, as detailed in several studies (Allman, 1998; Kalra et al., 2009; Radojichikj, 2015; Posey & Henderson, 2012).

Studies describing the value of braille in accessing information, have argued that it provides comprehensive and direct access to information written in a reading format that is almost equivalent to normal print for sighted readers, because it provides a link between words and sound (Greaney & Reason, 2000; Lorimer, 1990). Besides, braille is immediate and reliable since it enables the user exposure to the spelling of words, to repeatedly see or feel the letters to be able to correctly spell (Grenier & Giroux, 1997; Papadopoulos et al. 2009). Braille also enhances the reader's inclination towards the content by providing specific information that cannot be easily conveyed in an auditory format. For example, it is very easy for the braille reader to identify italicized and capitalized letters with one finger swipe. By running their hands

over the page, braille reader can also comprehend the general layout such as page number, punctuations, headings, subheadings, and paragraphs (Risjord, Wilkinson, & Stark, 2000). Furthermore, it is possible for braille users to compare two pieces of information on one or separate pages simultaneously, using both hands (Swenson, 1999 pp. 179-183). The full comprehension of the sentence involves the link of the semantic, syntactic and the various symbols of punctuations which is obtainable to the braille reader when dealing with normal reading of continuous text (Millar, 2003 pp. 138-141). Millar, (2003) also declared that braille reader will certainly be aware of words, syllables, and compounds, which would lead to a broader and more meaningful reading interaction in construing the text. The understanding of the relationship of these elements within written information will significantly augment the reader's comprehension of it (Emerson, Holbrook, & D'Andrea, 2009). Some information is best communicated via a graphical or illustrated representation such as maps, charts, and graphs (Zebehazy & Wilton, 2014). Often, this type of information cannot effectively be conveyed via auditory mediums. Usability of braille, however, has been emphasized (Alper, 2000; MacCuspie, 2002; Massof, 2009; Pring, 1994; Stanfa & Johnson, 2015) by revealing its flexibility, as it can be used in school for reading and taking notes, for various languages, and it has a set of musical, mathematical and scientific symbols. Therefore, there is a constant need for appropriate braille materials, tools, and competent instruction to maximize the utilization of the flexibility of braille for more academic and career potential for braille users (Basu, 2001; Breidegard et al., 2006; Kalra, Lauwers, & Dias, 2007; Koenig & Holbrook, 2000; Massof, 2009). In contrast, various studies (Arter & Layton, 2000; Goudiras et al. 2009; Jennings, 1999; Leas, Persoon, Soiffer, & Zacherle, 2008; Rogers, 2007; Stone, 1995) have listed hindrances in the use of braille. The bulkiness of braille books, which makes it a difficult task to carry them

around, as well as the high expenses, extra time, and further resources that are required to produce braille materials are the main disadvantages that have urged people to shift to auditory mediums to access written materials.

The views are different, however, regarding accessing written text via auditory mediums. For instance, D'Andrea (2010) and Wurzbach (1988) argued that modern technologies such as DAISY talking books, or scanning of ordinary reading material using assistive devices to convert them to audio materials, have facilitated access to printed materials, making them more available; thus, people who are visually impaired can access more audio books than when there were only braille books. Arif (2013), and Brzoza and Spińczyk (2006), argued that audio books are gradually becoming more affordable, versatile, and portable, as they can be easily stored and listened to whenever and wherever, according to the user's requirements. Audio books is also more appealing for the visually impaired who have lost their sight later in life (Carey, 2007; Golub, 2002; Wolfson, 2008). Through auditory mediums, the recently visually impaired can read materials equivalent to their sighted counterparts, or at a similar speed of reading when they were sighted. This will compensate for the difficulties they may confront in learning the braille system, and the time needed to become fluent in braille reading.

Various features of digital talking books and DAISY books have been discussed in research and can be summarized as follows: DAISY is an accessible multimedia standard to publish books or any other written information using converting software in different accessible formats (Gardner, Brzoza, & Soiffer, 2008; Kahlisch, 2008; Kawamura, 2006; Tank & Frederiksen, 2007). DAISY books provide a superior accessible reading experience because the book content can be read by using magnification for low vision, braille, and audio. Furthermore, the reader can enjoy the feature of navigation by page, section, and sentence, allowing them to search for

different elements or specific pages in the talking book. The reader can make bookmarks and annotations, choose the portable: mobile players or full-featured software players, select visual magnification and color, as well as translate to braille for refreshable displays.

There are opposing views on the value of this medium on the grounds that auditory access to written text cannot replace direct access to information via braille or print, although its use has significantly expanded the availability of information for the blind or visually impaired (Massof, 2009). Information access via auditory means can be obtained using screen readers to access digital text or the traditional method of using recorded material. Different critical views can be founded in studies undertaken with regards to the practicality and suitability of using recorded materials to access information for the visually impaired. As discussed by Alper (2000), since the information on recorded devices is generally read consecutively, this type of restricted access to information is less effective for the study of expository or informational content, in situations that requires specific portions of information to be repeatedly accessed for education, training, and research purposes. Although it is possible to deal with written material by storing and retrieving personal notes through the use of various dictating equipment, persons who are blind who have tried to record notes from a lecture or reference book will recognize the difficulties of depending mainly on one particular technique. Consequently, individuals who rely heavily on the auditory mode to meet their literacy needs find that they must, sooner or later, use supplementary techniques to complete long assignments, reading, or collecting information from various sources (Pădure, 2008). Such complicated tasks require even exceptionally good braille readers to use a combination of braille, recorded materials, and even human readers in some cases (Brzoza & Spińczyk, 2007; Sutton, 2002; Vikand & Fellenius, 2007).

However, auditory access to information can be more effective in leisure and literature reading. Accordingly, various studies underscored the link between braille reading and listening as to select the efficient way to gain information. This ongoing debate continued, since the use of recorded material on cassettes and talking books, up to the innovation of the recent DAISY technology and the screen readers. Several factors have stimulated the debate of listening versus reading as the method of learning for the visually impaired. The first factor is the interwoven nature of reading and listening, since these two skills are the other part of the four skills of languages, which include writing and speaking. Listening and speaking develop prior to school age, and thus provide the basis for the development of the reading and writing skills.

The second factor is the similarity of readiness for listening and readiness for reading components, and literacy in general (Good III, Simmons, & Kame'enui, 2001; McCall, 1997, pp. 152-154; Trent & Truan, 1997). These components include adjusting the pattern of listening and thinking to the type of material and listening purpose; selecting and summarizing material pertinent to the listening purpose; using sufficient listening vocabulary to comprehend the structural analysis of words; recognition of whole words; following successive thoughts to select facts and details to follow a sequence in reading material; predicting outcomes; remembering details from a complicated text; distinguishing between fact and opinion; making value judgements; evaluating the source of the information; selecting the main idea; summarizing and making inferences.

2.2.4. Comparison of Reading Speed in Braille and Auditory Mediums

Earlier studies reported braille oral reading rates of 52-84 words per minute (WPM) for elementary students (Foulke et al., 1962; Lowenfeld, Abel, & Hatlen, 1969; Mangold &

Mangold, 1989). Other previous studies were reviewed by Harley, Truan, and Sanford, (1997), who reported that the average blind high school senior reads braille at about 86 words per minute, while talking books and other recorded materials provide speeds of about 175 WPM. They also reported that braille reading students from grades six to ten can gain information through listening in one third of the braille reading time, without loss in comprehension. However, Nolan (1963) emphasized the relation of braille reading, comprehension and listening by stating when reading rates are slower than listening rates, listening comprehension may be superior, and the reverse occurs when reading rates are faster than listening rates. However, he further clarified that, reading rates rarely exceed listening rates for braille readers.

2.2.5. Importance of Teachers' Awareness of Assistive Technology for Students with Visual Impairments

The information age, characterized by the pervasive availability of information through various means of information technology, is expanding knowledge, and the use of technology has become a critical part in all aspects of life as, for example, success in school, community, and employment is directly influenced by one's ability to gain access to information (Burgstahler, 2003). Technology also offers enormous benefits to children as young as pre-school age. It is also vital to recognize the importance of technology and the variety of other literacy mediums in elementary schools as means to enhance students' access to information as a resource for education and recreational activities (Argyropoulos et al., 2019). While society continues to advance rapidly with information and communication technologies, the visually impaired struggle to catch up, and are aware of the technology-advancement gap according to Rule et al. (2011). Similar to their sighted counterparts, it is essential that students who are visually

impaired have access to equivalent information through technology via auditory and haptic means, as highlighted by Douglas (2001). It is vital that students with visual impairments develop the same skills as their sighted peers to ensure that they will be able to catch up with the rapidly changing technology-rich educational environment (Alper, 2000; Mangold & Mangold, 2002; Pădure, 2008; Sullivan, 1996; Veispak et al., 2012). It is also vital for teachers to be aware of all the technology options for their students. As discussed in several studies (Argyropoulos, Sideridis & Katsoulis, 2008; Bin Tuwaym & Berry, 2018; Isave, Uplane, & Isave, 2011; Kamei-Hannan et al., 2012; Zhou et al., 2011), the expansion of the use of digital information combined with the diversity and availability of new assistive tools, including software and hardware, has resulted in modifications in teaching strategies and techniques for educating students with visual impairments. This situation constitutes a challenge among teachers of students with visual impairments, to fill the gap concerning their awareness towards utilizing assistive technology, in order to increase the teachers' instructional skills and broaden their knowledge to deftly use both the software and hardware.

The sufficient skills and knowledge of teachers in assistive technology is an important factor towards its optimum use by students who are visually impaired (Zhou et al., 2012). Even though students are willing to use assistive technology, deficiency in knowledge among teachers will result in a lack of interest regarding maintaining, upgrading and replacing such devices, if necessary. The consequence is defective computers, and inappropriate software to enable learners to use them. Another consequence is that, the dearth of educators who are trained to teach learners how to utilize assistive technology constitute a major inconvenience when such tools need upgrading or maintenance; teachers at schools will be unable to interact with retailers concerning maintenance and technical issues (Alden, 2016).

These studies implied that if the teachers have difficulty familiarizing themselves with the use of a variety of assistive devices, or do not know how to retrieve or teach the use of those technologies, they may not be able to design the appropriate strategies for helping students develop assistive technology skills, such as how to use a particular device in a particular environment. Consequently, it will minimize the opportunity for students with visual impairment to gain the advantage of the efficient use of the assistive technologies. When students with visual impairment have learned to use assistive technology to access electronic information, they can participate more equally with their sighted classmates.

2.2.6. Producing Materials in Accessible Formats

The important factor that needs to be recognized and considered by educators is that people who are visually impaired have had a very restricted access to written information that are visually presented, as consequence of the slow pace and cost of the production of accessible formats (such as braille and audio) (Jackson & Presley, 2012). Consequently, only a minute number of published work has been made available in accessible formats. However, the situation has significantly changed since digital formats have come into being and it became possible to use text-to-speech (screen readers) and it also became possible to produce digital text using assistive technologies (Cooper & Nichols, 2007; Sivan & Darsan, 2016; Tobin & Hill, 2015; Tripathi & Shukla, 2014; Wiazowski, 2014). This new technical environment enables the blind and visually impaired to access digital information simultaneously to their sighted counterparts and at no additional cost. However, competent acquaintance with assistive or specialized technology is required to enable students with visual impairments to have access to equal informational content as their sighted peers. Assistive technology promotes literacy

skills by enhancing communication and learning, and expands the world of blind and visually impaired persons in many significant ways. As stated by Golub (2002), it enables students to access print and electronic text; produce written communication; and enables students and the professionals who work with them to produce material in accessible formats.

Previously, producing materials in large print, braille, or audio format was hard work, demanding, and time-consuming. Nowadays, technology is making progress in this area and the various written texts can be typed or scanned, and then reproduced in large print, braille, or audio. Accordingly, the availability of print information to blind or visually impaired students has expanded dramatically because of the use of such technology. For instance, modern technology has increased production of material in braille in a variety of forms that are produced by various braille printing houses all over the world, which resulted in a constant exchange of books and magazines by organizations and libraries for the blind from across the world. The use of technology within braille instruction has also improved learning outcomes by facilitating the creation of braille material that is very easy for braille users to use in instances that were previously awkward for them because of the inconvenient and the difficulty of portability of the traditional voluminous braille books and notes. As stated by several studies (Cooper & Nichols, 2007; Michaelson, Matz, & Morgan, 2015), using of the recent braille refresher displays and the note takers that provide various options to use braille, inspires the use of braille and enhances and motivates students to learn braille more often. The new methods have shortened the time required to produce material in hard-copy braille. The selection is still limited, however, compared to the information available in print. Nevertheless, technology has significantly improved the options for producing braille, which is now often generated

electronically. Appropriately prepared electronic files can be used to produce hard-copy braille by means of braille embossers and printers or can be read on electronic braille displays.

The role that assistive technology has increasingly played in enhancing literacy skills in recent years have been emphasized by Martiniello, Wittich, and Jarry (2018), in stating that technology enables students to access print and electronic text and to facilitate communication among students and the professionals who work with them by providing the facility of producing materials in accessible formats.

While there is support for the use of computer technology, there are opposing views on their value for persons who are visually impaired. Carey (2007) asserts that educators should not assume that the availability of access technology by using one medium to access information, provides full access to all forms of text. Using computers only, for instance, does not necessarily warrant full access to the information for the visually impaired with equal access as to their sighted counterparts. Thus, visually impaired user should be trained to be able to choose from multimedia to access information. While acknowledging the value of assistive technology, Alden (2016) emphasizes that technology enhances, but does not substitute for information access via printed materials. As also argued others (Cooper & Nichols, 2007; Kerscher, 2001; Leas et al., 2008; Stepien-Bernabe et al., 2019), educating the students who are with visual impairment to fully utilize the assistive technology doesn't mean that instructors should deviate them from the braille system or by the use of the modern assistive technology. People with visual impairment should not do away with braille because of the convenience that the new technology and the audio books provide. In fact, the personal preferences of each and every individual, the purposes and ways they wish to do their reading, become the decisive factors which determine their means of reading. Thus, written materials must be prepared in various

formats so it can be accessible to the people who are visually impaired, regardless of the medium they are familiar with.

2.2.7. The Effect of Screen Readers to access written text

Although with the introduction of screen access technology, many persons who are blind have increased their independent access using optical character recognition devices, screen readers and electronic note takers which ease access to a broader range of information. These devices have demonstrated such efficiency and helpfulness, that many persons who are visually impaired have included them as possible reading and writing options, resulting in worries that braille as a reading and writing medium would become obsolete, and the use of access to information via auditory medium formats would be significantly increased. Paradoxically, producing of braille materials became easier, as mentioned above, and the access to written text has increased by the introduction of the DAISY technology and the screen reader. Freitas and Kouroupetroglou, (2008) stress that using the assistive technology has inspired access to written text for the visually impaired via auditory means by the use of speech output or screen reader installed in various devices. The intention of a screen reader is to give a person with visual impairment access, manipulation, and control over the computer system via interacting using a screen reader. The blind users have the option of controlling their computer solely through the keyboard by means of a large number of shortcuts of keystrokes instead of a mouse. The principal objective of screen readers is to update to the user on their current task by presenting information that is normally relayed on the screen, either through synthesized speech or through a braille line (on a refreshable braille display). Jackson and Presley (2012) have emphasized the interactive role of the user when accessing informational or expository materials using speech

output by indicating the advantage of screen readers, which offers the user the option of controlling the reading rate, scanning backward or forward to explore the whole text, as well as the simultaneous access to listening, visual, and haptic reading. Other features of using the screen readers are adjusting speech preferences, pitch, and speed (Hersh & Johnson, 2010, p. 413). Reading is an essential task that differs according to the context of usage; for instance, since it is crucial for school and work, it might not be the case when sorting the bills, reading signs, menus, blank forms, leaflets, advertisements, reading a textbook or the daily newspaper. The listener has direct control over the content chosen or the order of reading, so good listeners adjust the reading rate of the screen reader to the purpose of the text they are listening to. The rate used is determined by the amount of information to be extracted from the text as well as by the complexity of the material contents. There are different factors affecting the listening speed associated with scanning big documents for particular information, skipping to cover a large amount of material that is not important.

Studies conducted recently to determine if reading rates have changed because of the technological advances, instructional changes, or other factors (Garcia, 2004; Isave, Uplane, & Isave, 2011; Junor & Junor, 1994), reported a mean of 100 to 120 WPM for braille reader against the 280 to 300 words reached by sighted individuals. Also, Wang, Al-Said, and Ye, (2017) have reported 100 WPM for braille readers while Arter (1997, pp. 146 147) reported that users who are visually impaired can obtain listening speed from 250 to 257 WPM. These studies have not reported the difference in reading rate for braille readers compared to the earlier studies conducted in the 20th century, prior to the wide spread of screen readers and audio books. Similar to the previous studies, the recent studies also indicated that listening is more efficient than braille and large print reading when the important factor of time is considered.

However, Arter (1997, p. 147) has reported that for most elementary learners, comprehension reduces when speeds are increased above 300 wpm. Stepien-Bernabe et al., (2019) stated that comprehension ability will be reduced when listening to expository materials using screen reader compared with reading braille hard-copy and digital braille display.

Studies that picked up the use of screen reader to access information for the visually impaired have argued that with practice, listening speeds will approach the average silent print reading rates. This ability can enable students in further and higher education to process large amounts of study material efficiently. Therefore, screen reader is required for visually impaired learners at the advance level of education, when they have to complete massive amounts of coursework or deal with expository text. Jackson & Presley, (2012) have argued that students will be more successful if they have the ability to select their best reading method. Thus, students should have the option to access text via braille reading or listening, since some may learn best via haptic reading, using either the braille hard-copy or braille display, while others might prefer auditory mediums using DAISY or screen reader.

These studies stated that slow braille readers may find dealing with text when trying to accomplish a long task to be cumbersome and tedious and that ultimately may lead to a shift to effective and efficient options, which would be using audio to access text. In other words, when speed and time factors are considered, shift to listening will occur; when listening is slower or dealing with expository or informational text, a shift to haptic reading will be executed.

2.2.7 Summary

From the foregoing, it is evident that there are conflicting views on the value of the various reading and writing media for persons who are visually impaired, since these studies have compared braille reading to accessing text via listening, and have also underlined the issue of comprehension, especially when dealing with expository or informational contexts.

Studies highlighted that the use of auditory mediums to access information have raised concerns regarding the major disadvantage to accessing information orally. Undertaking such task accordingly does not help students develop or reinforce certain literacy skills. When students are listening to material in an audio format, they do not receive information about the spelling of words, punctuation, or the structural format of the information. Another issue in this regard that is worthy of attention as subsequent to the frequent use of speech output, is that listening to accelerated speech starts to occur as users start to change the rate setting on their devices as they become more used to dealing with the listening speed. As a result, listeners do not receive complete acquaintance or practice that would help them increase their understanding and knowledge of the information in a particular text or components of literacy. Therefore, it is strongly recommended that visually impaired students not rely on auditory access as their only method of acquiring information, particularly students who are learning foreign languages. This review has revealed that exploring how quickly and accurately beginner students with visual impairment can understand by listening at faster rates, or about the most suitable listening rates, is a vital area of research.

In discussing issues related to the linkage of the use of braille to access information with regard to the use of auditory mediums, various studies disagreed with the statements that auditory tape and computer technology will make braille unnecessary, braille as a medium would be made

obsolete, or many learners who are blind are no longer learning to read and write braille. Inconsistently, several studies approved that assistive technologies should be used to enhance braille, not to replace it, because advances in technology has in fact, increased the availability of braille translation programs, which can quickly translate text files into braille format. Auditory access can assist students in completing lengthy reading assignments in less time than required to read the same information in print or braille alone. Literature, social studies, and some sciences can be comprehended easily by listening, although the applied sciences can be more difficult to understand aurally. Consequently, individual students need to use a combination of auditory technology and braille tools to accomplish literacy tasks, and they will need to be comfortable using these and other tools. Thus, choices of using particular medium to access information should be made on the basis of the needs and preferences of individuals.

This review has also revealed a dearth of studies discussing the relation of braille reading and writing to accessing text via listening. Further studies in this area are vital to investigate not only the effect of improving braille reading to accessing text via listening but also to explore the effect of improving braille writing to oral reading and listening. Pertinently, since many persons who are blind currently use different reading and writing media, it would be important to not merely compare one medium with another, but rather it would be more valuable to examine the efficacy of the different media on accessing information for the visually impaired, in accordance with the various tasks to be accomplished.

CHAPTER 3: METHODOLOGY AND DATA COLLECTION TECHNIQUES

3.1 Introduction

The previous chapter described an exploratory study in which literature pertinent to the utilization of braille by people with visual impairment in their educational process, and the impact of accessing printed information using braille and auditory mediums on comprehension of reading text were reviewed. The reviewed research provided an valuable contextual framework, to formulate the study design and interview questions for the next stage of this research. This chapter explains in detail the methods used in collecting the relevant data in order to answer the research questions set out at the beginning of this thesis. The chapter begins by describing the outline of the overall research design, indicating the choice of methods and the rationale for the selection of the participants, data collection, procedures, ethical considerations, and the approach adopted in coding and analyzing the data.

3.2 Research Design

This research has been designed to incorporate numerous themes pertinent to the education of the visually impaired in Sudan. Through various studies, the different stages of education, including the basic, junior secondary and the university and college education, are covered. Accordingly, data were collected to answer the research questions which encompass the following components:

- Placement of visually impaired students in specialized schools or integration into regular schools.

- The effect of using auditory mediums to access school curriculum on braille-related skills.
- The difficulties facing students with visual impairment when accessing information during their higher education stage.
- The type of assistive technology the participants have previously used.

Participants of the conducted studies were from different ages and educational levels, which included elementary schools, higher secondary and university students, teachers and personnel. The use of multiple methods was thought to be particularly appropriate since a controversial aspect of education, the placement of students with visual impairment in specialized schools or integrating them in regular ones, needed to be explored in depth and evaluated from multiple perspectives.

3.3 The Rationale Behind the Selection of the Research Methods

Collecting data from heterogeneous groups of participants requires the use of a variety of methods. Thus, in the present study, multiple methods was used to collect relevant data. Various reasons led to the choice of a mixed method approach. For instance, data from multiple sources helps in establishing a more complete understanding of the research problem, as stated by Hussein, (2019). Although manipulating different data sources and methodologies can be a very time-consuming and intensive effort, gathering data from varied sources explored in depth, and from multiple perspectives, may strengthen the validity of the research results and ensure that the conclusions drawn are meaningful, precise, and representative (Begley, 1996; Casey & Murphy, 2009). Moreover, the results from one data source will help to inform and refine those

from the other data sources. Although data from different sources and methods may be inconsistent or contradict each other (Bekhet & Zauszniewski, 2012; Wilson, 2014), this poses a challenge and an opportunity to demonstrate the researcher's ability in analysis, to make sense of why the acquired data are coherent. These inconsistencies are not only be challenging but may also lead to new avenues for further research (Casey & Murphy, 2009; Thurmond, 2001). Therefore, a mixed method approach was used, including both data triangulation to collect data and methodological triangulation for data analysis.

3.4 Participants and the Research Setting

The present research intended to conduct a comprehensive evaluation of the different stages of education provision for the visually impaired in Sudan. Thus, when selecting the participants, it was taken into account that the selected group must be represented of all categories of visually impaired. Therefore, the selected participants included students from different stages of education, in addition to teachers and personnel.

Study 1 comprised 20 participants who agreed to take part, including six students who graduated from specialized schools for the blind and later joined regular high secondary schools, three teachers working at the national school for the blind and one teacher at the national rehabilitation center for the blind, two students who have never had the opportunity to join specialized schools for the blind, four teachers working at regular schools, two staff members from Aljazeera State Rehabilitation Center for the Blind in central Sudan, in addition to one official from each of the provincial ministries of education in the Aljazeera and River Nile states. Access to participants was gained through both formal and informal communications. Students who participated were solicited via the SNAB and social groups for the visually impaired.

Selection of teachers was based on the states that included national or provincial institutions that offer education for the visually impaired. The authority were contacted in each of the selected states to elicit their support and assistance in locating teachers who were willing to participate in the study. They were also requested to allow up to 60 minutes of teacher release time for each interview session.

Participants for study 2 was with 34 students at the elementary level from El-Nour Institute for the blind in Sudan. Those students were enrolled during the academic year 2013-2014. The number of male and female students was 19 and 15, respectively. Due to the shortage of blind schools in Sudan, the schools usually accept only students who are totally blind. Thus, all participants were unable to read regular print, and therefore, braille was the primary study method for all the participants. The students were selected because they were using braille as the main method to access the school curriculum during their first stage of education. Subsequently, they began using audio materials in the upper grades to access the school curriculum because it was the only means available due to a shortage of braille prints.

Participants for study 3 were students with visual impairment who were enrolled in the University of Khartoum in Sudan, or who had already graduated. The author contacted the deanship of students' affairs of the University to help with recruiting participants. The author was also directed to contact the staff of the university audio library to obtain detailed information on this group of students. Thanks to the effort of a staff member who established contact, 16 of the students who were officially enrolled at the university consented to participate. Furthermore, through the efforts of the director of the Association of the Graduate Students with Visual Impairment at the University of Khartoum, another four graduate students agreed to participate. Accordingly, 20 students were interviewed, five women and 15 men.

3.5 Data Collection Methods and Procedures

This study sought to solicit thoughts and ideas to tackle issues pertinent to the education of people with visual impairment in Sudan. Therefore, it was necessary to collect primary data that authorizes the researcher to have full control over how it is generated so as to make it more specific to the purposes of the study. Thus, primary data was collected via two methods:

- **Interviews:** which were conducted with students at higher education (University of Khartoum), in addition to students at secondary schools, teachers who experienced teaching at schools for the visually impaired and staff who have work at teaching institutions or who have been in charge of education for the visually impaired in Sudan.
- **Experimentation data:** which was conducted with the students who have attended El-Nour Institute for the blind in the academic years 2013-2014.

3.5.1. Rationale Behind Selecting Interview As Method to Collect Data

Researchers working in developing countries often confront very different challenges in the collection of high-quality data. Census data may be largely unreliable or outdated, government information is not publicly available, and access to government documents is not an easy (Clark, 2006; Nyariki, 2009). Thus, the available option is to directly collect data from the target group of prospective participants in order to ensure data quality for the present study, collecting direct data from the participants was implemented by conducting interviews, rather than a survey methodology, for various reasons described below:

The main reason behind conducting interviews is the lack of statistics and documentation pertinent to the education of the visually impaired in Sudan. In addition, information based on the personal experiences of students who are visually impaired or staff who work in the same

field are rare. Thus, the present research sought to document the personal views of students and staff to solicit practical innovations, to enhance the provision of education for the visually impaired in Sudan. As mentioned by Lupu & Michelitch, (2018), it is excessively challenging to obtain high-quality survey response data in developing contexts, since surveys are less frequently conducted in such countries, and limited communication infrastructure is big impediment for sending questionnaires through traditional mailing services or online. Furthermore, many problems arise when collecting data from those who have visual impairments by distributing questionnaires. One of these problems is dealing with lengthy texts. Moreover, transitioning between different question formats may be challenging, especially for the target group. Since respondents may be unaccustomed to and uncomfortable with survey formats, which are rarely used in Sudan, they may be uncomfortable with answering questions and thus, may find the format awkward. In addition, personal interviews reduce the likelihood of error or misinterpretation of the respondent, since questions concerning instructions can be addressed immediately by the interviewer to prevent any misunderstanding of the survey instrument and its contents. Interview response rates are predictably higher than those of self-report surveys.

3.5.2. Advantages of Using the Interview Method

One of the advantages of an interview is that it permits researchers to know people at a personal level, and to observe their general demeanor and commitment to the matter under debate. Interviews allow greater depth since the interviewer can probe the respondents' thoughts to yield rich insights into the latter’s experiences, opinions and feelings (Alshenqeeti, 2014; Opdenakker, 2006; Queiros, Faria & Almeida, 2017). Another advantage of interviews is the

flexibility to gain more information from the respondents (Deakin & Wakefield, 2014; Fredricks & McColskey, 2012; Janghorban, Roudsari & Taghipour, 2014; Rahman, 2015). Skilled interviewers can follow-up a respondent's answers to gain more information and details. Interviewer can also build trust and rapport with the respondents to obtain information that that respondent may be unwilling to reveal by any other data collection method. Using interviews to collect data can also augment the participant's knowledge regarding the topic, since the interview process would not only provide information for the researcher but also for interviewees, and raise their awareness regarding the provision of education for the visually impaired in Sudan. As noticed in the present research, one respondent who is an administrator, became more active and enthusiastic in promoting local government to enhance environment of education of the visually impaired after participating in the interview relating to study one.

Interview procedure

Interviews were conducted via Skype, WhatsApp and phone call, Zoom, and in-person, at the respondents' convenient time secured by appointment. Prior to each interview, the interviewee was given a detailed explanation regarding the aims of the interview, informed that all the information would be confidential, and would be recorded and used only for the purpose of the present research. After permission was obtained for audio recording, the interviews were recorded, transcribed, and translated from Arabic to English. Questions were asked according to the set of order of the interview, the respondents being allowed to give a thorough and detailed answer before moving on to the next question. To obtain additional information, and to explore the perceptions and opinions of the participants, the interviewer had the freedom to probe beyond the answers, to obtain both clarification and elaboration, entering into a dialogue with the interviewee. The main interview was piloted with administrators and teachers who

have worked in the field of education for the visually impaired. Based on their suggestions, some changes were made to increase the precision and value of the information that could be obtained. Therefore, the new versions of the interviews were thoroughly revised with the same respondents to ensure that the questions were understandable and relevant to the raised topics.

3.5.3 Experimentation data

To answer one of the questions of this study, it became necessary to collect data assessing the braille competency of the students at the elementary education for the visually impaired, and to investigate how the use of auditory media to access school curriculum has affected the level of reading and writing braille. The data was collected during the regular school class by a teacher under the observation of the researcher. This was to avoid interfering with the class routine, and to diminish any abnormal feeling among the students. The experiment comprising three tests to assess braille reading and writing, in addition to a listening test to assess the participants' ability to acquire information using auditory media.

Experimental data procedure

The three tests used to assess the braille writing and reading skills were conducted for participants in study 2. The listening test was conducted only for the participants in the upper grades.

3.6 Ethical Considerations

When conducting research using human subjects, it is necessary to treat them with dignity. Therefore, several ethical issues were considered when carrying out this study. This research was approved by the Ethical Review Board of the Graduate School of Comprehensive Human Study, University of Tsukuba, Japan with the approval numbers 811 and tsuku23-46. Because

of the sensitive nature of research dealing with people with visual impairment, all the participants were made fully aware of the objectives and the scope. They were also assured that the information they provide will be treated with the utmost confidentiality, will not be disclosed to any other party, and will be used for the sole academic purpose of this research. They were requested to give their consent to participate, for their answers to be recorded on a digital recorder, and for the information they provide to be used in this research. All the participants were volunteers and they were all made aware that no fiscal or compensation otherwise would be offered in exchange for the data they provided.

3.7 Data Analysis

3.7.1 Interview Analysis

The interviews were recorded, transcribed, and translated from Arabic to English by a third party, to prevent bias and preconception during the analysis process. After transcribing all the interviews, the questions for study 1 were analyzed using the thematic analysis technique (Braun & Clarke, 2006). The interview data for study 3 was analyzed qualitatively by means of content analysis (Lincoln & Guba, 1985). Based on the interview questions, the first author and a colleague independently created an initial set of codes. Afterward, they met to discuss the similarities and differences in the created set of codes and agreed on a codebook. The codebook was then used by the first author and another colleague to code the interview data. Whenever appropriate, a frequency count was done to describe the number of responses in each category.

3.7.2 Analyses for Experimental Tests

An experimental test was conducted for the students who were affiliated to El-Nour Institute for the blind in Sudan, to investigate how the use of only auditory media to access school

curricula affects the development of braille-related skills such as writing and reading. To test the hypothesis of this research, which stated that improvement in the ability to understand texts by listening for students who have shifted from the use of braille to auditory media to access school curriculum during the early stages of education, negatively affects their ability to write full braille cells and the Arabic alphabet, and to read Arabic text. To test this hypothesis, an independent sample t-test to compare the two groups was used. Further, the strength of the correlation between each pair of measured variables was estimated using the t-test, to determine the relationship between listening, and writing and reading using the braille 6-dot alphabet, since this study used a within-subject experiment (with pre-test [before using audio books] and post-test [when using audio books]). In another words, the data represent the same subjects at different education stages to increase the validity and reliability. The independent sample t-test was used to compare the two groups, and as the data represent the same participants in different stages, the value of correlation between the two groups for each test was added as well.

3.8 Summary

This chapter began with explaining the framework of the research as well as the rationale for using a mixed method approach in an exploratory study of the effect of use of auditory mediums to access school curriculum on braille-related skills. A description of participants, materials, and procedures were presented, followed by a summary of the guidelines used to analyze both the descriptive and anecdotal data obtained in the research process. The next chapters will examine, in greater detail, the data which resulted from the personal interviews and experimental tests.

CHAPTER 4: STUDY 1: COMPARING THE TWO EDUCATIONAL SYSTEMS FOR THE STUDENTS WITH VISUAL IMPAIRMENT IN SUDAN: PROS AND CONS

4.1- Introduction

As mentioned in the previous chapters, the republic of Sudan does not have specialized schools at the high school level. Therefore, the only option for those who complete elementary education at specialized schools and desire to continue studying is to join schools that are designed for sighted students. Although the official placement for visually impaired students in Sudan has been residential segregated schools, many experts in the special education field are now questioning the efficacy and usefulness of this system. They argue that integrating such students at regular schools gives them the opportunity to socialize with their non-disabled peers and fosters mutual understanding within the student community. They also believe that students with visual disabilities are a small group among all other types of disabilities that can easily be integrated into public schools. Accordingly, tangible initiatives have recently been undertaken by the Ministry of Education towards promoting the inclusion of students with special needs in mainstream education (Baldo Mohamed, 2011). One example is the step taken by the Khartoum District Education Authority in 2007 to include visually impaired students within mainstream education. However, many problems arose, forcing this initiative to be halted.

One of these problems was the lack of sufficient prior preparation, which created difficulties in getting this group of students to adapt to the new system. Instead, they felt deprived of equal opportunities to compete with their sighted peers. As a result, many students dropped out and

returned to their original segregated schools to continue their education (Baldo Mohamed, 2011). Alhaj (2009) attributed the failure of the inclusion process of students with special educational needs in Sudan to several reasons, including a lack of buildings with specific accommodation designs, a shortage of qualified staff, and the absence of social awareness regarding people with disability.

The debate on the best way to educate visually impaired students in Sudan remains under discussion among educational experts. Some stand firm with the option of specialized institutions, while others prefer to continue and strengthen the integration process. Thus, this chapter of the present study will examine the advantages and disadvantages of enrolling students with visual impairment in specialized schools in Sudan, in contrast to integrating them into regular ones as well as the competencies of the teachers at the Sudanese General Basic School by raising the following questions:

- Is it better to place visually impaired students in Sudan in specialized schools or integrate them into regular schools?
- What are the advantages and disadvantages of each system?
- What competencies should the teachers at the Sudanese General Basic School have in order to fulfill the requirements of an inclusive education setting?

The findings of this study are expected to provide information and guidance to decision-makers and to offer solid ideas and prospects about educating the visually impaired in Sudan and other countries with similar contexts. In addition to teachers at regular schools, government departments and educational institutions for the blind in Sudan are in desperate need of scientific information and good planning to help the process of education of visually impaired

students to move forward. The findings of this part of the present study are also expected to aid the development of training programs, strategies, and feasible solutions for the challenges and obstructions facing the education of visually impaired students in Sudan.

Purpose

The aim is to understand and evaluate the participants' views regarding the advantages and disadvantages of specialized schools in Sudan. It also intended to identify the competencies Sudanese mainstream basic schoolteachers should have to be able to fulfill the needs of their students who are visually impaired and to achieve the ultimate goal of the inclusive school system. Moreover, the conducted study aimed to suggest concrete solutions that can help further the education of the visually impaired in Sudan and ensure it is in keeping with current times.

4.2- Methods and Participants

4.2.1. Participants

This study sought to solicit ideas to tackle issues pertinent to integrating students who are visually impaired in regular schools as opposed to separating them in specialized schools. Thus, the collected data ought to be more specific to the purposes of the study in order to obtain relevant results. Therefore, to make the most out of a small population, and to collect information from the best-fit participants, purposive sampling was chosen since it is deemed to be effective when limited numbers of people can serve as primary data sources due to the specific design of the study. Since there are a few national institutions that provide education and rehabilitation for the visually impaired in Sudan, the participant sample was limited to students and personnel who are affiliated with these institutions. Even regular schoolteachers

and government staff who participated in this study were chosen from Khartoum, Aljazeera, and River Nile states because a noticeable initiative has recently been taken by the authorities in these states towards promoting the inclusion of the students with visual impairment in the mainstream. Accordingly, a group of 20 participants comprising visually impaired students, their teachers, and associated staff agreed to participate in this study. The group included six students who graduated from specialized schools and later joined regular secondary high schools. Three visually impaired teachers working at the National School for the Blind and one sighted teacher at the National Rehabilitation Center for the Blind were also enrolled. The participants also included two students who had never had the opportunity to join specialized schools, four sighted teachers working at regular schools, two staff members with a visual impairment from the Aljazeera State Rehabilitation Center for the Blind in central Sudan, and one sighted official from each of the provincial ministries of education in Aljazeera and River Nile states in northern Sudan.

4.2.2. Method

Semi-structured interviews were conducted to explore the perceptions and opinions of the participants. This method allows for the questions to be asked in sequential order but also offers space for the interviewer to generate new questions depending upon the participants' answers. It also allows interviewers to ask for elaboration and to get into an extended dialogue with the interviewees if needed. Unlike standardized interviews and focused or unstructured interview methods, this methodology has the advantage of permitting participants to answer questions on their own terms and provides a platform for comparability.

4.2.3. Procedure

Interview data had been collected from Feb 2020 to June 2020 and were conducted via Skype or phone at the participants' convenience. The average duration of each interview was 40 to 60 minutes. Each interview started with an explanation of the aims of the study, assuring confidentiality, and affirming that all audio recorded data will be used anonymously and only for the purpose of the present research. In the preparatory stage for conducting the interviews for this research, and to enhance the validity of the data acquired, two teachers who have previously worked at the El-Nour Institution for the Blind and one person who has worked as the education secretary at the SNAB were consulted. This consultation considered the history, knowledge, and rich personal experience of those individuals in dealing with issues related to the education of the visually impaired people in Sudan. They all agreed that the questions should be designed in a way that allows the participants to clarify their perspectives and offer them the opportunity to express their views and suggestions accurately and adequately towards enhancing the provision of education for the visually impaired in Sudan.

Questions were asked according to the pre-determined sequential order of the interview, and respondents were given all the time they needed to provide full and detailed answers before moving on to the next question. The interview questions were as follows:

- What experience does the participant have with specialized schools?
- What is the participant's view of the characteristics, advantages, and disadvantages of specialized schools?
- What necessary support does the participant believe is required to ensure the success of inclusive education within regular schools?

- What are the challenges, advantages, and disadvantages of inclusive education in Sudan? What suggestions does the participant offer for the enhancement of education for the visually impaired in Sudan?

4.2.4. Data Analysis

The interviews were recorded, transcribed, and translated from Arabic to English by a third party to prevent bias and preconception during the analysis process. After transcribing all the interviews, the interview questions were analyzed by adapting the thematic analysis technique (Braun & Clarke, 2006). Based on the interview questions, the first author and colleague independently created an initial set of codes. Afterward, they met to discuss the similarities and differences in the created set of codes and agreed on a codebook. Then, the codebook was used by the first author and another colleague to code the interview data. Whenever appropriate, a frequency count was used to describe the number of responses in each category.

4.3- Results

The analysis revealed a notable variation in the participant's views between those who support the education of visually impaired students at specialized schools and those who support integrating them into regular schools. The first section of the interview required respondents to provide their views on the education of the visually impaired at specialized schools. The question about the participants' experiences with specialized schools drew a range of varied responses. The participants listed several advantages and disadvantages of specialized schools in response to Question 2. These responses are presented in Table 4.

Table 4. **Advantages and Disadvantages of Specialized Schools for the Blind. This data has been reported in Bilal Salih & Kakizawa (2022)**

Advantages	Number of Responses	Disadvantages	Number of Responses
Provide a comprehensive social and academic environment	10	High cost of establishing and operating specialized schools	12
Allow parents to participate in the educational process	9	Living in a setting that differs from the outside world	7
Offer an environment to accommodate academic needs	8	Mismatch of mutual interest among the students	6
Conduct comprehensive assessment prior to schooling	7	Separation of children from their families at an early age	5
Have teachers who are patient, dedicated, and passionate	7	Deviate families' attention when children attend various schools	4
Offer after-school activities	5		

Based on the answers listed in Table 4, it is possible to derive five broad features related to the specialized schools. The first is the comprehensive assessment that these schools conduct before students start their programs. One of the participants who was an official from El-Nour Institute for the blind summed up the assistance provided by the school to the students during the admission process as "categorizing their aspects of strength and weaknesses, assessing their ability to perform daily activities, investigating the history of disability in the family, evaluating disability condition, and identifying the activities performed by the child at home before joining the school." The specialized school, according to the same official "checks whether treatment of the visual disability is possible, and if any other disability exists. If another disability becomes known during the assessment phase, the school evaluates its impact on the student's

academic achievement and proposes an appropriate learning method for the student to access the school curriculum."

The second feature highlighted in the answers was the well-developed social and academic environment at specialized schools. In these schools, students start learning braille, mathematics, and other subjects in their first year under the supervision of teachers who are experts in the field of educating the visually impaired. One participant, who was a visually impaired teacher, pointed out the regular tests given to students to assess their ability to absorb the contents of the teaching materials as well as their ability to accomplish the required academic tasks.

These evaluation tests are accurately and professionally conducted by visually impaired teachers who, based on their personal experience with disability, are better suited to evaluate the intellectual abilities of this group of students. One participant from this group of teachers affirmed that students could not move to the upper classes until they met the required academic criteria and passed annual exams. Those who fail are required to retake the same class.

The third feature highlighted through the answers was that specialized schools possess the proper infrastructure to accommodate students' private and academic needs, which may not be available at public schools. This is another benefit that students at specialized schools enjoy. One participant who graduated from a specialized school confirmed that each child had a designated space to maintain their personal belongings, and the schedule and classroom rules were posted in a manner that the students could understand. The classroom setting is well-organized and divided into areas for different purposes, including entertainment and reading activities. Books and other reading and writing materials are displayed in a way that makes them attractive to children. Another student commented that materials for braille writing are available, including braille paper of various sizes for short and long messages, braillewriters,

staplers, and envelopes. A visually impaired teacher added that while sighted students enjoy a well prepared setting for their reading and writing activities, students who are blind are also surrounded by braille materials for their own classroom assignments. They are given many opportunities to exercise and develop their braille reading and writing skills daily. A frequent activity is the exchange of braille messages between the teacher and students in addition to assignments and homework lists, class schedules, and letters to read.

The fourth positive feature highlighted through the participants' answers was the presence of caring, patient, dedicated, and compassionate teachers at specialized schools. Most participants agreed that this was one of the most excellent features of these schools. As stated by a participant student, "The students feel comfortable with those teachers because, in addition to some of them being visually impaired themselves, they are also well acquainted with the assistive devices used by the students. They deal with the students based on the experience they have accumulated throughout their extended teaching career at specialized schools as well as their well-founded knowledge of students' educational needs." Another student stated, "Students go to their teacher's office at any time to ask for help with any of the assistive devices. Students also get help with their braille writing homework or mathematical drills. Such assistance by highly competent teachers may not be available at regular schools." Another student commented that "teachers have the appropriate competence for dealing with their students. Daily work schedules and classroom assignments are made very clear to the students, and examinations are conducted for determining the criteria to be fulfilled for advancing to the next level of learning. In addition, school personnel are very attentive, so the school rules are meticulously followed by the students and there is a consequence when rules are broken."

The fifth feature was the specially designed after-school activities for students that may not be found at regular schools. A visually impaired teacher confirmed that academic activities are designed to tackle all aspects of the weaknesses and deficiencies that arise during the school day. These include problems with incorrect writing and reading braille due to weak haptic senses that may have been caused by other disabilities accompanying blindness. This can also be a result of inadequate pre-school rehabilitation. Another visually impaired teacher stated that they constantly attempted to eliminate such weaknesses. Specialized schools also organize several after-school activities, such as sports, music, drama, and games, to allow students to enjoy a recreational setting similar to their sighted peers. The development of these skills at this age helps create a positive psychological atmosphere that boosts self-confidence and facilitates future inclusion in surrounding communities. Another visually impaired teacher emphasized the importance of these activities by saying, "These schools are designed to rehabilitate the students by making the best possible use of the remaining senses in order to compensate for the loss of vision. Therefore, such activities allow students to immerse themselves in normal life, such as moving alone and playing with their blind peers." In the case of students who live on campus, one teacher commented, "Schools substitute the families in monitoring, supervising, following, and directing the students while performing their daily life activities such as movement, eating, washing clothes, cleaning the room, sewing clothes, wearing shoes, and organizing their belongings."

However, the participants also listed several disadvantages of the specialized schools. One disadvantage that came up in most of the participants' answers was the high cost of establishing this type of school and the difficulty of allocating adequate financial resources to keep them operating. One participant emphasized the high cost of operating these schools in Sudan, given

that most of their needs and equipment were imported. He proposed, “NGOs should be solicited to support these schools.” What adds to the already high cost of these schools is their “presence in urban areas, and the need to follow a specific disabled-friendly design, including the construction materials and equipment that help the visually impaired to compensate for their vision loss. This is essential to their education. However, securing enough funds to provide educational facilities such as special tools, effective teaching systems, audiobooks, and optical aid devices is beyond what the allocated budget for these schools can bear.”

4.3.1. Separation from Family at an Early Age

One of the disadvantages of specialized schools that was highlighted in the participants’ answers was the uncomfortable long-distance travel the students had to make to get to their schools. Those who choose to reside on campus were away from their families during weekdays. A participant who was an education official commented that “students who are enrolled in specialized schools generally have limited contact with their non-disabled peers, unlike those who are full-time public school attendees. The solution to this is gradual integration by allowing those who attend specialized schools to receive some instruction in local public schools.”

4.3.2. Losing Common Ground and Shared Interest with Age-Mates at Home

The participants’ responses acknowledged the importance of the home-setting in the growth of children in general, particularly those with disabilities. Students with visual impairment who are separated from home and go to live on campus for the larger part of the year face two problems, as one participant teacher mentioned. “They begin to lose all aspects of common grounds and shared interest that they used to have with their age-mates at home. They also begin to develop feelings of belonging to different communities.”

4.3.3. Current Inclusive Education System in Sudan

This section presents and analyzes participants' views on the challenges, advantages, and disadvantages of the integrated education system in Sudan. Table 5 summarizes the advantages and disadvantages of the current integrated educational system in Sudan as reported by the participants.

Advantages of the Inclusive System

As the table above shows, growing up within a family setting is hailed by many participants as an advantage of the inclusive system. One student believed this system provides visually impaired students the opportunity to stay with their families since there is no boarding house option. Therefore, it helps to create deep family relations and stronger bonds with their age-mates in the neighborhood. This will eventually lead to improvements in the way communities deal with the visually impaired.

Table 5. The Advantages and Disadvantages of the Current Inclusive Educational System for the Visually Impaired in Sudan. This data has been reported in Bilal Salih & Kakizawa (2022)

Advantages	Number of Responses	Disadvantages	Number of Responses
Provides opportunities to include more students	18	Offers excessive care, but inadequate instruction in classes	14
Offers students the opportunity to interact with sighted peers	13	Denies students' prospect to use assistive technologies	12
Allows students to grow within their families	11	System is implemented without adequate preparation	12
Offers students an opportunity to experience the real world	5	Offers no scientific academic assessment	9

This system also offers students the opportunity to interact with sighted peers, spend time with them, and participate in daily classroom activities. From a teacher's perspective, this helps them understand and learn from the behaviors of others and gives them the opportunity to develop principles of social interaction, independence, and self-advocacy skills. An official from the department of special education believed that if education through integration is efficiently and properly implemented, it can compensate for the shortage of specialized schools in Sudan. It has the capacity to expand educational opportunities for a larger number of visually impaired people.

Disadvantages of the Inclusive System

A common view among interviewees was that the integration policy is being implemented without adequate preparation. A visually impaired teacher criticized the overall policies of enrolling students with visual disabilities in schools. He believed that most of these students ended up either outside the educational system due to limited seating at specialized schools or getting enrolled as listeners at public schools. Another critique came from a visually impaired teacher who believed that educational support and other services relating to disability must be designed based on what the expected recipient's need, not what the system thinks he should receive. A student objected to labeling this system "inclusive" and proposed to call it "oral education" instead. His objection was based on the fact that visually impaired students usually attend regular schools as listeners. They are exempted from regular academic tasks, such as mathematical exercises and spelling tests, and are also given lighter oral tests at the end of the year. Another student commented on the practice of accepting students as listeners at public schools because they lacked the skills of reading and writing in braille and were unable to use other assistive technologies to access the school curriculum. The reason behind the current form

of education for the visually impaired in Sudan was further criticized by a regular schoolteacher who believed it is not based on solid scientific research and is not clearly defined within the national strategic educational plan. Rather, it is a compromise that families have accepted and adopted to educate their children. Another visually impaired teacher expressed a negative opinion about this system, rejecting it as a basis for educating the visually impaired in Sudan. The reason for this objection was that although the families knew it was not ideal, they agreed to adapt it for their children because of the limited number of specialized schools in the country. Such a situation does not fit the standards of either good or inclusive education. Another teacher believed that the system required rigorous and systematic evaluation and review to improve it and make it properly functioning.

One teacher with visual impairment believed that the implemented integration policy in Sudan was an easy way out for officials at the special education department who do not want to tackle all the difficult and complicated problems that come with building a truly functioning educational system for the visually impaired. He further emphasized that such inaction produces a generation of students who do not have any knowledge of how to deal with assistive technology, which is vital for the progress of their education. It also deprives them of the opportunity to use their other senses, and consequently, limits their ability to comprehend class content.

The importance of assistive devices in boosting academic capabilities and learning progress was reiterated by another teacher with a visual impairment who stated that it helps the students to become qualified and competent when they graduate and will increase their chances to compete in the job market in the future. Allowing them to rely only on their listening sense is

risky because, as another teacher who was visually impaired believed, it will lead them to think that it is the only learning technique available to acquire knowledge.

Several participants touched upon the excessive care students received at various public schools. One female student complained that her teacher was completely ignorant of how her visual impairment impacted her abilities. All that the teacher was able to offer was asking her to lay down on the bed for the whole day every day. This resulted in the student hating her kindergarten. Another student was exempt from class assignments and sports activities, and another student was asked to stay in class when his classmates were performing activities directed at cleaning the school campus. The participants also lamented the insufficient opportunities for students to receive special instruction at regular schools. Another problem noted by the visually impaired teachers at regular schools was overcrowding in classes. With an average of 40 students in each class, it is difficult for students to become fully attentive and carefully follow-up on their classes. Another problem was the delivery of the class instructions. Teachers usually write on the board but rarely read out loud what they write. The use of visual aids in teaching is advantageous only for sighted students. The practice differs in specialized schools, where the number of students in class is smaller and teachers have a better chance to administer individual diagnostic measures.

4.3.4. Suggestions for Enhancing the Education of the Visually Impaired in Sudan

The interview ended by asking participants to propose suggestions that would contribute to enhancing the education of the visually impaired in Sudan. These proposals are categorized as either urgent or long-term and are summarized in Table 6.

Table 6. **Solutions for Enhancing the Education of the Visually Impaired in Sudan.**

Urgent solutions	Number of Responses	Long-Term solutions	Number of Responses
Promote teacher training for an efficient inclusive education	16	Establish more special schools in the main cities	17
Enact unified regulations to include the visually impaired in public schools	15	Create organizations specialized in visually impaired education	16
Create a database for school age students with visual impairment	14	Secure the necessary assistive technologies	15
Emphasize to families the importance of educating visually impaired children	9	Conduct conferences discussing the education of the visually impaired	14
Raise students to fittingly interact with their visually impaired peers	9	Work towards gradual integration	13
Promote the participation of the visually impaired in cultural activities	5	Involve experts to design strategies to implement inclusive education	11

Urgent Solutions

One of the suggestions was to create a database of students with visual impairment. This came from four participant officials from Aljazeera and the River Nile states who criticized the lack of accurate statistical information about visually impaired students. They believed that providing a good-quality educational service requires the existence of a comprehensive database that shows the area of residence, age, level of disability, family's economic status, and any other relevant statistical information.

The second suggestion focused on the importance of enacting standardized laws and rules to regulate the process of integrating the visually impaired in public schools. The absence of such laws and rules is one of the main reasons for the ambiguity and disparity in dealing with these students in schools. The fact that schools do not follow a unified code in dealing with all matters relating to visually impaired students has resulted in imbalanced educational services at various schools. The student participants reflected on their experiences at public schools and revealed

a notably different array of attitudes and ways of treatment depending on the school they joined. One of them stated that it was a matter of pure luck. A visually impaired teacher believed that it should be upon the formal education authority in each state to provide brochures with guidelines and rules regarding the integration of the visually impaired into public schools. Making these documents available will be consistent with the state's policy regarding the education of the visually impaired in public schools. An example of a complicated situation that results from the absence of these policies and rules is the process of admission for students who graduate from the El-Nour Institute into nearby schools. A visually impaired teacher mentioned that the schools' administrations often do not accept those students, and they must wait for a special arrangement between the institute and the Ministry of Education to facilitate their admission process.

A third suggestion focused on the importance of raising awareness regarding blindness among sighted students. In the view of the visually impaired teachers, awareness compensates for the lack of assistive technologies. In order to make real progress with regard to spreading awareness about blindness, there has been a suggestion of creating a section in the curriculum to teach non-disabled students how to deal with different types of disabilities in order to facilitate the inclusion of their peers with disabilities in public schools.

The fourth suggestion asserted the need to promote the participation of visually impaired students in cultural activities taking place in the schools. A visually impaired teacher strongly advocated this as it will encourage the students to develop strong relationships with their classmates and demonstrate their personal abilities and intellectual talents. An example of this was a participant student who became a regular contributor to school cultural festivals and developed good singing and music skills. According to him, he became a star in school with

very strong and wide social networks that had a positive impact on his academic and personal life.

In the fifth suggestion, the participants highlighted the importance of organizing training programs for teachers regarding the implementation of inclusive education and how to deal with visually impaired students. The participants affirmed the value of training teachers in the field of special education and making it a part of their ongoing professional development. One teacher with visual impairment stated that when this training is provided, teachers will have no excuse to release themselves from responsibility when students with visual impairment join regular schools. This will be a vital step in avoiding the undeniable negative consequences of handling the academic and personal matters of those students without being professionally trained and prepared to do so.

Long-Term Solutions

Interviewees agreed that inclusive education is extremely advantageous in providing more opportunities for a larger number of visually impaired students. It helps to maximize care and promotes the kind of education offered by specialized schools. However, the interviewees believed that the inclusive system would work best if the plan is implemented gradually. In fact, the idea of gradual integration of students with visual disabilities has been suggested by a teacher with visual impairment and was enthusiastically received, supported, and approved by the authority of education in Aljazeera. The idea proposes that the integration process should start in grade 4 at one of the regular schools in the student's neighborhood. This process requires schools to be adequately prepared to guarantee proper accommodation for incoming students, including the required equipment for assistive technology. Teachers specializing in the education of the visually impaired need to be appointed to handle all the situations that schools

may face during the integration process. In addition to teaching, supervising, and following up on the academic progress of the students, teachers will also need to carry out other duties that are essential for the education of this group of students, including preparing the study material in braille, handling the examination in braille, and keeping an eye on their scores and grades.

Another long-term solution included establishing partially specialized schools that adapt the gradual integration strategies proposed by the participants. These schools would be built in the capital city of each state in the country. These schools must offer education to visually impaired students during their first three years of school before moving to regular schools. This would notably cut down on the expenses of establishing comprehensive specialized schools. One educational supervisor from the Aljazeera state suggested that these schools can be accommodated within existing regular public schools or in any other unused public buildings.

Several participants emphasized the significance of involving teachers who were themselves visually impaired were working in the field of the education of the visually impaired for a long time, and thus, became experts in designing and implementing the strategies and future planning of an inclusive education policy. Currently, visually impaired teachers are not being consulted in this policy, as per a participant in this study. This viewpoint was further supported by another teacher with visual impairment, who was also surprised that many decisions relating to the education of the visually impaired are taken without any prior consultation. There was a consensus among the participants that the well-founded experience, expertise, and valuable knowledge of teachers and personnel who have been working for extended periods of time in the field of educating the visually impaired must be recognized and utilized to the maximum potential.

The participants stressed the utmost importance of securing equipment for assistive devices used to write in braille, print braille textbooks, and large textbooks. One student participant looked at schools' failure to provide assistive device equipment to the visually impaired while their sighted peers enjoy having all the educational resources they need as "an act of discrimination."

Other suggestions included setting up an organization to work specifically in the field of education of the visually impaired, in addition to organizing annual workshops and conferences to exchange ideas and present new research findings to enhance the quality of this field of education.

4.4- Discussion

The first two questions in the interview addressed the participants' experiences in specialized schools, in addition to soliciting their views regarding the characteristics, advantages, and disadvantages of these schools. As noted by the participants, the most prominent virtues of specialized schools when compared to regular schools are the steps that are carried out before the students' school programs begin. These steps aim to identify the specific personality and psychological factors that often accompany the growth of children with visual disabilities. These factors are often missed by teachers and families due to a lack of awareness and the scarcity of specialized counseling and early intervention centers that work to support and administer cases of blindness during the early years of childhood in Sudan.

The results of various studies have shown that skill tests and careful follow-up of children during their early years in specialized schools help identify any possible accompanying disabilities besides visual impairment (Ajuwon & Oyinlade, 2008; Lifshitz, 2007; Pogrund, 2013; Agesa, 2014; Mushoriwa 2001).

The participants stated that students receive carefully prepared monthly and semi-annual exams and quizzes and are assigned several academic duties during the school year. This gives students the experience of a real competitive academic atmosphere similar to their counterparts in regular schools. When they attend regular schools, they are treated differently because of teachers' lack of knowledge regarding how to evaluate their academic progress. The teachers consider them as listeners only and, accordingly, give them random grades or the minimum pass grade to allow them to move to the next level. This deprives them of the right to be equally evaluated. This becomes a source of frustration for teachers who try to make the same class material equally accessible to everyone in the class, and to students with visual impairment who feel unable to fully participate in the learning process.

One of the disadvantages of specialized schools that came up repeatedly in the participants' answers was the high cost of building these schools in comparison to regular public schools. Establishing a specialized school requires a barrier-free building design, a dormitory for students and teachers, braille printing services, assistive devices, and transportation for students, teachers, and other staff. The high expenses of establishing specialized schools for visually impaired students have been discussed intensively in other studies (Mann, 2006; Omede, 2015).

Participants were asked to compare the benefits of enrolling students in each of the two educational systems and to address the factors that impede the integration of students with visual impairment in regular schools. According to current educational regulations, students who do not attend specialized schools are commonly accepted in any nearby regular public school to receive education with sighted students. As stated before, these regular schools are not equipped with assistive devices or resource rooms that offer special educational services. These students depend on memorization and asking volunteers to help them read the study

materials and write during quizzes and tests in order to access the school curriculum and class information (Salih & Kakizawa, 2016). The participants believed that the current inclusive educational system is a fait accompli solution for households and families given the limited number of specialized schools that provide education for the visually impaired. Families are left with no other options for educating their children. Salih & Kakizawa (2016) stated that this learning method will have severe negative consequences on the educational progress of students who are visually impaired, as they have no experience with braille and other assistive technologies. Moreover, this system does not have a true and scientific academic evaluation method and lacks any platform that schools and families can use to monitor students' academic achievement. This corresponds with Mushoriwa, (2001) who stated that inclusive education is being introduced before thorough studies on whether it is applicable to adapt inclusive education in a particular country. Consequently, people with disabilities in general, and those who are visually impaired more specifically, have been left out of the discussion regarding how best to include them in schools.

One of the most common practices in the inclusion policy, as many participants pointed out, has been treating these students in regular schools with excessive care and sympathy. Under this umbrella, these groups of students are usually excluded from a range of extracurricular activities to spare them from unwarranted physical efforts. This practice shows an undisputed lack of awareness and inadequate knowledge of the proper way to handle their special educational needs. Studies have repeatedly shown that when such practices become the norm and no interventions are taken to correct them, the education of these students is jeopardized and will suffer negative consequences (Chiu & Wild, 2021; Lieberman & Conroy, 2013; Lewis & McKenzie, 2010; Wolffe & Kelly, 2011). These studies have recommended that when

students with visual impairment are enrolled in a mainstream school setting, a careful assessment of their academic and social needs must be performed to determine their viability to function at both the academic and social levels alongside their sighted peers (Hazekamp & Huebner, 1989). This assessment will determine the basis of this group of students' participation in all academic and non-academic activities with their classmates. This participation is necessary for students to gain and develop social skills, self-confidence, and independence when it takes place within an appropriate educational program (Swallow & Huebner, 1987). The teachers and instructors who work with these students must refrain from providing too much and unneeded assistance or imposing constant and close-proximity supervision so as to leave room for them to develop their own independent skills (Hazekamp & Huebner, 1989).

Another complaint was inadequate class instruction, which directly affects the academic acquaintances of these students. Classes with a small number of students in specialized schools make it easier to offer careful guidance and ideal class management (Lowenfeld, 1973). On the other hand, packed classes at regular schools make it difficult for this group of students to follow class instructions. It is important to consider the factors that special education experts recognize to have an immense influence on creating an effective learning setting for the education of these students. These include, but are not limited to, consistency and quality of instructional style, curriculum, amount of instructional time, opportunities for active learning, and classroom setting, in addition to a shortage of teaching aids, low-vision devices, textbooks, and modern assistive devices (Agbenyega, 2007; Ajuwon, 2012; Arrah & Swain, 2014).

Special education experts emphasize the importance of offering carefully designed literacy classes in specialized schools. This task should be shouldered by highly qualified instructors

with good knowledge of braille and a deep awareness of how to teach reading and writing in order to ensure that the students finish the course with an adequate level of basic literacy skills (Pogrund, Darst & Boland, 2013). This requires close follow-up of these students and making them fully aware of the educational tools that will help boost their literacy levels, such as braille, visual aids, and other assistive technologies. In addition to aiding their academic potential, these skills are also important for them to easily adapt when they find themselves surrounded by sighted peers at schools, universities, or future workplaces (Omede, 2015). Failing to secure assistive devices at regular schools will lead such students to be far behind in subjects such as mathematics and science (Akakandelwa & Munsanje 2012). Although most countries across the globe face problems in providing and securing assistive devices for people with special educational needs, braille writing machines, or placing sign language interpreters at all corners, this is more challenging in low-income countries (Urwick & Elliott, 2010). Urwick & Elliot (2010) also found that to tackle this problem, there is a consensus among special education experts and experts to make these services available at select schools. This is a part of the support students expect to receive.

The participants in this study offered several short-term and long-term solutions to enhance education for the visually impaired in Sudan. They argued that short-term solutions need to be implemented sooner and prior to the initiation of integrating the visually impaired into public schools to lay the ground for a successful integration process.

One point that has been raised is the number of children with visual impairment in the country, which is reported not to be accurately documented and precise numbers are not known. The number of those currently enrolled in schools is, by no means, the complete number of those who are eligible for education. One proposed short-term solution is to conduct a meticulous

survey to determine the exact number in each neighborhood. The decision to send this group of students to school lies with the family. However, some families choose to rear their children themselves and do not send them to school. Therefore, the total number is a matter of speculation. This is a common occurrence in many developing countries and Sudan is no exception (Banks, 2003; Green, 2003; Lansdown et al., 2013; McCabe, 2007; Rohwerder, 2018; Wang et al., 2011).

A number of participants in this study highlighted the problem of the absence of a unified code or standardized policy to handle all matters relating to the education of the visually impaired in public schools in Sudan. The current way of handling this situation, according to the participants, is a matter of personal preference for teachers and administrators at different public schools. Accordingly, the education and inclusion of the visually impaired continues to face many negative consequences. Some schools have taken the deficiency of regulations relating to the education of the visually impaired as an excuse to not take responsibility for such students and to deny them the right to enroll in their programs. As discussed by Baldo Mohamed (2009), this is expected as a result of the lack of school staff with sufficient knowledge to handle these situations.

Another decisive factor to be considered in the process of admitting visually impaired students to an inclusive education program is to test their psychological maturity and social readiness to mingle with sighted students. This begins with raising awareness among sighted students on how to socialize with visually impaired classmates and ensure that they understand the basics of visual disability. It is a miscalculation, according to Celeste, to put visually impaired students in a classroom with sighted peers and to think that doing so is enough to make them full members of that setting (Celeste, 2006). It is crucial for support professionals, educators, and

special education experts to remain vigilant and sensitive to all aspects of social challenges that students with visual impairment may encounter and address them head-on whenever they appear.

One of the proposals made by the participants emphasized the vitality of training classroom teachers. Visual impairment may be total or partial, and handling each of them requires a certain level of know-how. If teachers have no previous experience in teaching this group of students, they will be unable to identify the necessary educational tools and policies that help them learn. Therefore, it is important for teachers to become acquainted with the personalities, strengths, abilities, and needs of their students and become sensitive to their individual needs and requirements. They need to know as precisely as possible the type of special devices their students use, the type of accommodations and modifications they require in the classroom, and any other additional skills they may need to learn and develop (Bina, 1993; Mann, 2006; Savich, 2008). Hiring qualified and trained teachers is unquestionably the most important component in ensuring the success of the inclusive education policy; without it, this policy becomes completely dysfunctional regardless of how many equipment and resource rooms are made available.

This is similar to the case of many African countries such as Ghana, Cameron and Kenya (Agbenyega 2007; Arrah & Swain, 2014; Alhassan, 2014; Daniel, 2012). These studies have also emphasized the fact that a lack of teacher training and inexperience in handling situations involving visually impaired students is often used as an excuse to not grant them admission.

4.5- Conclusion

The success of inclusive education programs in Sudan requires effective legislation, a proper environment, and accessibility of assistive devices that meet the specifications and requirements for each degree of visual disability. The current integration policy is in desperate need of meticulous reform that must start with a comprehensive system evaluation and careful identification of deficiencies and disadvantages. Another key factor for the success of the integration policy is to improve the academic environment by appointing qualified staff and competent and professional teachers who, in addition to the national curriculum, can implement the extracurricular curriculum for the visually impaired.

Paying special attention to the short- and long-term solutions that have been suggested by this study after comprehensive evaluation might help take a step towards improving the academic environment in order to provide better educational services. The list of long-term solutions in Sudan includes securing the necessary assistive technologies, implementing a gradual integration policy for students with visual impairment at regular schools, and establishing specialized schools in each state capital in the country. It is also recommended that teachers with visual impairment, particularly those who are currently working in specialized schools, in addition to experts in the education of the visually impaired, be involved in planning and designing the implementation regulations of the inclusive education policy.

This study also recommends that a systematic review of policies pertaining to the education of the visually impaired should be implemented via annual conferences and workshops.

The conclusion of this study is that the implementation of both systems requires carefully calculated techniques, a range of logistic and technical requirements, intensive training, and sophisticated teaching skills to provide quality education to this group of students.

The decision to place a visually impaired student in one of the two educational systems is interchangeable, depending on the educational needs of the student. Students with visual impairments should not be compelled to continue a specific program if it becomes clear that it is unsuitable for them and does not fulfill their academic and personal needs. Even within a specific program, students' needs change from one level to another. They usually require intensive assistance and direct supervision during the early stages of their studies, but these requirements reduce in the upper stages. It might be ideal and preferable for one group of visually impaired students to start their education in specialized schools and finish at schools with integrated education programs. This arrangement may work in reverse for other groups of students. The solution lies in finding a combination of the two settings that allow for a variety of activities to be offered and a proper platform for students' social talents, psychological wellbeing, and academic skills to mature.

CHAPTER 5: STUDY 2: ASSESSING THE IMPACT OF AUDITORY MEDIA ON BRAILLE READING AND WRITING SKILLS IN THE CASE OF ELEMENTARY SCHOOL STUDENTS WHO ARE BLIND IN SUDAN

5.1- Introduction

This study was conducted in an academic setting at El-Nour Institute for Those Who are Blind, in Khartoum, the capital city of the Republic of Sudan. Within the academic environment for students with visual impairments in Sudan, students are urged to use more than one medium to access the school curriculum. They often cannot utilise their preferred medium, which makes access to the school curriculum even more difficult for them. For instance, although the students learned braille at EITWAB at lower grades, a lack of braille books forced them to shift to another medium in their later elementary education. One such medium is DAISY technology, which is an internationally recognised tool used by the visually impaired to read recorded books (Kerscher, 2001; Kimbrough, 2001; Leas et al., 2008). Unfortunately, this technology is not widely accessible in Sudan. Due to a shortage in standard services for recorded books at the educational institutions in Sudan, students have created their own recorded books through the help of peers who record the textbooks for them or by recording notes or class summaries (Salih & Kakizawa, 2016). Thus, this study investigates how the use of only auditory media to access school curricula affects the development of braille-related skills such as reading and writing.

Research Hypothesis

This study hypothesises that for students who have shifted from the use of braille to the use of auditory media to access school curriculum during the lower elementary grades, improvement in the ability to understand texts via listening negatively affects their ability to write full braille cells and the Arabic alphabet and read Arabic text.

5.2- Method

Students from the EITWAB were selected for this study. The study design allowed for a comparison of participants who used braille alone to those who used both braille and audio methods to access their school curriculum. The experimental procedures of this study were approved by the Institutional Review Board of The University of Tsukuba Faculty of Comprehensive Human Sciences, and all participants provided written informed consent before participation.

5.2.1. Participants

The study sample comprised 34 students at the elementary level. The number of male and female students was 19 and 15, respectively. Due to a lack of schools for students with visual impairments in Sudan, only students who are completely blind are usually accepted. Thus, all 34 participants were unable to read regular print. The students were selected because they were using braille as their main method to access the school curriculum in lower elementary grades. They began using audio materials in the upper elementary grades to access the school curriculum because of a shortage of braille printed materials. Therefore, the participants in this

study can be regarded as an ideal sample in examining the impact of the use of auditory methods in early education classes to access school curriculum on Arabic braille writing and reading. Additionally, the participants were available for follow-up meetings or further investigations.

The first group, Group 1, included the 34 students in grades 3 and 4 when they used braille alone to access their school curriculum. The second group, Group 2, included the same 34 students when they were in grades 5, 6, 7, and 8 and used both braille and audio methods to access their school curriculum.

5.2.2. Materials

The following tests were conducted to assess braille 6-dot writing, Arabic alphabet writing, Arabic text reading, and the ability to listen to audio recorded material.

Test 1: Braille 6-Dot Writing

Participants were given two minutes to write the six dots of a braille cell using a regular braille paper slate and stylus. This test was intended to measure the participants' braille writing ability and speed.

Test 2: Braille Writing of the Arabic Alphabet

There are 28 letters in the Arabic language, which have a specific order and are known collectively as the Arabic alphabet (Figure 1). Participants were given two minutes to write the Arabic alphabet in order. This test was intended to check the participants' accuracy of braille writing.

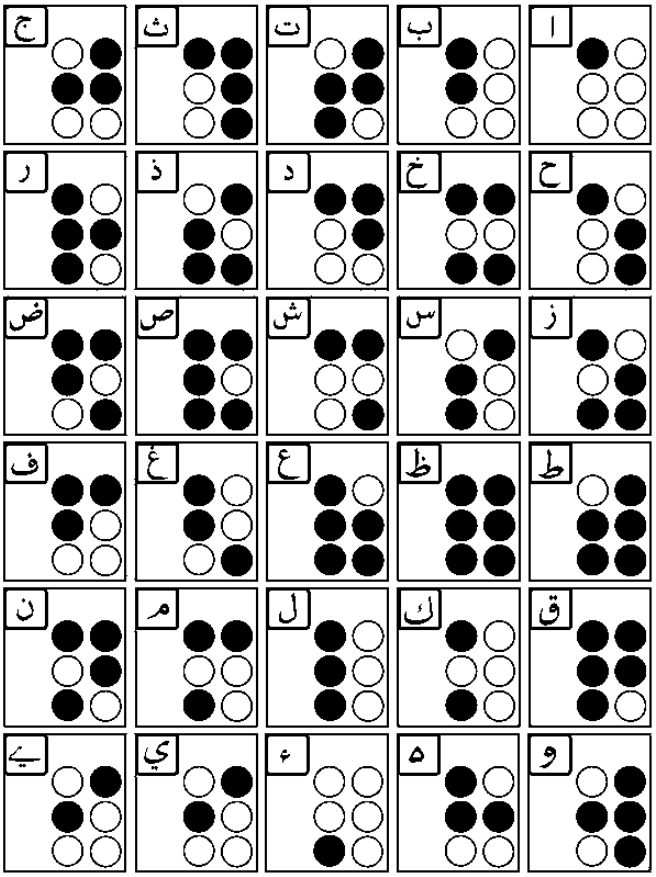

Figure 1. Order of Arabic Alphabet in 8-Dots braille Coding. This data has been reported in Bilal Salih & Kakizawa (2022)

Test 3: Braille Reading of Arabic Text

All materials were typed in grade-1, uncontracted braille, with up to 40 characters and intervals in each of the 28 lines on each page. Each participant was allowed three minutes to read part of the grade 1 braille text in Arabic. This test was recorded for analysis, and the reading speed for the first minute was documented.

Test 4: Assessment of Listening Speed

The goal of this test was to evaluate the listening speed within Group 2 to understand the growth in students' listening speed as their grade level increased. The participants were asked to listen to a 1-minute fragment of an audio recording at different speeds (80, 100, 120, and 140 WPM) using a multispeed audio player. The same auditory text at each speed was presented only once in a counterbalanced order from the fastest to successively slower versions. Then, the participants were asked to report the most suitable rate for which they could easily recognise all of the text without exertion while listening to it.

Reading Passage

A moderately long expository text selected by the schoolteacher was used to test the participants' reading skills. The passage was written at a fourth- to fifth-grade reading level according to the school readability test. Although the reading level of the text is considered advanced for the lower grade students, the contents underwent moderate modifications by the schoolteachers to enable students' comprehension at all grade levels.

Listening Passage

An expository text selected by the schoolteacher at the fifth- to sixth-grade level was recorded at different speeds in MP3 audio format using a free Arabic text-to-speech engine (TTS) that was familiar to the participants. The text used in the braille reading test was substituted with different versions of audio text to assess students' listening speeds; the purpose of the substitution was to minimise the effect of users' prior knowledge of the information presented in the text on their listening test performance. However, prior knowledge of the subject proved to be irrelevant because students were not required to analyse the passage or make inferences

based on the information presented in the text. The selected passage contained frequently used words, and the use of specialised and technical words was avoided to make the passage easier to understand.

5.2.3. Procedures

The four tests were conducted before the morning classes of the school schedule and were monitored by two schoolteachers in order to conduct the braille-related tests during routine classes without interfering with normal activities. Group 1 took Tests 1–3, the tests on braille 6-dot writing, Arabic alphabet writing, and Arabic reading, but did not take Test 4, the assessment of listening speed, because students in the lower grades (1–4) were not allowed to use auditory means to access the school curriculum. Group 2 took the same three tests in the same order, and then completed the assessment of listening speed.

Scoring

The total score was the number of cells completed by each participant for Test 1, the number of letters written within two minutes for Test 2, and the reading speed for one minute (WPM) for Test 3.

Statistical Analysis

T-tests were used to determine differences in the levels of related skills between the two groups and between braille-related skills and listening skills for Group 2. The strength of the correlation between each pair of measured variables was estimated using an independent sample t-test to

determine the relationships between listening, writing, and reading using the braille 6-dot alphabet for Group 2.

5.3 Results

Test 1: 6-Dot braille Writing

Students in Group 1 obtained a lower mean score (M = 36.53, SD = 09.08) than those in Group 2 (M = 55.32, SD = 14.64) as shown in Figure 2.

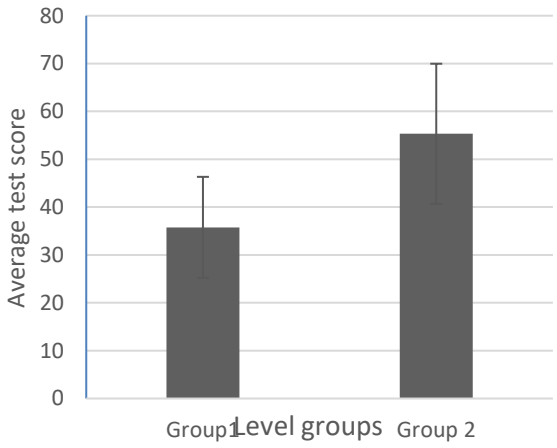

Figure 2. Results for 6-dot braille writing. N = 34. Group 1 (grades 3–4). Group 2 (grades 5–8). This data has been reported in Bilal Salih & Kakizawa (2022)

Test 2: braille Writing of the Arabic Alphabet

Students in Group 2 (M = 45.09, SD = 16.96) demonstrated a higher mean score than those in Group 1 (M = 39.38, SD = 14.78), as shown in Figure 3.

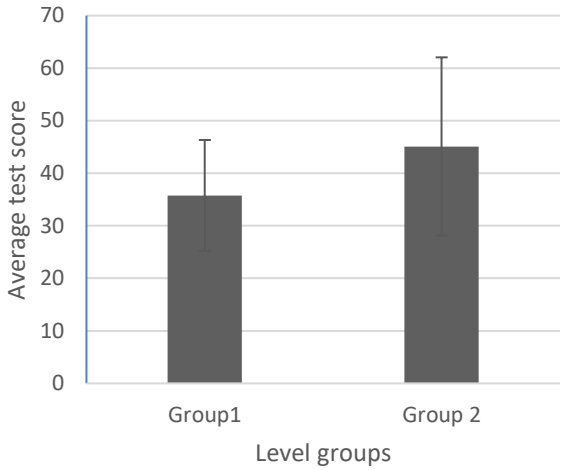

Figure 3.Results for braille writing of Arabic alphabet. N = 34. Group 1 (grades 3–4). Group 2 (grades 5–8).

Test 3: braille Reading of Arabic Text

There was higher variability in the scores for Test 3 (see Figure 4), but students in Group 2 (*M* = 37.34, *SD* = 21.95) had a higher mean reading speed of Arabic braille than those in Group 1 (*M* = 26.44, *SD* = 8.00). In addition, two exceptionally high values were considered outliers for Group 2.

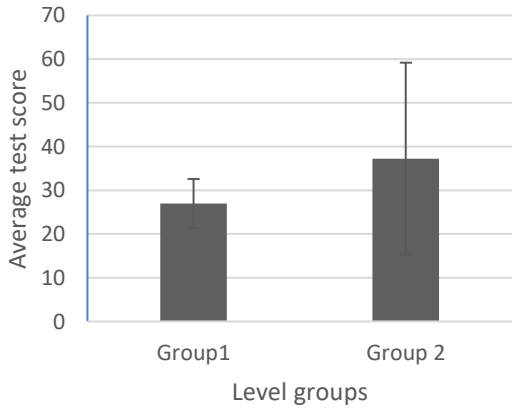

Figure 4.Results for braille reading of Arabic text. N = 34. Group 1 (grades 3–4). Group 2 (grades 5–8).

Test 4: Assessment of the Participants' Listening Speed

Figure 5 reveals the results for the assessment of the participants' listening speed. Students in grades 5 and 6 scored the lowest, with mean scores of 85.71 (*SD* = 9.76) WPM and 96.00 (*SD* = 12.65) WPM, respectively. The scores were significantly higher for grades 7 and 8, with mean scores of 115.56 (*SD* = 16.67) WPM and 132.50 (*SD* = 10.35) WPM, respectively.

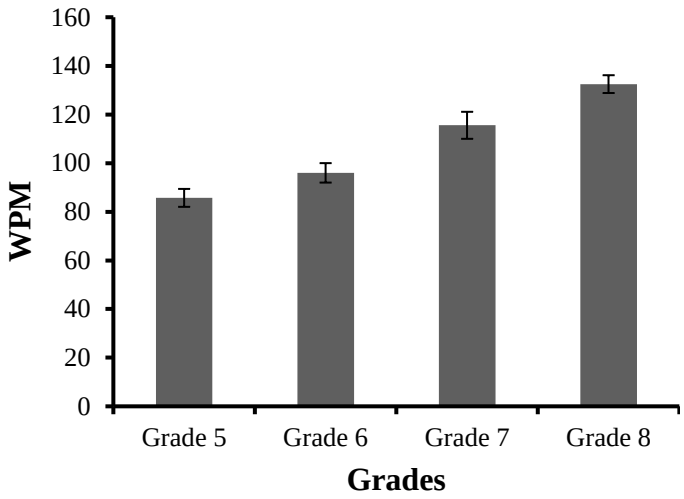

Figure 5.t Results of Test 4 for Group 2. This data has been reported in Bilal Salih & Kakizawa (2022)

Note. N = 34. Group 2 = Grades 5–8; Test 4 = Assessment of Listening Speed.

Comparative Analysis

Additionally, the three tests were compared for each group separately. The comparison of the three tests was based on an understanding of the relationships among braille full cell writing, alphabet writing, and Arabic text reading at each grade level. Table 7 demonstrates a significant

difference between the two groups for Tests 1, 2, and 4, with $p < 0.05$. However, there was no significant difference between the groups for Test 3 ($p > 0.05$).

Table 7. **T-Test Results by Group and Test. This data has been reported in Bilal Salih & Kakizawa (2022)**

	Test 1		Test 2		Test 3	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
M	36.53	55.32	39.38	45.09	26.44	37.24
Variance	82.44	214.47	218.49	287.78	64.07	481.94
t(66)	-6.36		-1.48		-2.69	
p	<0.001		0.145		0.013	
r	0.33		-0.48		-0.11	

Note. $N = 34$ for Groups 1 and 2.

5.4. Discussion

The results of this study emphasized the relationship between the acquisition of information through auditory media and braille, as well as the negative effect of using audio methods to access information during the early school years on braille reading ability. Therefore, the results support the hypothesis that braille reading ability is adversely impacted by the use of audio methods to access information. Additionally, the lack of a significant difference in the ability to write the Arabic alphabet in Group 2 supports the research hypothesis. However, students in Group 2 had begun to access the school curriculum via listening methods, which deteriorated or had an indirect impact on their braille-related skills. In contrast to the findings revealed here, the students in Group 2 may, in fact, continue to exhibit improvement in their scores for braille writing and reading skills as their grade level increases. If such improvement occurs, the hypothesis should be rejected. Conversely, students in Group 2 may become long-term audio

users, which may ultimately minimize their ability to use braille as their primary method for accessing information.

Based on the results of this study, two main factors are worthy of discussion. First, all participants in Group 1 had the opportunity to learn braille early in their education, which is the most important period for mastering braille and attaining the required level of proficiency to fully utilise braille throughout the educational and vocational stages of life (Lamb, 1996, 1998; Rex et al., 1994; Swenson, 1991). However, the deterioration in braille-related skills for the participants in Group 2 after they shifted to the use of auditory media, may eventually lead to a failure to master braille as an original reading medium. This result may render the significant advantage of learning braille at an early stage of their educational lives worthless. As stated by Schroeder (1989), having knowledge of braille as a primary reading medium will favorably enhance the employment qualifications of people with visual impairments, as extensive use and early acquisition of braille reading skills are the two factors that promote vocational opportunity.

Another factor that is exclusive to the study setting is the lack of braille printed text, which forced the participants of Group 2 to depend on other media to access information related to the school curriculum and other written materials. This lack of braille text has had a tremendous effect on the academic environment of the students by limiting their selection of study media to access the school curriculum. Shifting to the use of audiobooks as a study medium has undoubtedly affected the other braille-related skills for students in Group 2, as demonstrated in this study. Although this study found that braille writing and reading skills exhibited a progressive decline for participants in Group 2, there was a noticeable increase in listening skills.

One possible explanation for this finding is that reading materials in the early schooling years, including academic and storybooks, are limited and reading tasks are relatively short in duration. As students gradually progress through school, the size and number of pages of the textbooks increase (Koenig & Holbrook, 1989). Logically, these differences will significantly increase the duration of reading tasks, making it impossible for slow braille readers to keep pace with their classes and cause them to replace braille with alternative methods for accessing school curriculum (Hamilton & Pascual-Leone, 1998).

There are many other important factors regarding braille instruction that should be considered when assessing academic performance for students who are blind, including the duration of teaching time, sufficient funding, and the availability of quality braille tools and reading materials (Allman, 1998; Rogers, 2007; Trent & Truan, 1997). These factors have a profound influence on the entire pedagogical process and the development of braille skills in particular. Offering instruction on the use of appropriate technology and having instructors who are competent in teaching both braille and the use of other media for accessing information, including audiobooks and computers with screen readers, are equally vital (Allman, 1998; Hall & Newman, 1987; Lamb, 1996; Stephens, 1989). It is also important to test the flexibility of the school curriculum and ensure that teachers have sufficient time to offer additional instruction regarding necessary braille skills and the daily life activities of students who are blind.

5.5. Conclusion

The results of this study indicate that the decline in braille skills is associated with two main factors. First, the students' complete reliance on auditory media to access the school curriculum

has a tangible effect on braille-related skills in the upper grades. Further attention must be given to the adjustment of the ratio of working time devoted to listening, to the working time devoted to braille, as the results of this study indicate that depending on listening skills as the main medium to access school curricula will have a negative effect on other braille-related skills.

Second, the systematic assessment of students' progress in braille competency is deficient, which leads teachers to cease monitoring of student progress in the upper grades. This study reveals that the students may find working with text during long tasks burdensome and tedious; ultimately, this will lead them to using audio to access the school curriculum as an effective and efficient option. Thus, it is necessary to closely monitor students' braille using, particularly their reading skills. These skills relate to comprehension, which is directly affected by the use of auditory study materials.

CHAPTER 6: STUDY 3: EVALUATING THE LEARNING SETTING AND IDENTIFYING THE STUDY NEEDS OF STUDENTS WITH VISUAL IMPAIRMENT AT THE UNIVERSITY OF KHARTOUM IN SUDAN

6.1- Introduction

The number of children with visual impairment who get admitted into specialized schools every year is less than 40. The others who don't find a seat in these schools may attend regular schools with sighted students, where they will encounter the problem of lacking special academic facilitations for the blind.

Despite this gloomy situation, many of the students continue with their general education and a considerable number of them manage to enroll for college education. The Ministry for Higher Education and Scientific Research records indicate that by the year 1996, there were only 60 graduates of El-Nour Institute and other schools enrolled in the University of Khartoum (Anonymous, 1997). However, the policies regulating the educational process of this category of students are still vague and are in a desperate need for reform. It is still not clearly stated what special considerations those students should receive to help facilitate their education. It is also uncertain what exactly the instructors and teachers ought to do to ensure that this sector of the student population receive the same quality of education as their sighted peers.

The ultimate target of this study is to identify the needs of this category of disabled students as they perceive them, to highlight the difficulties they encounter while performing any of their school requirements, and to determine their level of satisfaction or dissatisfaction toward the support mechanisms at the university. It also aims to draw a conclusion on how the academic

settings and facilities are set to meet the special needs of this group of students, and how strategies for overcoming barriers are designed. Finally, this study will offer some recommendations for improving the academic environment to help these students perform better in their studies.

6.2- Method

The hypothesis of this study is that academic support, including the use of assistive technology that the visually impaired students have been receiving during their pre-college school experience contributes tremendously to shaping their college education experience. To examine this hypothesis, this study will address the following questions:

1. What type of support have the participants received during the period of their pre-college education to help them overcome the obstacles pertinent to their visual impairment?
2. How has the existence or absence of this support affected their academic performance during their pre-college education?
3. What level of support were the students anticipating to receive upon their admission to the university?
4. What type of assistive technology did the participants know about or previously used?

In order to find answers for these questions, a research was designed using the semi-structured interview model. It follows the model, suggestions and adjustments proposed by Allison & Lucy (2003) and Orsini-Jones et al (2005) with regards to the field of research on students with visual impairment in higher education institutions.

In preparation for the interviews, each of the director of the Association of the Graduate Students with Visual Impairment at the University of Khartoum, one associate professor who is visually impaired working at the same university, three Sudanese students who are residents of Japan, and one member on the board of trustees of the Japan-based non-profit, CAPEDS were consulted. The fact that all participants were visually impaired and had personal experiences with the topics raised in this research, makes their views a valuable source of information. They all agreed that the questions should be designed in a way to permit the participants to explicitly and adequately reflect on their situation and experience at the University of Khartoum. Therefore, it became necessary to examine the participants' educational history, including their early stage of schooling. The idea behind including the pre-college experience is to obtain information relating to the level and kind of support the participants may have received during that period to help them overcome the obstacles that resulted from their visual impairment. Another intention was to know how much the existence or absence of this support may have affected their academic performance at the earlier stages of their schooling. If the students received any level of formal support during that stage, it becomes important to know what level of support they might have anticipated to receive upon their admission to the university. Investigating the pre-college experience is also thought to reveal if the participants were specifically familiar with any of the special reading and writing methods used by students who are classified as having a visual impairment. The importance of this aspect is that it shows if the participants came equipped with any skills to employ or if the university offered them any technical facilities.

Accordingly, the questions of the interviews were phrased in a way that made it possible to acquire in depth details relating to personal data, educational background before attending the

university, administrative efforts to accommodate their special needs, academic support offered to them through any authorized government body, study methods they have used during university, role of specialists to enhance their academic environment, and an overall evaluation of the support system.

The questions used in the interview were categorized in three main sections:

1- Pre-college education including methods of study and characters being used, period of acquiring the used characters, specifying the support available at their local area or school before joining the university, steps taken to encourage visually impaired students to proceed with their university study.
2- University period including obtaining financial support such as scholarship or assistive tools, submission of additional documents regarding disability issues, initiatives taken by the university administration to meet the needs of the disabled students.
3- Academic support including methods of study, level of qualification of specialist or staff who is in charge of caring for the students with visual impairment, role of the support staff, procedures for receiving support, training received by staff on supporting students with disability, satisfaction with the support system, type of support deemed necessary to improve the study environment for the students with visual impairment.

6.2.1. Procedures

In the academic year 2010, sixteen visually impaired students who were enrolled at the University of Khartoum, Sudan, and another four who graduated since 2005 were contacted and asked to take part in this study. The interviews were conducted face to face with 19

participants at the main campus and via telephone with one participant. Each interview took between 30 to 50 minutes. The author contacted the deanship of student affairs to help with recruiting the visually impaired students at the university to participate in this study. The author was also directed to check with the university audio library to obtain detailed information on this group of students. Due to the effort made by a staff member who contacted the participants, 16 out of the 30 students who were officially enrolled and consented to participate. Through the efforts of the director of the Association of the Graduate Students with Visual Impairment at the University of Khartoum, four graduate students agreed to participate. In accordance with the research ethics practice of the University of Tsukuba in Japan, where the author was a graduate at the time of data collection, the purpose and the scope of the study were adequately communicated to the participants who voluntarily granted their consent to record the interviews on a digital recorder. The participants fell within an age range between 17 and 31 years. No names will be revealed in this paper and, instead, the participants' assigned numbers will be referenced. Table 8 gives details of the participants' demographic data. Eight of the participants attended El-Nour Institute for the blind during their primary education, while the remaining 12 had their primary education at regular schools. All of the participants attended regular high schools.

The reason for selecting this setting is that the University of Khartoum is the premier higher educational institution in Sudan and has an established tradition and history of accepting students with visual impairment. Given the nature and purpose of this research, the academic qualifications of those who agreed to participate make them the ideal sample to represent the students with visual impairment at higher education institutions in Sudan.

6.2.2. Data Analysis

The data and personal details that were collected through the interviews have been classified into two categories. One category relates to the participants' pre-college experience, and the other pertains to their college experience. The open-ended questions were analyzed qualitatively by means of content analysis (Lincoln & Guba, 1985). Data were sorted into categories that gave rise to themes. Through dialogue with a colleague, consensus was reached on the themes. Where appropriate, a frequency count was also used to describe the number of response within each category.

6.3- Results

6.3.1. The Pre-College Experience

The data collected through these interviews made it possible to identify two sets of obstacles described by the participants. The first relates to acquiring adequate support during pre-college education and the other, to the lack of information and shortage in special tools and supplies to help them perform their school duties.

Table 8. **Participants' Personal Profile. This data has been reported in Salih & Kakizawa (2016)**

Participant Number	Gender/Age	Degree of disability	Field of study and Year of admission or graduation	Attended Blind school
1	F/ 17	Partially sighted since age of 4	Economic and Social Studies, enrolled in 2008	Yes
2	F/ 18	Partially sighted since age of 4	History and Psychology, enrolled in 2007	No
3	F/ 18	Partially sighted since age of 3	Psychology and Islamic Studies, enrolled in 2007	No
4	F/ 18	Congenitally blind	Faculty of art, enrolled in 2008	No
5	F/ 19	Partially sighted since birth	Mass Media and History, enrolled in 2007	Yes
6	M/ 20	Congenitally blind	Faculty of art, enrolled in 2008	No
7	M/ 22	Congenitally blind	Arabic Language and Islamic Studies, enrolled in 2005	No
8	M/ 22	Totally blind since age of 5	Arabic Language and Mass media, enrolled in 2005.	Yes
9	M/ 22	Partially sighted since age of 12	History and Psychology, enrolled in 2006	No
10	M/ 22	Congenitally blind	Mass media and Islamic studies, enrolled in 2008	No
11	M/ 24	Totally blind since age of 3	Mass Media and Islamic Studies, enrolled in 2005	Yes
12	M/ 24	Congenitally blind	Faculty of art, enrolled in 2007	No
13	M/ 25	Congenitally blind	French Language, enrolled in 2002	No
14	M/ 25	Totally blind since age of 13	Arabic language and Islamic studies, enrolled in 2003	No
15	M/ 25	Congenitally partially sighted	Psychology and Mass Media, enrolled in 2006	No
16	M/ 25	Partially sighted	Faculty of Education, enrolled in 2006	Yes
17	M/ 26	Partially sighted since birth	Arabic and English languages, enrolled in 2002	No
18	M/ 27	Totally blind since age of 3	Economic and Social Studies, graduated in 2006	Yes
19	M/ 30	Congenitally blind	Arabic language and Mass Media, graduated in 2006	Yes
20	M/ 31	Partially sighted since birth	English and French, graduated in 2005	Yes

Support during pre-college education

Nine of the participants received helpful support from their teachers during their high school years. This is partially due to the fact that some high schools had the experience of having students with visual impairment in the past. According to participant 12's own translated words, "the teachers helped me and acted very positively toward me because of their previous intensive experience in dealing with a number of situations similar to mine in the same school." Participant 2 mentioned that his case was appropriately dealt with because one of the teachers had the experience of volunteering for the SNAB. The same participant describes one teacher as helpful and ready to "explain to the other teachers, the different ways to handle a situation such as mine." Consequently, "the teachers became highly aware and understanding of my situation and helped me a great deal." Another four participants stated that their hard work and focus on their studies motivated their teachers, who believed in their seriousness and became more willing to offer help.

Study methods during pre-college period

Most of the participants used to take oral examinations during their pre-college study period. They used auditory assistance such as getting assistants to read aloud for them, using tape recorders and MP3 players (digital audio player), in addition to careful memorization. Although there are eight participants who came from El-Nour Institute, only four of them kept using the braille system during their high school study, while the others ceased using it. They credited their decision of no longer using this technique to the fact that it is very expensive, and also because they discovered using other auditory techniques more convenient. Data regarding the study methods that were used by the students before they entered university are indicated in Table 9.

Table 9. **Study Methods Used Pre- and During College by Participants. This data has been reported in Salih & Kakizawa (2016)**

Study Method	Pre-college	During College
Tape recorder, MP3 players and reading assistance	10	15
Braille only	8	1
Braille and computer with screen reader	0	3
Magnifier	2	1

6.3.2. Participants' College Experience

Academic support

Academic support includes providing technological devices and materials such as cassettes and tape recorders to students upon being admitted to the university. The participants' overall evaluation indicated their dissatisfaction with the academic support offered to them. They indicated that the cassettes they received were not sufficient to carry their entire study data for a semester long period. The students who used the braille system complained that the specific kind of paper this system uses is either unavailable or unaffordable. Participant 11 stated that he was given a tape recorder and ten cassettes when he was first admitted to the university. He also received a monthly payment approximately equal to $45 as financial support from the Deanship of Students Affairs which was, according to him, not enough at all. He estimated his need of 40 cassettes per year at the minimum, for which he had to pay an amount equal to $80 and another $200 for the braille system paper. All these expenses would be an additional financial burden that the students and their families had to shoulder, in addition to the everyday living expenditures. The participants' answers regarding the initiatives to accommodate their special needs, overwhelmingly denied any tangible effort in this direction. Participant 13 stated

that he didn't notice any tangible action from the university's side to accommodate his needs. He thought the instructors must have been notified of his situation before classes began in order to be prepared. According to the same participant, this was not the case. He had to explain his disability status to them and that he requires special arrangement to accommodate his impairment. The participants indicated that these initiatives were inadequate, and primarily limited only to the admission stage. No subsequent follow-up was undertaken to understand and evaluate their problems while taking classes. For instance, two of the participants pointed out that they were denied admission to certain departments, such as foreign languages. Participant 20 intended to study French but was also not given the opportunity. They requested that admission to the various departments should be specifically and clearly regulated. Additionally, they indicated their needs, such as having textbooks in braille and recorded teaching materials, providing assistance in writing the assignments, and extra time for the examinations.

Study methods during the university period

The participants mentioned a variety of methods they used to handle their study at the university, the details explanations of which are given in Table 9. Using tape recorders was the most preferred method for 15 participants. Three participants managed their study by using either braille or a combination of braille and a computer with screen reader, while one of the remaining two used magnifier, and the other one received reading assistance.

Because examinations are still being done manually, one major problem the participants encountered was to have a person available to write for them during exam sessions. It is even more difficult for the newcomers, because they don't have the time to get acquainted with other students who may be willing to help. Participant 1, who is partially sighted, couldn't manage to

find a person to write for him during one examination, and for that reason he lost a whole year. Participant 15 who is also partially sighted complained that it was not always possible to find a person who will dedicate their time to help with 12 school subjects. Volunteer students make themselves available sometimes and at their own convenience but certainly not during examination time when the need is at its zenith. Participants 5 and 11, who are both totally blind, gave detailed explanations regarding these problems. They stated that these volunteers, if found, lack any experience in dealing with students with visual impairment and never had any professional training to help in such situations. They may also have poor handwriting, or not be qualified enough to accurately write all the examination details in the way the examinees would have wanted.

The support facilities and personnel

The University of Khartoum has an audio library with one room for studying by using tape recorders and another room for the braille books. The library is equipped with one Closed-Circuit Television (CCTV), five tape recorders in addition to a collection of braille books and cassettes. It also has two computer centers equipped with five computers with screen readers. Five of the participants commented that five tape recorders were not enough for more than 30 students who constantly want to use them. Also, the participants made no reference to the high-tech computer centers; this is a signal that they didn't possess enough technical skills to use them.

Another problem was the limited number of qualified staff to provide support. There is only one person responsible to offer help to people with different kinds of disabilities, including overseeing their financial and academic support. The audio library had four employees to supervise the process of recording, copying the cassettes, and organizing the collection of books

and cassettes. The staff members at the audio library were criticized by ten of the participants on the grounds of not being permanent staff and regularly rotated with other employees. They were also described as too incompetent to professionally handle the academic matters of the students with visual impairment, especially in regards to the technical equipment they use. The participants were also asked to provide an evaluation of the overall university academic environment for students with visual impairments. Their answers overwhelmingly showed a state of utter dissatisfaction.

Table 10. **Overall Satisfaction Level Regarding the University Support System of the Visually Impaired Students. This data has been reported in Salih & Kakizawa (2016)**

Satisfaction level	Participants
Very efficient	0
Efficient	4
Average	8
Somewhat Inefficient	6
Totally inefficient	2

6.4- Discussion

It became clear from the participants' feedback that the limited and unsatisfactory level of academic and logistic support they receive is, on many occasions, forcing them to rely on their own resources to manage their school requirements, and also to exercise their own efforts to get voluntary help from their sighted peers. This, they felt, was not very different from what they experienced in their pre-college education, when they were mostly with sighted students. Several factors appear to have contributed to the unsatisfactory level of academic and logistic

support available to those students. Among these is the fact that students with visual impairment did not have adequate information that could have helped them to make better plans for their education. Many of them came to the university without knowing exactly what to expect, how to manage their studies, and how their special needs will be met and handled. It became clear from the participants' feedback that there is high need for a clear and transparent policy to identify and specify the various needs of this category of students, based on the level of their disability, as contended by Parker (2000). This is important because each level of visual impairment requires a different level of support (Gray & Wilkins, 2005).

Another factor that was highlighted through the participants' comments is their complete dependence on auditory means and assistance during their pre-college and college education. The tendency to depend on auditory means appeared in the answers of 15 participants, who didn't use braille in their study at the university. It is, thus, easy to imagine the difficulty those students face when they have to write an assignment, take notes or give the correct spelling of a word. Using auditory techniques will make correct spelling and good writing skills an impossible task to achieve. They would have to learn to read and write words, use word signs, contractions and abbreviations, and also learn the full spelling of words, in order to have their notes taken correctly and assignments submitted appropriately (Etheridge et al., 1994).

It can also be noticed from the answers of two participants who attended the blind school in their primary education, that they have the desire to develop their skills of using assistive devices, such as computers with screen reader in combination with braille, as shown in Table 9. Although the number is small, this supports the hypothesis this study is making about the effect of the pre-college education on the participants during their period of study at the university.

It is undeniable that having students with visual impairment is a challenge for all the staff involved. However, the necessary adjustment to meet the needs of such a group should be carefully coordinated between the different university offices, including the teaching staff. As expressed in previous publications (O'Connor & Robinson, 1999; Orsini-Jones et al, 2005), the creation of a safe environment within which a disabled student can thrive requires a high level of collaboration between all staff and students. Accordingly, it is crucial to have a clearly and carefully crafted policy and procedures to regulate the admission of students with visual impairment in certain departments, such as foreign languages, and to also provide assistance for them during examination periods.

Issues regarding the situation of disabled students in higher education, such as the lack of policy, general lack of educational materials and infrastructural facilities, as well as unfavorable attitudes towards individuals with disabilities are likewise reported in Europe as well as African countries that have a similar cultural background to Sudan. For instance, in a study conducted in the UK by Goode (2007), participants stated that some lecturers were reluctant to meet the learning needs of students with disabilities. The issue of showing a negative attitude towards this category of students is reported in a study conducted in Botswana by Moswela & Mukhopadhyay (2011), as well as in Zimbabwe by Chataika (2010). In both cases, participants lamented that many negative attitudes resulted in more barriers for them to carry throughout their higher education.

Another aspect that has repeatedly come up in the participants' comments is the importance of designating permanent staff members to handle their academic needs and other services that are provided to them. The staff needs to be professionally trained and academically qualified to handle the special needs of visually impaired students effectively and efficiently. This will make

them familiar with the methods and the special techniques used by these students. The unpalatable truth is that professional librarians do not consider employment in library services for the blind to be a serious career option, particularly in underdeveloped countries, as stated by Rowland (2008).

6.5- Conclusion and Recommendations

This study investigated the transition from pre-college to the college level of education for 20 Sudanese students who are diagnosed with complete or partial visual impairment. The research identified a series of obstacles that the participants have experienced during their course of study at the University of Khartoum in Sudan. These include:

- Lack of support from the schools they attended.
- Absence of the correct guidance to help them handle their study properly.
- Lack of information regarding the education of the students with visual impairment.
- Procedures of admission do not follow a specific criteria and this makes it harder to anticipate what is required to complete the admission process.
- Technical support and supplies are much less than the actual need.
- No clear policy to regulate or closely monitor after classes begin.
- Relying mainly on auditory assistance and neglecting using braille system resulted in a sharp drop in reading and writing skills.

CHAPTER 7: GENERAL DISCUSSION OF THE FINDINGS

7.1- General Discussion

As repetitively stated in this study, learners who are blind in Sudan do not have access to printed resources, compared to the mass of print available in numerous formats for their sighted peers. This situation has forced them to depend on other mediums to access information related to their school curriculum and other written materials. This condition has tremendously affected the academic environment of school instruction for these students and correspondingly, has intensely limited their selection of a study medium to access the school curriculum. Furthermore, inadequate braille instruction has severely minimized the student's willingness to use it as primary method to access information. Thus, this study intended to develop a comprehensive evaluation of the education of people with visual impairment in Sudan, with the aim of exploring the stages from elementary, higher secondary, until higher education. This evaluation has been conducted by carefully reviewing the techniques by which the students, who are visually impaired, receive their education through the various educational stages. In this study, each stage was separately dealt with, as the study scrutinized the methods that the El-Nour Institute for the blind (the main academic setting of this study) has adopted to teach the students during the elementary stage of education. This study also discussed the factors that accompanied the implementation of the teaching techniques and its effect on the progress of the required learning skills for each stage of education. Such factors are vital to scrutinize the ability of the students to attain the required skills that are necessary during particular stages of education, and for the students to utilize such skills during the subsequent educational stages.

As is generally recognized, braille is the official and approved method for teaching students with visually impairment in all schools and institutions that provide educational services for the

blind and visually impaired. Thus, this study mostly focused on teaching braille, as well as the comprehensive analysis of the factors that have generally contributed to the development or deterioration of braille education in Sudan. In order to enrich the scientific discussion of the topics covered, the study adopted many scientific methods to strengthen the credibility of the results, and to obtain the largest amount of data that allowed for coherent results to be reached and to qualify this study to be classified as a reliable scientific reference. Obtaining trustworthy results is the most important factor that this study has focused on, to enable the authors to propose policies and strategies based on the results of this study that can contribute toward creating an ideal educational environment. An ideal educational environment will likely introduce the academic curriculum for students who are visually impaired in a scientific manner that meets all the systematic, proficiency, and technical needs and skills that a student is supposed to acquire in each educational stage.

Primarily, review of literature related to the theme of the study was conducted, largely to highlight what previous work had covered, and what this study should add to the existing knowledge base. Likewise, the comprehensive review conducted of research related to the topics covered by the current study, allowed for the establishment of strong scientific guidelines that led to the formulation of the questions that this study sought to answer. The review of literature also contributed to the development of a solid frame of reference that enabled the researcher to develop a research theory and choose the appropriate technical methods to collect data. This in turn helped to prove the research hypothesis, achieve the objectives of the research, and answer the questions raised by the study.

As mentioned above, the researcher applied several data collecting methods that assisted in fulfilling the purpose for which the study had been conducted. Conducting direct tests on

students to measure their ability to write and read braille, helped strengthen the results of this study. Similar tests were conducted for the students who are participating in the study, to examine their ability to utilize auditory media to access school curriculum. The data collection techniques were also changed according to the nature of the participants. For example, the semi-instruction interview was used in collecting information from students who are in advanced educational stages. Additionally, this method was used to obtain information from teachers and other staff, and officials who are in charge of the education of the visually impaired, as well as students who graduated from different educational institutions. The information obtained from these groups of participants has contributed to understanding their experiences, and their helpful opinions on their educational progress. Therefore, conducting direct interviews was the best methodology to obtain a summary of the experiences and practical opinions of the participants. Furthermore, the interview methodology contributed to obtain important data, with which construction of scientific strategies that contribute to improving the education environment for the blind in Sudan and other countries with similar political and economic circumstances to Sudan, may be possible. Conducting direct interviews, as an approach, also granted the researcher the opportunity to obtain the maximum possible information that had not been uncovered from the available literature documented in the current study. The archiving method is not common in many developing countries, as explained in chapter 3. For these reasons, the researcher adopted the direct interview approach for documentation purposes, such that as much as possible of information related to the education of the visually impaired in Sudan could be documented. Such documentation process contributes greatly to the scientific value of the study.

As detailed in the previous chapters, three consecutive studies were conducted to cover all the educational stages for the visually impaired in Sudan. The results of the first study scrutinized

the overall condition of the academic support provision for the students who are visually impaired, within the mainstream education and specialized schools. This is because students with visual impairment who joined the specialized schools, and those who primarily studied in regular schools, eventually have to join the mainstream option. Thus, study 1 was designed to understand the views and evaluation of participants towards education at specialized schools, and also intended to gain insights into the processes and practices of integrated education in mainstream schools. Thus, the two specific questions this study attempted to answer regarding the best way to provide education for people with visual impairment in Sudan are:

- Is placement of students with visual impairment in specialized schools in Sudan the best choice for their education?
- What are the benefits and the hindrances which prevent the proper inclusion of students with visual impairment in regular schools compared to specialized schools?

The study explained the situation of educating students with visual impairment during elementary and higher secondary education by affirming that most learners with visual impairment have either fallen outside of the educational system due to the scarcity of seats in specialized schools, or been mainstreamed by default as listeners in public schools. The common approach is that the students who do not attend the school for the blind are usually accepted in the nearby public schools to receive education with sighted students. Because of the absence of assistive devices and resource rooms that offer special services for blind students, they use various other methods to access the public curriculum. These methods include depending on the information they remember from classes, asking a person to read the study materials, and to have somebody to write for them during the evaluation exams, as reported in chapter 4. The mainstreaming of students with visual impairment at regular schools in its

current form had been criticized for its inefficiency in providing proper education. The participants in the study affirmed that educational support and other services pertinent to the provision of the education of the visually impaired must be created in response to what is required by the expected recipients, and not what the system thinks they should receive. The integrated education in its current form was also criticized on the grounds that when students with visual impairment attend regular schools as listeners, the teachers usually exempt them from their school duties, such as mathematic exercises, spelling tests, or giving them easier oral annual tests. Whereas at the specialized schools, the students receive sufficient monthly and semi-annual exams, and academic duties from their teachers and thus, can experience an atmosphere of full academic competition with peers, which allows them to enjoy a holistic academic environment, equivalent to their counterparts in regular schools. On the other hand, at regular schools, the teachers do not know how to evaluate those students according to their exceptional position as a listener at the particular school. Thus, the teachers assign to them random degrees, or the minimum required degree for success, to allow them to proceed to the next semester. Consequently, those students cannot be subject to the equivalent criteria of academic evaluation as their sighted counterparts. This is frustrating both for class teachers, who are expected to teach the curriculum to all students, and for the students with visual impairment, who are unable to fully participate in the learning process.

The current policy of integration for the students with visual impairment in Sudan is regarded by the participants of this study as a compulsory solution for households due to the lack of specialized schools that provide education for the blind. Thus, families of children who are blind and have reached school age, are forced to send them to public schools. This process has severe consequences on the educational future of those students since they receive their

education without the use of braille and other assistive technologies. There is also a lack of actual academic evaluation within the school, as stated above, as well as the mutual assessment between the school and the family to monitor the academic progress of the students.

Further issues accompanying the implementation of integration policy in its current application were raised in this study. Students being paid excessive care and exclusion from the involvement in various activities at regular schools, are one of the issues raised by the participants. Various practices pertain to dealing with students with visual impairments, and without enough knowledge of the special needs for the visually impaired, may have negative consequences on the integration of those students in public schools, since the teachers are not aware or familiar with teaching these students. Essentially, when students who are visually impaired enroll in mainstream setting, careful consideration and thorough assessment of the student's academic and social functioning are indispensable to check whether the student can function both academically and socially alongside their sighted peers (Hazekamp & Huebner, 1989 pp. 21-30). Students with visual impairment should participate as fully as possible in all academic and non-academic activities with their classmates. Such participation allows the student to gain skills, self-assurance, and independence and enables them to learn and grow in an appropriate educational program (Swallow & Huebner, 1987). When working with students who are visually impaired, it is important for instructors to refrain from providing too much assistance or supervision, because doing so can interfere with the student's ability to develop independent skills, as stated by Hazekamp & Huebner (1989).

Inadequate instruction at classes is another issue that can directly affect the academic performance for these students. Visually impaired students who are attending regular schools require intensive and high-quality instruction in literacy through short-term program at

specialized schools, or visiting teachers who have good knowledge of braille and awareness on how to teach reading and writing, to attain an adequate level of basic literacy skills during primary school years, as emphasized by Pogrund, Darst, & Boland (2013). This can be conducted by systematic follow-up of students who are still in the primary classes. Enlightening them about the special educational means such as braille, visual aids, and other assistive technologies, may boost their academic performance as emphasized by Belay (2005). Students who are still at an early age, can acquire the necessary skills required to be proficient in braille in particular, and other assistive devices in general, to utilize their intellectual ability to the maximum extent. These acquired skills enable those students to master such techniques and continue to use them, even in their advanced stages of education. In addition, it provides students with the skills to adapt to an environment with sighted classmates, which will become important as they enter the world of work and college (Omede, 2015). Whereas, failure to secure assistive devices at regular school will eventually cause the students to drop major subjects, such as mathematics and science, as emphasized by Akakandelwa & Munsanje (2012).

Study 2 aimed to answer the research question of how the use of only auditory media to access school curricula affects the development of braille-related skills, such as writing and reading.

To answer this question an investigation was conducted to examine the braille writing and reading proficiency, as well as the ability to access school curriculum via listening media, with the students attending El-Nour Institute for the blind. The investigation took place in the academic year 2013-2014. As mentioned in chapter 5, tests for 6-dot braille writing, alphabet writing, reading of Arabic text, and listening speeds were conducted. To reach a well-founded conclusion and recommendations regarding the impact on braille-related skills of using

different auditory mediums, such as audio tapes, to access printed information in Sudanese schools for the blind, the results of the three braille-related skills tests as well as data from a listening ability test were examined. Subsequently, a comparison of ability to read and write braille before and after they used auditory media to access school curricula was conducted. The ultimate goal was to understand how the process of accessing printed information impacts braille education in Sudanese schools for the blind. It was also vitally important to determine whether adequate steps have been taken to ensure that those who do not have access to printed materials become competent enough to properly utilize braille as a study method by the end of their elementary education.

The statistical results of these tests indicated that there are significant differences between the four groups in the two conducted studies. The results has also emphasized an interrelated relationship between the acquisition of information through auditory mediums and braille-related skills, as well as the negative effect on braille reading ability, of the use of audio methods to access information during earlier stages of education. This result supports the hypothesis that improvements in listening ability through the use of auditory media during the early stages of education negatively affects the writing of full braille cells, the writing of the Arabic alphabet, and the reading of Arabic text.

The research hypothesis would have been rejected if students continue to show improved braille-related skills in the upper grades, because progress in braille efficiency can be associated with the experience that students gain due to long-term practice using braille. However, it seems that students in the upper grades had entirely depended on auditory media to access the school curriculum, which obviously deteriorated their braille-related skills. In contrast to the findings

revealed here, continuous improvement in scores is anticipated as students continue to apply the instructions provided to them to advance their braille writing and reading skills.

To further investigate the association of the sudden deterioration of braille ability in students in the upper grades with their growing dependency on listening mediums to access the school curriculum, the correlation coefficients between braille-related skills and listening speed were determined for participants in the upper grades in study 2. The evaluation aimed to recognize the relationship of braille-related skills to listening skills. Apparent improvement of the students' listening speed was significantly found among the participants, which severely constrained the improvement of the skills required to utilize braille as the main medium to access school curriculum, such as braille full cell writing, alphabet writing and Arabic text reading.

The use of auditory media as the study medium to access curriculum was identified as starting in grade five, and has undoubtedly affected students' performance in other braille-related skills. The acquired data revealed that, generally, the braille writing and reading skills declined progressively at the upper grades for the participants. On the contrary, a noticeable increase in the listening skills at the same grades was apparently confirmed. Exclusive reasons that have directly led to the decreasing braille writing and reading speed for students at El-Nour Institute in Sudan, was related to three factors which are the lack of braille books, inappropriate instruction during braille teaching, and students' sole dependence on auditory media to access school curriculum at the upper classes. The first reason behind the poor efficiency of students regarding braille writing and reading is related to the long-lasting problem of the lack of braille printed materials, which have forced the students to shift to alternative methods to access school curriculum, particularly at the upper grades, as inferred from the data obtained from study 2.

The results obtained from the data of the correlation coefficient has also strengthened the assumption relating the declining braille ability of the students to the inappropriateness of the braille instructional method that had been implemented at El-Nour Institute as discussed in study 2.

The decline in braille skills leads to questions regarding the level of student competence in comprehending textbook materials during the educational process. The level of comprehension that students are required to reach in order to be able to acquire information from educational content is 75% accuracy (Koenig & Holbrook, 1989). Teachers are supposed to ensure that students reach this level during reading instruction. They should also carefully examine all factors that might contribute to the decline in comprehension accuracy. It is very likely that some reading skills related to comprehension may not have been sufficiently developed during earlier stages of education. Moreover, failure to select the correct reading medium is another factor that adversely affects comprehension (Craig, Harnack & DePriest, 1997; Koenig & Holbrook, 1989). The first factor certainly deserves systematic investigation and follow-up to determine the cause of the reading problem. Based on the results of this study, three main factors are worthy of discussion.

The first factor is the influence that the disproportionate improvement in braille writing and reading skills, and the relationship to listening skills, may have had on the linguistic progress during the schooling process. The acquisition of oral language is a natural process that gradually progresses with the development of other mental skills. However, attainment of oral language skills occurs prior to the acquisition of written language, and therefore, a more efficient instruction is needed to utilize the progress of oral language ability to enhance the writing skills for students with visual impairment, as mentioned by Diakidoy et al. (2005). Although the

learning processes of each skill are diverse, this difference in the acquisition process does not negate the correlation of the two skills, and thus, instruction effort on listening and reading comprehension should be comparable (Rex et al., 1994, p.8). Rex et al. (1994) have also discussed the interaction of listening and reading by stating that throughout the educational process and during the successive years at school, the gap or the insufficiency in the acquired vocabularies will be filled, since oral vocabulary is an outcome of reading vocabulary. In another words, as the student progresses they meets unfamiliar words in the course of reading, which then become a part of their oral language. Rex et al. (1994) have also mentioned that children who enter school with well-developed listening and speaking language ability would likely be superior in learning to read and write. They also stated that, educators now agree that reading, writing, listening, and speaking are components of integrated language processes, not isolated components of language. Since listening comprehension and reading comprehension are highly interrelated and converge in some common components, instructional interventions aiming towards enhancing listening comprehension will mostly have positive effects on reading comprehension performance. As stated by Hedrick & Cunningham, (1995), the uneven development of one skill will have a detrimental effect on other skills. Such a condition will lead to differences in developing various braille skills such as reading and writing. Likewise, this condition will lead to the superiority of one skill, likely listening ability in this case, which in this study seems to be more likely as the learning method to be used by these students.

The second factor is that the students had the opportunity to learn braille during their primary stages of education, which is the most important period for mastering braille and attaining the required level of proficiency to fully utilize braille throughout their educational and vocational stages (Lamb, 1996, 1998; Rex et al., 1994, p.11; Swenson, 1991). However, failing to master

braille use as an original reading medium before completing elementary school, will render the significant advantage of learning braille at an early stage of their lives, worthless. As stated by Schroeder (1989), having knowledge of braille as a primary reading medium will favorably enhance the employment qualifications of people with visual impairment, because extensive use and early acquisition of braille reading skills are the two factors that promote vocational opportunity.

The third factor is exclusive to the background of the study setting, which is the lack of braille printed text in the upper grades. This situation forced the participants to depend on other mediums to access information related to school curriculum and other written materials. This condition has tremendously affected the academic environment of school instruction for those students, and intensely limited the selection of the study mediums for the students to access the school curriculum. The practice of using audio books as a study medium to access curriculum starting at grade five has undoubtedly affected students' other braille-related skills, as demonstrated in this study.

In the last investigation of educational stages for the visually impaired in Sudan, the higher education is worthy of thorough study. This is because students with visual impairment are also confronted with difficulties to access written information and academic curriculum when they attend the higher education institutions. The study has found that the participants used the assistive technology that they have mastered during their earlier stages of education to access the written information. Thus, two key factors that have been acquired from the results of the study, were pertinent to the participants' previous educational history, prior to admission in the higher educational institutions. The first factor is that the students are not well prepared to use the assistive devices that are commonly arranged to provide support for the visually impaired

during education. For instance, many of the students come to college without knowing exactly what to expect, how to manage their studies, and how their case would be dealt with.

The second factor that came out of the participants' feedback, is the poor braille competency for those who learned it, and the complete dependence for most of the participants on auditory means and assistance during their pre-college and college education. Making the visually impaired students depend only on the auditory techniques creates more problems than it solves. Using only auditory means will make spelling an impossible task to achieve. They must learn to read and write words using word signs, contractions and abbreviations, and yet, must also learn the full spelling of a word for taking notes, submitting class assignments, and it is indispensable when manipulating modern technology for typing to produce a print copy. It is thus easy to imagine the difficulty those students face, when they have write an assignment, take notes, or give the correct spelling of a word.

7.2- Implications for the Field of Knowledge

Integrated instruction strategies, to utilize braille and auditory media to access information, can be suggested based on the results of the present study. From the background of this study as well as on the basis of the results, it has been recognized that students at El-Nour Institute are depending on both braille and listening mediums to access school curriculum. The students have certainly received braille education; however, they may not be receiving explicit instruction regarding the use of listening mediums. Therefore, even if the two methods (auditory and haptic) are useful to gain access to the information contained in a particular text, each one works differently. Therefore, comprehension and extraction of information could be affected by these differences, and a pertinent question arises:"Can braille or listening mediums alone be

sufficient to attain the basic knowledge and skills to learn and succeed in pursuing university degrees and vocational qualifications?"

If the answer is negative, a second question arises: "How can braille writing and reading ability merge with listening or integrate into a literacy curriculum?"

Moving forward, it would be most advantageous to develop a curriculum that would combine basic literacy instruction using braille and listening skills with explicit instruction in both of them, along with regular instruction on using the available assistive technologies. In order to include instructions concerning these mediums in curriculum design, an integrated instruction strategy to utilize braille and auditory media to access information is suggested below.

During the reading process, students can use braille or audio mediums as a framework to extract information from different written materials, for example, to form a cognitive illustration of the highlighted statements and the ideas stated within the written material. These tasks also include encoding words, interpreting groups of words, integrating new information with particular information in previous parts of the written material, and extracting ideas implied in the entire document. Within this framework, the three means that are available to access school curricula (writing, reading and listening) are suggested to be integrated during the process of designing educational individual teaching plan (EIP). Using dictated writing for example, where the text is dictated initially by the teacher and then written down by students, can be the basis for a number of activities that link the special skills of braille reading, writing with listening. Thus, each of the three mentioned mediums can serves as a medium for the development of the others to facilitate curriculum access for students with visual impairment. In another words, in a comprehensive Brail based literacy program for example, the braille is kept entirely as framework, such that all braille-related skills, in addition to the auditory mediums, can

strengthen each other with the balance maintained regarding the learning time devoted to the three mediums. That is to say, during the education process, the educators are required to encourage the students to utilize both braille and auditory mediums to access school curriculum. Furthermore, it is necessary to monitor the students' understanding of what they have learned and their comprehension of the various contents, as they deal with the study material. Paying attention to the adjustment of the ratio of working time devoted to listening versus the time devoted to braille is vital to securing the parallel development of braille-related skills and the use of auditory media.

The rationale for developing an integrated instruction strategy was based upon the notion that despite the obvious differences in the features of braille and auditory mediums, the skills required to effectively access information are similar. Both braille and auditory mediums are methods for accessing and extracting meaning from text. Consequently, the differences between the braille usage and auditory media are not sufficient enough to intercept the simultaneous improvement of these skills during the educational process, or obstruct the acquisition of information using any of the two mediums.

When designing the teaching strategy, however, it must be compatible to encompassing the special skills required for accessing information via braille and auditory mediums. It involves the use of braille-related skills as appropriate, for example, orally reading, recording, and listening to a particular text for self-evaluation of one's reading ability, can be an efficient way to encourage students to improve their reading ability. The next step is to ask the students to write down what they have heard. This process can help to develop conversion of written text to audio by using any other recorded device, as well as enabling students to develop dictation ability to be more efficient in taking notes in different contexts. Ultimately, the student will

gain the ability to transfer and process information, utilizing different methods including use of word processors and computers with speech synthesis.

At a further stage, it may empower students' ability to utilize their listening skills to improve braille-related skills, to give the students individual or group's assignments. For example, during class activities, the teacher can instruct the students to listen to books that introduce various tips to make the students an efficient braille user. Students then can be asked to write notes while listening to these books and to present their notes as groups or individually to the whole class. Such steps can likewise be followed by systematic reassurance, and evaluations whereby the students can check their progress, based on their comprehension and cognition, of what they have learned from the books that they have listened to, and how they can apply the newly acquired tips and skills to access information. These techniques can certainly be made available to students in their advanced educational stages, and they can then use these techniques to make combinations of their selected educational mediums for accessing and dealing with text. They can take notes thoroughly while rapidly listening to familiar text, or extract information from complex and difficult braille text content to create auditory notes as well. Therefore, a comprehensive training program encompassing these components has considerable possibility to enhance learning of skills that students will use during the educational process. Furthermore, competency assessment for students should be done by professionals associated with schooling and practicing to ensure that the integrated instruction strategy reflects all the specific requirements that are necessary for a specific medium. As assistive technologies change, the basic trend toward adopting the new technology in the integrated plan syllabus should be implemented such that the relevant recent knowledge and skills are taught to both the professional and students.

7.3- Summary

The most important factors surrounding a child's education are not determined by setting, but other factors may influence their effective learning. These factors may include, but not be limited to, consistency of instruction, curriculum, amount of instructional time, quality of instruction, opportunities for active learning, the classroom setting, shortage of affordable and accessible teaching aids, low vision devices, textbooks, and latest assistive devices. With regard to braille instruction, there are many other important factors that should be considered when assessing the academic performance of students with visual impairment. These factors include the length of teaching time, sufficient funding, and the availability of quality braille tools and reading materials. These factors have a profound influence on the development of braille skills in particular, and the entire pedagogical process. Offering instruction on how to use appropriate technology and having instructors who are competent in teaching both braille and the use of other mediums to access information, such as audio books and computers with screen readers, are equally vital. It is also important to test the flexibility of the school curriculum and to ensure that teachers have enough time to offer additional instruction regarding necessary braille skills and the daily life activities for students with visual impairment. These factors are undoubtedly fundamental to providing quality education for students who are visually impaired. However, having a system that guarantees the supply and maintenance of equipment and materials, indispensable for the education of students with visual impairment, is likewise important. Providing such assistive tools should be based on the actual educational needs of the students, and should not be restricted solely by the financial capacity of the educational system. These tools are crucial for establishing an effective school system, capable of realizing the educational

goals of students who are visually impaired, and providing them with the skills they need for academic progress and their future careers. Additionally, having professionals who are qualified and adequately trained to offer appropriate assistance and instruction during the educational process will be of great help in creating a dynamic academic environment. Taking all these factors into consideration will help ease learning barriers and enhance the quality of education for students with visual impairment.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

8.1- General Conclusions

This chapter presents a summary of the conclusions reached from the studies conducted on the selection of the study media and issues related to education provision for learners with visual impairment in Sudan. It covers the summary of the conclusions drawn from the studies, and provides recommendations and suggestions for further research.

The present study was conducted to investigate and analyze the effect of the use of auditory mediums to access school curriculum on braille-related skills in special primary schools for learners with visual impairment. The rationale behind conducting this study was based on a reported decline in braille usage to access information in students with visual impairment, at higher education stages. The study also aimed to shed light on education provision for students with visual impairment at higher secondary school by raising the issue of their placement in specialized schools versus integrating them into regular schools. The study also sought to investigate the teachers' readiness to integrate students with visual impairment at regular schools.

Investigating the methods of accessing information for the students with visual impairment in Sudan at the higher education level, revealed that there is strong relation between information relating to the type of assistive technology that the participants know or have previously used during the pre-college education period and the selection of the media method used to access written information. The investigation of the pre-college experience period had revealed that the assistive technology that those students had been using during their pre-college school experience, had contributed to shaping their college education. The assistive technology used

by the participants had significantly affected their way of accessing written materials at their higher education. The study presented the participants' poor level in braille and also presented their sole dependency on auditory means in their study rather than braille.

Scrutinizing the braille competency and the relation of braille usage paralleled to the use of audio media to access school curriculum during earlier stages of education, was one of the core objectives of the present study. The statistical analyses conducted for each of the two group of students in the second study, indicated that there were significant differences between the two groups in 6-dot writing and Arabic text reading, whereas there was no significant difference in Arabic alphabet writing.

This study presented significant differences for the braille only groups and braille and audio media groups, with respect to braille-related skills. Generally, the braille writing and reading skills declined progressively at the upper grades in study 2. On the contrary, a noticeable increase in the listening skills was apparent. The conclusion reached is that mastery of braille is an integrated process that requires instruction towards the parallel development of all braille-related skills, and thus, the ratio of instructional time devoted to listening compared to the time devoted to braille may require adjustment.

Types of schools attended by students with visual impairment during their elementary education was one of the issues that was thoroughly investigated in this study. This is because, placement of students with visual impairment at specialized schools or integrating them into regular schools remains to be a subject of excessive debate among those who are interested in this field. The investigation of the present study sought to find an answers for two associated questions. The first question tackles whether placement of students who are visually impaired in specialized schools for the blind in Sudan serves their education best. The other question

compares the advantages and the disadvantages of integrating this group of students in regular schools, as opposed to separating them in specialized schools for the blind.

The study revealed that students with visual impairment, teachers who work in specialized schools, and the group of special education officials who participated in this study, together suggested that students should be integrated into regular schools, in parallel with strengthening the institutes that specialize in the education of the visually impaired.

The three studies that have been conducted to perform a comprehensive assessment of the education for the visually impaired in Sudan, revealed various issues pertinent to the use of the various reading and writing media, since these studies compared oral braille reading to accessing text via listening, and also underlined the issue of comprehension, especially when dealing with expository or informational context. Based on the results of these studies, some general conclusions can be drawn:

1. The present study has put emphasis on the important of braille instruction and constant assessment. There are many other important factors that should be considered when assessing academic performance for students who are blind. These factors include the length of teaching time, sufficient funding, and the availability of quality braille tools and reading materials. These factors have a profound influence on the development of braille skills in particular, and the entire pedagogical process. Offering instruction on how to use appropriate technology, and having instructors who are competent in teaching both braille and the use of other mediums to access information, such as audio books and computers with screen readers, are equally vital. It is also important to test the flexibility of the school curriculum and to ensure that teachers have enough time to offer additional

instruction regarding the necessary braille skills and daily life activities for students who are blind.

2. The decline in braille skills as revealed by the data in this study, necessitates paying more attention and providing intensive instructions to boost the level of student competency in comprehending textbook materials during the educational process. The level of comprehension that students are required to reach in order to be able to acquire information from educational content is 75% accuracy. Teachers are supposed to ensure that students reach this level during reading instruction. They should also carefully examine all factors that might contribute to the decline in comprehension accuracy. It is very likely that some reading skills related to comprehension may not have been sufficiently developed during earlier stages of education.

3. Failure to select the correct reading medium is another factor that adversely affects comprehension. This factor certainly deserves systematic investigation and follow-up to determine the cause of the reading problem.

4. The present study has also emphasized the important of utilizing braille during the education process for the students who are visually impaired. This is because braille provides comprehensive and direct access to information content, written in a readable text that is almost equivalent to normal print for sighted readers, since it provides a link between words and sound. Besides, braille is an immediate and reliable medium that enables the user to get acquainted with the spelling of words by repeatedly seeing or feeling the letters. Braille also enhances the reader's inclination toward the reading content, by providing specific information that cannot

be easily conveyed in an auditory format. For example, it is very easy for the braille reader to identify italicized and capitalized letters with one finger swipe. By running their hands over the page, a braille reader can also comprehend the general layout, such as page number, punctuations, headings, subheadings, and paragraphs. The understanding of the relationship between these elements within written information, will significantly augment the reader's comprehension of the information in a written text.

5. This study revealed that educators should not assume that, because of the availability of access technology, by using one medium to access information, full access to all forms of text is available. Thus, visually impaired users should be trained to be able to choose from various multimedia to access information. In fact, the personal preferences of each and every individual, the purposes and ways they wish to do their reading, the type of documents retrieved by the reader—whether informational or expository—become the decisive factors which determine their means of reading. Thus, students should have the option to access text via braille reading or listening. The conducted studies approved that assistive technologies should be used to enhance braille, not to replace it, because advances in technology have, in fact, increased the availability of braille translation programs, which can quickly translate text files into braille format.

6. Securing the assistive devices for the students will undeniably increase the students' efficiency in accessing written information. However, having a system that guarantees the supply and maintenance of equipment, and the materials indispensable for the education of students who are visually impaired, is likewise

important. Providing such assistive tools should be based on the actual educational needs of the students and should not be restricted solely by the financial capacity of the educational system. These tools are crucial for establishing an effective school system capable of realizing the educational goals of students who are visually impaired and providing them with the skills they need for educational progress and their future careers.

7. Having professionals who are qualified and adequately trained to offer appropriate assistance and instruction during the educational process will be of great help in creating a dynamic academic environment. This factor is undoubtedly fundamental for providing quality education for students who are visually impaired. Taking all these factors into consideration will help ease learning barriers and enhance the quality of education for students with visual impairment.

8.2- Recommendations for Practice and Policy

Based on the results of the present work, the following recommendations can be made:

1. Conducting constant supervision and systematic assessment of braille-related skills to monitor the students' progress in braille competency, and the development of the equivalent use of different braille-related skills by students at the different educational stages, are factors revealed by the present study. These factors ought to reduce the trend among teachers to cease monitoring of student progress in the upper grades, and to stop giving them further instructions, and encourage more observation to assist their development in reading and writing, or in utilizing braille during their

daily academic activities. This study reveals that the students may find working with text during long tasks burdensome and tedious; ultimately, this will lead them to use auditory media to access the school curriculum as an effective and efficient option. Thus, it is necessary to closely monitor students' braille use, particularly their reading skills. These skills relate to comprehension, which is directly affected by the use of auditory media to access written study texts.

2. Facilitating access to braille printed academic text books as well as other braille publications for those who are visually impaired, such as weekly or monthly published newspapers. This is to provide further access to braille text in order to enhance their development in reading and writing, or in utilizing braille during their daily and academic activities.

3. The authority in charge of education affairs in the country should take full responsibility for providing proper education to students with visual impairment, equivalent to their sighted peers, through establishing specialized schools at the main cities, and providing an ideal study environment. These schools can be partial schools to provide education for the first 4 years, to reduce the high cost of establishing full specialized schools.

4. Implementation of gradual integration of visually impaired students from the earlier classes. The procedures of integrating the students should start gradually, from grade 4, in the welcoming schools or schools close to the students' home. This process should start after these schools are prepared to guarantee that it can accommodate those students and meet their special needs. Teachers specialized in the education of the visually impaired, should be appointed to deal with the students' needs. The

teachers' duties should be to supervise and follow-up on the academic progress of these students, prepare study materials in braille, handle the examination in braille, and supervise students' academic evaluation.

5. Establishing a resource room in schools where blind students can be integrated. These rooms should be accommodated with the necessary assistive devices, with a special instructor to assist the users when necessary.

6. Involving visually impaired teachers and experts in education of the visually impaired in designing the strategy for the implementation of inclusive education or any future related plans. Various personnel have worked for long periods of time in the field of educating the visually impaired, for the various special educational institutions in the country. Therefore, their accumulated precious experience and valued knowledge should be utilized to the maximum extent in improving the educational environment, for students with special needs in general, and the visually impaired in particular.

7. Conducting frequent training for teachers on accommodating the needs of students with visual impairment, to facilitate the implementation of an inclusive education process.

8. Raising awareness and enlightening communities regarding the assistive technology and visual aids that blind students are using to access information. This endeavor is vital to raising societal awareness toward educating students with visual impairment, to overcome the problem of lack of interest among families to educate their children with disability in general, and those who are with visual impairment in particular.

8.3- Recommendations Pertinent to Information Access for the People with Visual Impairment

8.3.1. The Production of Books in Braille.

First, after El-Nour School for the Blind has distributed the textbooks of the curriculum to all students, it is necessary to distribute textbooks to children enrolled in other schools for the blind, as well as for the students who are attending regular schools.

Second, in Sudan, schools for the blind only provide primary education, and all children with visual impairment who are at the secondary educational level have to attend regular schools. Therefore, there is an urgent need to print school curricula for the secondary education into braille to satisfy the needs of those students.

Third, in parallel with securing the textbooks, there is a need for training sessions to teach braille for students who are attending regular school, in order to actually read the textbooks. To secure the use of braille textbooks in the local regular schools, there is a need for continuous braille instruction in parallel with the distribution of the braille books of the school curriculum.

8.3.2. Audio Books

A plan is in progress to establish an efficient system to organize and share the already existing recorded books. This must be paired with improving the necessary environment for adapting the DAISY book technology for standardization and quality improvement of audio books. On the other hand, DAISY is different from using cassette tapes. Personal computers or playback devices are required to play DAISY files. It is, therefore, essential to consider securing the devices to access DAISY books for the students as well as to enrich the contents of the produced books to cover not only school curriculum, but other fields of knowledge.

8.3.3. Electronic Content

It is crucial to cover more fields and not be limited to religious and classical Arabic material. It is also important to share the already available books among the blind and visually impaired. This becomes more important in the case of higher education institutions. In addition, taking advantage of the adaptability of electronic content is important to create textbooks and other reading materials that can meet the diverse needs of students with visual impairment, such as braille, audio recording, enlarged text, etc.,

8.3.4. Assistive Devices to Access Information

The NVDA is now spreading around the world, and it is a potential means of access to information for the visually impaired in Sudan. On the other hand, it is important to enhance training opportunities for users who are blind, to utilize the NVDA to the maximum extent.

Smartphones, which are spreading recently, also have great potential. This is because the voice software built inside, reduces the cost since there is no need to purchase and install additional voice software of a screen reader. In the future, it will be interesting to see how smartphones can be used to expand access to information. If the Marrakesh Treaty comes into effect and the DAISY books are shared among Arab countries, a device to play such new technology will be necessary. Although computers can, of course, be used to play the books, the use of smartphones is something that many visually impaired people are looking forward to, seeing how it can ease their access to information.

The importance of the basic education that is required for the visually impaired to qualify them to efficiently utilize these accessibility devices is worthy of special attention and should be

emphasized. Since many visually impaired people still lack education, enhanced basic education is an essential factor to improve information accessibility in the future.

8.4- Limitations and Recommendations for Further Research

Several factors had contributed to the limitations of this research, which are as follows:

1. The lack of available research data regarding the education of students with visual impairment in Sudan has limited the amount of information presented in the study. Presenting more data and statistics regarding the provision of education for students with visual impairment in Sudan would have enriched the present study.

2. The scarcity in institutions that grant services for the visually impaired has limited the number of participants. The small number of participants who are involved in this research is due to logistical factors that made reaching a bigger number impossible. Although the participants held enough knowledge about the investigated topics, interviewing more participants would have strengthened the generalization of the obtained results.

3. The study conducted with the students who attended the University of Khartoum, failed to reflect on the views of the teachers and the support provider. The study presented only the opinion of the students who are visually impaired, regarding the support provision. Investigating the views of the teachers is highly recommended for future research.

4. The failure to introduce audiobooks to the students at the elementary school in the first, second and the third grade as an intervention. Such a procedure would be ideal to test the progress of braille-related skills while using audio methods in the upper

grades; however, this step would contradict the school policy, which prohibits the introduction of auditory media to students in the lower grade levels. Additionally, it is recommended that this study's findings be tested on a larger sample of students to determine its ultimate impact on the progress of their education. This information would be useful when designing an IEP, and when decisions are made regarding the time needed for students to practice and improve their braille writing or reading abilities.

5. This study failed to compare braille-related skills of students who are living at the school dormitory with those who live at home. This is a possible area for further research and a much larger sample can generalize this conclusion; it can make a noticeable contribution concerning educating students with visual impairment at school dormitories in countries that lack the essential facilities for educating the students who are with visual impairment at inclusive setting, such as resource rooms and itinerant teachers to accept those students at the mainstream school setting.

6. The absence of views from the students' families regarding the education of their children with visual disabilities. This could be the focus of future research in this field. As the result of this study revealed a lack of awareness pertaining to the inclusion and educational needs of the students who are visually impaired, future work may also focus on investigating a larger number of teachers and students at regular schools about their knowledge regarding the inclusion and the special requirements of this group of students.

REFERENCES

Abedi, J., Kao, J. C., Leon, S., Sullivan, L., Herman, J. L., Pope, R., & Mastergeorge, A. M. (2008). Exploring Factors that Affect the Accessibility of Reading Comprehension Assessments for Students with Disabilities: A Study of Segmented Text. CRESST Report 746. National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

Agbenyega, J. (2007). Examining Teachers' Concerns and Attitudes to Inclusive Education in Ghana. International Journal of whole schooling, 3(1), 41-56.

Agesa, L. (2014). Challenges faced by learners with visual impairments in inclusive setting in Trans-Nzoia County. Journal of Education and Practice, 5(29), 185-192.

Ajuwon, P. M. (2012). Making inclusive education work in Nigeria: Evaluation of special educators' attitudes. Disability studies quarterly, 32(2).

Ajuwon, P. M., & Oyinlade, A. O. (2008). Educational placement of children who are blind or have low vision in residential and public schools: A national study of parents' perspectives. Journal of Visual Impairment & Blindness, 102(6), 325-339.

Akakandelwa, A., & Munsanje, J. (2012). Provision of learning and teaching materials for pupils with visual impairment: Results from a National Survey in Zambia. British Journal of Visual Impairment, 30(1), 42-49.

Al Nassiri, A., & Abdulla, S. (2018). A fuzzy Classification and Recognition System for Arabic Braille Segmented Characters. International Journal of Applied Engineering Research, 13(6), 3662-3669.

Alden, P. (2016). Provision of Braille Reading and Learning Material in South Africa: A Balance between Technology and Braille Adding Value and Creating a Love of Reading. Journal of Blindness Innovation & Research, 6(3).

Aldrich, F. K., & Parkin, A. J. (1988). Tape recorded textbooks for the blind: a survey of producers and users. British Journal of Visual Impairment, 6(1), 3-6.

Al-Ghanim, A. M. (1989). Blindness and educational services for blind persons in the Middle East region. Journal of Visual Impairment & Blindness, 83(1), 13-16.

Alhassan, A. M. (2014). Implementation of inclusive education in Ghanaian primary schools: A look at teachersattitudes. American Journal of Educational Research, 2(3), 142-148.

Ali, M. M. (2011). Holy Quran. Ahmadiyya Anjuman Ishaat Islam Lahore USA.

Alkhateeb, J. M., Hadidi, M. S., & Alkhateeb, A. J. (2016). Inclusion of children with developmental disabilities in Arab countries: A review of the research literature from 1990 to 2014. Research in developmental disabilities, 49, 60-75.

Allison, J. & Lucy, A. T. (2003) Provision of electronic information services for the visually impaired: an overview with case studies from three institutions within the University of Wales. Journal of Librarianship and Information Science, 35(2), 105 – 113.

Allman, C. B. (1998). Braille communication skills: What teachers teach and visually impaired adults use. Journal of Visual Impairment & Blindness, 92(5), 331-337.

AlMosa, Naser A. Reading and teaching of Braille in schools for Blind in Saudi Arabia. Ph. D. Dissertation. Vanderbilt University, USA. 1987.

Al-Mousa, N. A. (2010). The experience of the Kingdom of Saudi Arabia in mainstreaming students with special educational needs in public schools (a success story). Riyadh, Saudi Arabia: UNESCO.

Almusa, A., & Ferrell, K. (2004, April). Blindness in Islam. In Council for Exceptional Children Conference, New Orleans, LA.

Alotaibi, A. s. K. (1993). Blind Education in the Arab Countries: the Emergence of the Arabic Braille (in Arabic)

Alper, M. (2000). Promoting emerging new media literacies among young children with blindness and visual impairments. Dynamics, 74, 243-256.

Al-Salman, A. S., & Al-Khalifa, H. S. (2003). Towards a computerized Arabic Braille environment. Software: Practice and Experience, 33(6), 497-508.

Al-Salman, A., AlOhali, Y., AlKanhal, M., & AlRajih, A. (2007). An arabic optical braille recognition system.

Al-Shamma, S. D., & Fathi, S. (2010, December). Arabic braille recognition and transcription into text and voice. In 2010 5th Cairo International Biomedical Engineering Conference (pp. 227-231). IEEE.

Amato, S. (2002). Standards for competence in braille literacy skills in teacher preparation programs. Journal of Visual Impairment & Blindness, 96(3), 143-153.

Anonymus, (1997) Ministry for Higher Education and Scientific Research in Sudan http://www.mohe.gov.sd/

Anonymus, (2010) Sudan Disability Survey 2010 Report (arabic). Sudan Federal Ministry of Health, Reports department. 401p.

ANTHONY, BLEIER, FAZZI & POGRUND, (2002). CHAPTER 10 MOBILITY FOCUS: Developing Early Skills for Orientation and Mobility. In Pogrund, R. L., & Fazzi, D. L. Early focus: Working with young blind and visually impaired children and their families. American Foundation for the Blind. pp. 330-335

Antonacopoulos, A., & Bridson, D. (2004, September). A robust Braille recognition system. In International Workshop on Document Analysis Systems (pp. 533-545). Springer, Berlin, Heidelberg.

Argyropoulos, V. S., & Argyropoulos, V. S. (2002). Tactual shape perception in relation to the understanding of geometrical concepts by blind students. British Journal of Visual Impairment, 20(1), 7-16.

Argyropoulos, V. S., Sideridis, G. D., & Katsoulis, P. (2008). The impact of the perspectives of teachers and parents on the literacy media selections for independent study of students who are visually impaired. Journal of Visual Impairment & Blindness, 102(4), 221-231.

Argyropoulos, V., Padeliadu, S., Avramidis, E., Tsiakali, T., & Nikolaraizi, M. (2019). An investigation of preferences and choices of students with vision impairments on literacy medium for studying. British Journal of Visual Impairment, 37(2), 154-168.

Arif, S. (2013). Electronic Braille Document Reader (Doctoral dissertation, University of Huddersfield).

Arnold, A. (2004). Learning to read by touch: developing braille reading schemes. British Journal of Visual Impairment, 22(3), 89-92.

Arrah, R. O., & Swain, K. D. (2014). Teachers' Perceptions of Students with Special Education Needs in Cameroon Secondary Schools. International journal of special education, 29(3), 101-110.

Arter, C. (1997). Chapter 10 The Primary School Child. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 99-101). Routledge.

Arter, C. (1997). Chapter 10 The Primary School Child. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 97-99). Routledge.

Arter, C. (1997). Chapter 15 Listening Skills. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 146-147). Routledge.

Arter, C. (1997). Chapter 15 Listening Skills. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 146-147). Routledge.

Arter, C., & Layton, L. (2000). Reading preferences of pupils with visual impairment. British Journal of Visual Impairment, 18(1), 41-44.

Asamoah, E., Ofori-Dua, K., Cudjoe, E., Abdullah, A., & Nyarko, J. A. (2018). Inclusive education: Perception of visually impaired students, students without disability, and teachers in Ghana. Sage Open, 8(4), 2158244018807791.

Authman, Z. I., & Jebr, Z. F. (2012). Arabic Braille scripts recognition and translation using image processing techniques. Journal of Education for Pure Science, 2(3), 18-26.

Baldo Mohamed, N. H. (2011). Inclusion of pupils with special education needs in Sudan: teachers perceptions of their competence and their perceived training needs (Doctoral dissertation, Institute of Education, University of London).

Banks, M. E. (2003). Disability in the family: a life span perspective. Cultural Diversity and Ethnic Minority Psychology, 9(4), 367.

Basu, A. (2001). Bharati Braille Information System: An affordable multilingual system for empowering the sightless population.

Bazna, M. S., & Hatab, T. A. (2005). Disability in the Qur'an: The Islamic alternative to defining, viewing, and relating to disability. Journal of Religion, Disability & Health, 9(1), 5-27.

Beal, C. R., & Rosenblum, L. P. (2015). Use of an accessible iPad app and supplemental graphics to build mathematics skills: Feasibility study results. Journal of Visual Impairment & Blindness, 109(5), 383-394.

Belay, M. T. E. (2005). African Perspective on Visual Impairments. In A paper presented to UNESCO at the World Summit on the Information Society Workshop on ICT and persons with disabilities.

Bhatty, I., Moten, A. A., Tawakkul, M., & Amer, M. (2009). Disability in Islam: Insights into theology, law, history, and practice. Disabilities: Insights from across fields and around the world, 1, 157-176.

Bilal Salih, H.E., & Kakizawa,T. Assessing the impact of auditory media on Braille reading and writing skills: The case of elementary school students who are blind in Sudan. British Journal of Visual Impairment. DOI: 10.1177/02646196221099156

Bilal Salih, H.E., & Kakizawa,T. Comparing the Two Educational Systems for Visually Impaired Students in Sudan: Pros and Cons Education Sciences

2022-06-16 | Journal article. DOI: 10.3390/educsci12060411

Bin Tuwaym, S. T., & Berry, A. B. (2018). Assistive technology for students with visual impairments: A resource for teachers, parents, and students. Rural Special Education Quarterly, 37(4), 219-227.

Bina, M. J. (1993). Do myths associated with schools for students who are blind negatively affect placement decisions?. Journal of Visual Impairment & Blindness, 87(6), 213-215.

Borland, J. & James, S. (1999) The Learning Experience of Students with Disabilities in Higher Education: A case study of a UK university. Disability and Society, 14(1), 85 – 101.

Brambring, M. (2007). Divergent development of verbal skills in children who are blind or sighted. Journal of Visual Impairment & Blindness, 101(12), 749-762.

Breidegard, B., Jönsson, B., Fellenius, K., & Strömqvist, S. (2006). Disclosing the secrets of Braille reading—computer-aided registration and interactive analysis. Visual Impairment Research, 8(3), 49-59.

Brennan, S. A., Luze, G. J., & Peterson, C. (2009). Parents' perceptions of professional support for the emergent literacy of young children with visual impairments. Journal of Visual Impairment & Blindness, 103(10), 694-704.

Brown, J. E., & Beamish, W. (2012). The changing role and practice of teachers of students with visual impairments: Practitioners' views from Australia. Journal of Visual Impairment & Blindness, 106(2), 81-92.

Brzoza, P., & Spinczyk, D. (2006, July). Multimedia browser for internet online daisy books. In International Conference on Computers for Handicapped Persons (pp. 1087-1093). Springer, Berlin, Heidelberg.

Brzoza, P., & Spińczyk, D. (2007). E-learning Platform for Interactive Access to Multimedia Materials in Daisy Format. In CVHI.

Burgstahler, S. (2003). The role of technology in preparing youth with disabilities for postsecondary education and employment. Journal of Special Education Technology, 18(4), 7-19.

Carey, K. (2007). The opportunities and challenges of the digital age: A blind user's perspective. Library Trends, 55(4), 767-784.

Carreiras, M., & Alvarez, C. J. (1999). Comprehension processes in braille reading. Journal of Visual Impairment & Blindness, 93(9), 589-595.

Celeste, M. (2006). Play behaviors and social interactions of a child who is blind: In theory and practice. Journal of visual impairment & Blindness, 100(2), 75-90.

Chataika, T. (2010) Inclusion of disabled students in higher education in Zimbabwe. In J. Lavia and M. Moore (Eds.), Cross-cultural perspectives on policy and practice: Decolonizing community contexts, New York: Routledge, 116 – 131.

Chiu, Y. T., & Wild, T. (2021). Incorporating the Expanded Core Curriculum into science. British Journal of Visual Impairment, 02646196211029341.

Clark, A., & Murphy, F. (1998). Teaching music to the visually impaired student in a standard school setting. British Journal of Visual Impairment, 16(3), 117-122.

Cole, R. A., & Slavin, A. J. (2013). Use of a video assistive device in a university course in laboratory science: A case study. Journal of Visual Impairment & Blindness, 107(4), 311-315.

Cooper, H. L., & Nichols, S. K. (2007). Technology and early braille literacy: Using the Mountbatten Pro Brailler in primary-grade classrooms. Journal of Visual Impairment & Blindness, 101(1), 22-31.

Coppins, N., & Barlow-Brown, F. (2006). Reading difficulties in blind, braille-reading children. British Journal of Visual Impairment, 24(1), 37-39.

Craig, C. (1999). Home literacy experiences of a child with a visual impairment. Journal of Visual Impairment & Blindness, 93(12), 794-797.

Croft, A. (2013). Promoting access to education for disabled children in low-income countries: Do we need to know how many disabled children there are?. International Journal of Educational Development, 33(3), 233-243.

Cutsforth, T. D. (1951). The blind in school and society: A psychological study. American Foundation for the Blind. pp 2013-2014

D'Andrea, F. M. (1997). CHAPTER 4 MAKING THE TRANSITION FROM PRINT TO BRAILLE. In Wormsley, D. P., & D'Andrea, F. M. Instructional Strategies for Braille Literacy (pp. 111-115). American Foundation for the Blind.

D'Andrea, F. M. (1997). Chapter 5 Teaching Braille to Students with Special needs. In Wormsley, D. P., & D'Andrea, F. M. Instructional Strategies for Braille Literacy (pp. 145-150). American Foundation for the Blind.

D'Andrea, F. M. (2010). Practices and preferences among students who read braille and use assistive technology. Unpublished PhD dissertation), University of Pittsburgh.

D'Andrea, F. M. (2012). Preferences and practices among students who read braille and use assistive technology. Journal of Visual Impairment & Blindness, 106(10), 585-596.

Daniel, K. (2012). Psychological Assessment of Visual Impaired Children in Integrated and Special Schools. Education, 2(1), 35-40.

Davidson, P. W., Appelle, S., & Haber, R. N. (1992). Haptic scanning of braille cells by low- and high-proficiency blind readers. Research in developmental disabilities, 13(2), 99-111.

de Verdier, K., & Ek, U. (2014). A longitudinal study of reading development, academic achievement, and support in Swedish inclusive education for students with blindness or severe visual impairment. Journal of Visual Impairment & Blindness, 108(6), 461-472.

Douglas, G. (2001). ICT, education, and visual impairment. British journal of educational technology, 32(3), 353-364.

Douglas, G., Corcoran, C. & Pavey, S. (2007) The role of the WHO ICF as a framework to interpret barriers and to inclusion: visually impaired people's views and experiences of personal computers. British Journal of Visual Impairment, 25, 32 – 50.

Douglas, G., McLinden, M., Farrell, A. M., Ware, J., McCall, S., & Pavey, S. (2011). Access to print literacy for children and young people with visual impairment: implications for policy and practice. European Journal of Special Needs Education, 26(1), 39-46.

Douglas, G., McLinden, M., McCall, S., Pavey, S., Ware, J., & Farrell, A. M. (2011). Access to print literacy for children and young people with visual impairment: findings from a review of literature. European Journal of Special Needs Education, 26(1), 25-38.

Duxbury Systems Arabic Translation Table Details https://duxburysystems.com/documentation/dbtmac12.2/Content/language_translation_tables/arabic.htm (last visited 19/8/2020).

Edmonds, C. J., & Pring, L. (2006). Generating inferences from written and spoken language: A comparison of children with visual impairment and children with sight. British Journal of Developmental Psychology, 24(2), 337-351.

Efron, M., & DuBoff, B. R. (1975). A Vision Guide for Teachers of Deaf-Blind Children.

Eldridge, C. (1979). Braille Literacy: The Best Route to Equal Education. Journal of Visual Impairment and Blindness, 73(8), 331-33.

El-Sharkawy, M. T. (1997). The Arabic Braille: Evaluation and Suggestions for Modification (Doctoral dissertation, American University in Cairo).

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 & Blindness, 103(10), 610-624.

Emerson, R. W., Sitar, D., Erin, J. N., Wormsley, D. P., & Herlich, S. L. (2009). The effect of consistent structured reading instruction on high and low literacy achievement in young children who are blind. Journal of Visual Impairment & Blindness, 103(10), 595-609.

Eriksson, Y. (2018). -Tactile Reading: Tactile Understanding. In Assistive Technology for Blindness and Low Vision (pp. 111-135). CRC Press.

Erin, J. N. (2007). CHAPTER 7 From Regular Classroom to Specialized Program: Exploring the Options for Your Child. In LaVenture, S. A Parents' Guide to Special Education for Children with Visual Impairments (pp. 72-78). American Foundation for the Blind

Etheridge, D., Mason, H. & Chapman, E. (1994) The Visually Impaired: Curricular Access and Entitlement in Further Education. ed. London, England : Fulton, 122p.

Farnsworth, C. R., & Luckner, J. L. (2008). The impact of assistive technology on curriculum accommodation for a Braille-reading student. RE: view, 39(4), 171.

FAZZI D. L. & KLEIN M. D. (2002). CHAPTER 4 COGNITIVE FOCUS: Developing Cognition, Concepts, and Language. In Pogrund, R. L., & Fazzi, D. L. Early focus: Working with young blind and visually impaired children and their families. American Foundation for the Blind. pp. 115-135

Ferrell, K. A., (2000). Growth and Development of Young Children . In M. C. Holbrook & A. J. Koenig (Eds.), Foundations of education (2nd Ed.): Vol. I. History and theory of teaching children and youths with visual impairments (pp. 1-54). New York: AFB Press.

Ferrell, K. A., Mason, L., Young, J., & Cooney, J. (2006). Forty years of literacy research in blindness and visual impairment. Retrieved from University of Northern Colorado, National Center on Severe and Sensory Disabilities website: http://www. unco. edu/ncssd/research/literacy_meta_analyses. shtml.

Fichten, C.S., Asuncion, J.V., Barile, M., Fossey, M.E., Robillard, C., Judd, D., Wolforth, J., Senecal, J., Genereux, C., Guimont, J.P., Lamb, D. & Juhel, J.C. (2004). Access to Information and Instructional Technologies in Higher Education I: Disability Service Providers' Perspective. Journal of Postsecondary Education and Disability, 17(2), 114-133

Foulke, E., Amster, C. H., Nolan, C. Y., & Bixler, R. H. (1962). The comprehension of rapid speech by the blind. Exceptional Children, 29(3), 134-142.

Freitas, D., & Kouroupetroglou, G. (2008). Speech technologies for blind and low vision persons. Technology and Disability, 20(2), 135-156.

Garcia, L. G. (2004). Assessment of text reading comprehension by Spanish-speaking blind persons. British Journal of Visual Impairment, 22(1), 4-12.

Gardner, J., Brzoza, P., & Soiffer, N. (2008). Life Cycle of a DAISY Book with Math: From Authoring to Players. In 23rd Annual International Technology & Persons with Disabilities Conference, Los Angeles.

Gharaibeh, N. (2009). Disability in Arab societies is a challenging subject for several reasons (pp. 63-79). Westport, CT: Praeger.

Golub, K. (2002). Digital libraries and the blind and visually impaired. In 4th CARNet Users Conference-CUC, Zagreb, Croatia, September 25-27, 2002. Croatian Academic and Research Network.

Good III, R. H., Simmons, D. C., & Kame'enui, E. J. (2001). The importance and decision-making utility of a continuum of fluency-based indicators of foundational reading skills for third-grade high-stakes outcomes. Scientific studies of reading, 5(3), 257-288.

Goode, J. (2007) Managing disability: Early experiences of university students with disabilities. Disability & Society 22(1), 35 – 48.

Goodman, S. A., & Wittenstein, S. H. (Eds.). (2003). Collaborative assessment: Working with students who are blind or visually impaired, including those with additional disabilities (pp 23-37). American Foundation for the Blind.

Gray, G. & Wilkins, S. M. (2005) A ‘Psychology Core Graphics Resource Pack' for HE: The development of a resource to support blind and visually impaired students in higher education. The British Journal of Visual Impairment, 23(1), 31 – 37.

Greaney, J., & Reason, R. (2000). Braille Reading by Children: Is there a Phonological Explanation for their Difficulties?. British Journal of Visual Impairment, 18(1), 35-40.

Greaney, J., Arter, C., Hill, E., Mason, H., McCall, S., Stone, J. & Tobin, M. (1994). The development of a new test of children's braille-reading ability. British Journal of Visual Impairment, 12(2), 54-56.

Green, S. E. (2003). “What do you mean ‘what's wrong with her?’”: Stigma and the lives of families of children with disabilities. Social science & medicine, 57(8), 1361-1374.

Grenier, D., & Giroux, N. (1997). A Comparative Study of Spelling Performance of Sighted and Blind Students in Senior High School. Journal of Visual Impairment & Blindness, 91(4), 393-400.

Griffin-Shirley, N., Banda, D. R., Ajuwon, P. M., Cheon, J., Lee, J., Park, H. R., & Lyngdoh, S. N. (2017). A survey on the use of mobile applications for people who are visually impaired. Journal of Visual Impairment & Blindness, 111(4), 307-323.

Hadidi, M. S. (1998). Educational services for visually impaired children in the Arab countries. Journal of Visual Impairment & Blindness, 92(7), 535-538.

Hadidi, M. S., & Al Khateeb, J. M. (2015). Special education in Arab countries: Current challenges. International Journal of Disability, Development and Education, 62(5), 518-530.

Hall, A. (1982). CHAPTER 3 Teaching Specific Concepts to Visually Handicapped Students. In Mangold, S. S. A teachers' guide to the special educational needs of blind and visually handicapped children (pp. 10-20) American Foundation for the Blind

Hampshire, B. (1981). Working with braille: A study of braille as a medium of communication. United Nations Educational.

Harley, R. K., Truan, M. B., & Sanford, L. D. (1997). Communication skills for visually impaired learners: Braille, print, and listening skills for students who are visually impaired. Charles C Thomas Pub Ltd.

Hartley, J. (1987). Some aspects of current research on text design and its implications for the setting of braille. British Journal of Visual Impairment, 5(1), 17-20.

Hatlen, P. (2000). Historical perspectives. In M. C. Holbrook & A. J. Koenig (Eds.), Foundations of education (2nd Ed.): Vol. I. History and theory of teaching children and youths with visual impairments (pp. 1-54). New York: AFB Press.

Hatlen, P. (2004). Is social isolation a predictable outcome of inclusive education?. Journal of Visual Impairment & Blindness, 98(11), 676-678.

Hazekamp J. & Huebner K. M., (1989). Program Planning and Evaluation for Blind and Visually Impaired Students: National Guidelines for Educational Excellence. American Foundation for the Blind, New York, p. 21-30

Helps, D. H., & Herzberg, T. S. (2013). The use of an iPad2 as a leisure activity for a student with multiple disabilities. Journal of visual impairment & blindness, 107(3), 232-236.

Herrington, M., & Simpson, D. (2002). Making Reasonable Adjustments with Disabled Students in Higher Education. University of Nottingham.

Hersh, M., & Johnson, M. A. (Eds.). (2010). Assistive technology for visually impaired and blind people. Springer Science & Business Media.

Horton, J. K. (1988). Education of visually impaired pupils in ordinary school. Education, 1, 2.

Isave, M., Uplane, M., & Isave, S. (2011). Teacher's awareness about the availability and use of technology for Visually Impaired: A Study. International journal of scientific and engineering research, 52.

Ittyerah, M. (2010). Haptic touch and hand ability. Advances in haptics, 463-475.

Jackson, R.M. & Presley, I. (2012). Audio-Supported Reading for Students who are Blind or Visually Impaired. Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved [8/11/2019] from http://aem.cast.org/about/publications/2012/audio-supported-reading-blind-visually-impaired-asr.html

Jarjoura, W., & Karni, A. (2014). Braille reading in blind and sighted individuals: educational considerations and experimental evidence. In Handbook of Arabic Literacy (pp. 395-408). Springer, Dordrecht.

Jennings, J. (1999). Print or Braille: decision-making in the choice of the primary literacy medium for pupils with a severe visual impairment. British Journal of Visual Impairment, 17(1), 11-16.

Jeong, W. (2006). Force feedback textual and graphic displays for the blind. Proceedings of the American Society for Information Science and Technology, 43(1), 1-11.

Jessup, G. M., Bundy, A. C., Hancock, N., & Broom, A. (2018). Being noticed for the way you are: Social inclusion and high school students with vision impairment. British Journal of Visual Impairment, 36(1), 90-103.

Jessup, G., Bundy, A. C., Broom, A., & Hancock, N. (2017). The social experiences of high school students with visual impairments. Journal of Visual Impairment & Blindness, 111(1), 5-19.

Julia Todaro, A. (2005). Library services for people with disabilities in Argentina. New library world, 106(5/6), 253-268.

Junor, L., & Junor, P. (1994). A comparison of reading and listening performance: computer-controlled speech and printed text presentations. British journal of educational technology, 25(3), 189-197.

Kahlisch, T. (2008). DAISY: An opportunity to improve access to information for all. Information Services & Use, 28(2), 151-158.

Kalra, N., Lauwers, T., & Dias, M. B. (2007). A braille writing tutor to combat illiteracy in developing communities.

Kalra, N., Lauwers, T., Dewey, D., Stepleton, T., & Dias, M. B. (2009). Design of a braille writing tutor to combat illiteracy. Information Systems Frontiers, 11(2), 117-128.

Kamei-Hannan, C., Howe, J., Herrera, R. R., & Erin, J. N. (2012). Perceptions of teachers of students with visual impairments regarding assistive technology: A follow-up study to a university course. Journal of visual impairment & blindness, 106(10), 666-678.

Kawamura, H. (2006, June). DAISY: a better way to read, a better way to publish?a contribution of libraries serving persons with print disabilities. In World Library and Information Congress: IFLA, Seoul (August 20-24, 2006).

Kelly, S. M., & Wolffe, K. E. (2012). Internet use by transition-aged youths with visual impairments in the United States: Assessing the impact of postsecondary predictors. Journal of Visual Impairment & Blindness, 106(10), 597-608.

Kerscher, G. (2001). DAISY Consortium: information technology for the world's blind and print-disabled population–past, present, and into the future. Library Hi Tech, 19(1), 11-15.

Khochen, M. (2011). Reading through touch, importance and challenges. In Ponencia presentada en el 21 Congreso Mundial de Braille. Universidad de Leipzig: Biblioteca Alemana Central para los ciegos (DZB), Alemania.

Kim, J. S. (2012). The effect of "read-aloud" as a test accommodation for students with visual impairments in South Korea. Journal of Visual Impairment & Blindness, 106(6), 356-361.

Kinash S. & Paszuk A. (2007) Accessible education for blind learners: Kindergarten through postsecondary. Information Age Publishing (IAP), North Carolina. 32p

Kipke, S. (2008, July). Sensitive braille displays with ATC technology (active tactile control) as a tool for learning braille. In International Conference on Computers for Handicapped Persons (pp. 843-850). Springer, Berlin, Heidelberg.

Koenig, A. J., & Ashcroft, S. C. (1993). An analysis of errors in braille writing samples. Journal of Visual Impairment & Blindness, 87(1), 12-18.

Koenig, A. J., & Holbrook, M. C. (1989). Determining the reading medium for students with visual impairments: A diagnostic teaching approach. Journal of Visual Impairment & Blindness.

Koenig, A. J., & Holbrook, M. C. (2000). Ensuring high-quality instruction for students in braille literacy programs. Journal of Visual Impairment & Blindness, 94(11), 677-694.

Lahav, O., & Mioduser, D. (2000, September). Multisensory virtual environment for supporting blind persons' acquisition of spatial cognitive mapping, orientation, and mobility skills. In Proceedings of the Third International Conference on Disability, Virtual Reality and Associated Technologies, ICDVRAT 2000 (pp. 53-58).

Lamb, G. (1996). Beginning Braille: A Whole Language-Based Strategy. Journal of Visual Impairment & Blindness, 90(3), 184-89.

Lamb, G. (1998). Dots for tots: emergent literacy and braille reading. British Journal of Visual Impairment, 16(3), 111-115.

Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Campodonico, F., & Alberti, G. (2017). Use of a smartphone for leisure and communication by people with blindness and motor disabilities. Journal of Visual Impairment & Blindness, 111(2), 181-186.

Lansdown, G., Groce, N., Deluca, M., Cole, E., Berman-Bieler, R., Mitra, G., ... & Burlyaeva-Norman, A. (2013). Children and Young People with Disabilities: Fact Sheet.

LaVenture, S. (2007). A Parents' Guide to Special Education for Children with Visual Impairments. American Foundation for the Blind. p176

Leas, D., Persoon, E., Soiffer, N., & Zacherle, M. (2008). Daisy 3: A standard for accessible multimedia books. IEEE MultiMedia, 15(4), 28-37.

Lewin-Jones, J., & Hodgson, J. (2006). Students with a severe visual impairment taking modern foreign language modules: the role of the support worker. Language Learning Journal, 34(1), 33-36.

Lewis, S., & McKenzie, A. R. (2010). The competencies, roles, supervision, and training needs of paraeducators working with students with visual impairments in local and residential schools. Journal of Visual Impairment & Blindness, 104(8), 464-477.

Lewis, S., & Tolla, J. (2003). Creating and using tactile experience books for young children with visual impairments. Teaching Exceptional Children, 35(3), 22-29.

Lieberman, L. J., & Conroy, P. (2013). Training of paraeducators for physical education for children with visual impairments. Journal of Visual Impairment & Blindness, 107(1), 17-28.

Lieberman, L. J., Haegele, J. A., Columna, L., & Conroy, P. (2014). How students with visual impairments can learn components of the expanded core curriculum through physical education. Journal of Visual Impairment & Blindness, 108(3), 239-248.

Lifshitz, H., Hen, I., & Weisse, I. (2007). Self-concept, adjustment to blindness, and quality of friendship among adolescents with visual impairments. Journal of Visual Impairment & Blindness, 101(2), 96-107.

Lorimer, J. (1990). Improving braille reading skills: The case for extending the teaching of braille reading to upper primary and lower senior classes. British Journal of Visual Impairment, 8(3), 87-89.

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.

Lowenfeld, B. (1973). The visually handicapped child in school. John Day Company, Incorporated. (page186))

Lowenfeld, B., Abel, G.L., & Hatlen, P.H. (1969). Blind children learn to read. Spring-field, IL: Charles C Thomas.

Lynch, P., & McCall, S. (2010). Impact of educational inclusion on children with visual impairment in Malawi. The Educator, 22(2), 28-32.

MacCuspie, P. A. (2002). Access to literacy instruction for students who are blind or visually impaired: A discussion paper. Toronto, ON, CA: The Canadian National Institute for the Blind. Retrieved on January 1, 2020.

Mackenzie, C. N. (1954). World Braille Usage: A Survey of Efforts Towards Uniformity of Braille Notation. Unesco.

Mangold, S. S., & Mangold, P. (2002). Braille literacy instruction for the next generation. In Proceedings of the 11th ICEVI World Conference, new visions: Moving toward an inclusive community.

Mangold, S., & Mangold, P. (1989). Selecting the most appropriate primary learning medium for students with functional vision. Journal of Visual Impairment & Blindness.

Mann, C. (2006). Educational Placement Options for Blind and Visually Impaired Students. Olympia: Washington State University.

Marks, S. U., Kurth, J. A., & Bartz, J. M. (2014). Exploring the landscape of inclusion: Profiles of inclusive versus segregated school districts in the United States. The Journal of the International Association of Special Education 15(2), 74-84.

Martiniello, N., Wittich, W., & Jarry, A. (2018). The perception and use of technology within braille instruction: A preliminary study of braille teaching professionals. British Journal of Visual Impairment, 36(3), 195-206.

Massof, R. W. (2009). The role of Braille in the literacy of blind and visually impaired children. Archives of Ophthalmology, 127(11), 1530-1531.

McCabe, H. (2007). Parent advocacy in the face of adversity: Autism and families in the People's Republic of China. Focus on Autism and Other Developmental Disabilities, 22(1), 39-50.

McCall S. (1997). Chapter 16 The Development of Literacy through Touch. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 51-55). Routledge.

McCall S. (1997). Chapter 16 The Development of Literacy through Touch. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 146-147). Routledge.

McCall, S., McLinden, M., & Douglas, G. (2011). A review of the literature into effective practice in teaching literacy through Braille. VICTAR, University of Birmingham.

McConachie, L. J. (2016). An Examination of School Readiness: How Is the Construct Defined for Children Who Are Blind?. Dissertations and Theses. Paper 2948. retrieved 2020/03/22 from https://pdxscholar.library.pdx.edu/open_access_etds/2948 10.15760/etd.2943

McKenzie, A. R., & Lewis, S. (2008). The role and training of paraprofessionals who work with students who are visually impaired. Journal of Visual Impairment & Blindness, 102(8), 459-471.

McMahon, E. (2014). The role of specialized schools for students with visual impairments in the continuum of placement options: The right help, at the right time, in the right place. Journal of Visual Impairment & Blindness, 108(6), 449-459.

Mendy, A. N. (2011). Inclusion of Blind and low Vision Children in Regular Schools in the Gambia. url: www. african. org/Ghana/Nancy. doc.

Millar, S. (2003). Reading by touch. Routledge.

Miller, M. T., Romanov, M. G., & Savant, S. B. (2018). Digitizing the textual heritage of the premodern islamicate world: Principles and plans. International Journal of Middle East Studies, 50(1), 103.

Moswela E., Mukhopadhyay S. (2011) Asking for too much? The voices of students with disabilities in Botswana. Disability & Society, 26(3), 307-319.

Mushoriwa, T. (2001). Research Section: A study of the attitudes of primary school teachers in Harare towards the inclusion of blind children in regular classes. British Journal of Special Education, 28(3), 142-147.

Newman, S. E., & Hall, A. D. (1987). Perceiving, learning and remembering braille. British Journal of Visual Impairment, 5(2), 43-44.

Nolan, C. Y. (1963). Reading and listening in learning by the blind. Exceptional children, 29(7), 313-316.

Ocloo, M. A., & Subbey, M. (2008). Perception of basic education school teachers towards inclusive education in the Hohoe District of Ghana. International Journal of Inclusive Education, 12(5-6), 639-650.

O'Connor, U. & Robinson, A. (1999) Accession or Exclusion? University and the Disabled Student: A Case Study of Policy and Practice. Higher Education Quarterly, 53(1), 88 – 103.

Omede, A. A. (2015). The Challenges of Educating the Visually Impaired and Quality Assurance in Tertiary Institutions of Learning in Nigeria. International journal of educational administration and policy studies, 7(7), 129-133.

Orsini-Jones, M. (2009) Measures for inclusion: coping with the challenge of visual impairment and blindness in university undergraduate level language learning. Support for Learning, 24(1), 27 – 34.

Orsini-Jones, M., Courtney, K. & Dickinson, A. (2005) Supporting foreign language learning for a blind student: a case study from Coventry University. Journal of Computer Assisted Learning, 146 – 152.

Ozkubat, U., & Ozdemir, S. (2014). A comparison of social skills in Turkish children with visual impairments, children with intellectual impairments and typically developing children. International Journal of Inclusive Education, 18(5), 500-514.

Padure, M. (2008). Methods and techniques for the access of persons with visual impairments to handbooks and textbooks. Revista Informatica Economică nr, 2(46), 125.

Papadopoulos, K. S. & Goudiras, D. B. (2004) Visually-impaired students and university examinations. The British Journal of Visual Impairment, 22(2), 66 – 70.

Papadopoulos, K. S., Arvaniti, E. K., Dimitriadi, D. I., Gkoutsioudi, V. G., & Zantali, C. I. (2009). Spelling performance of visually impaired adults. British Journal of Visual Impairment, 27(1), 49-64.

Papuda-Doli?ska, B. (2017). Differences in social and academic functioning among visually impaired children in special, integrated and inclusive educational settings in Poland. Hrvatska revija za rehabilitacijska istra?ivanja, 53(Supplement), 113-126.

Paris, S. G., Cross, D. R., & Lipson, M. Y. (1984). Informed strategies for learning: A program to improve children's reading awareness and comprehension. Journal of Educational psychology, 76(6), 1239.

Parker, A. T., & Pogrund, R. L. (2009). A review of research on the literacy of students with visual impairments and additional disabilities. Journal of Visual Impairment & Blindness, 103(10), 635-648.

Parker, V. (2000) Developing a code of practice for disability coordinators. European Journal of Special Needs Education, 15(3), 275 – 284.

Paugh, P. C., & Dudley-Marling, C. (2011). 'Speaking'deficit into (or out of) existence: how language constrains classroom teachers' knowledge about instructing diverse learners. International Journal of Inclusive Education, 15(8), 819-833.

Pester, E. (1993). Braille Instruction for Individuals Who Are Blind Adventitiously: Scheduling, Expectations, and Reading Interests. RE: view, 25(2), 83-87.

Pillai, P. R. (2011). Provision of library and information services for the visually impaired in India_ a study.

Pogrund, R. L., Darst, S., & Boland, T. (2013). Evaluation study of short-term programs at a residential school for students who are blind and visually impaired. Journal of Visual Impairment & Blindness, 107(1), 30-42.

Posey, V. K., & Henderson, B. W. (2012). Comprehensive Adult Student Assessment Systems braille reading assessment: an exploratory study. Journal of Visual Impairment & Blindness, 106(8), 488-499.

Pring, L. (1994). Touch and go: learning to read Braille. Reading Research Quarterly, 29(1), 67-74.

Priya R. Pillai, Neela J. Deshpande. (2012). Library Services for Blind and Visually Impaired People APH Publishing Corporation. pp. 100-107

Punia, P., & Berwal, S. (2017). Alienation in students with visual impairment in special and inclusive schools: A study of Haryana state. Journal of the Indian Academy of Applied Psychology, 43(1), 67.

Radojichikj, D. D. (2015). Students with visual impairments: Braille reading rate. International Journal of Cognitive Research in Science, Engineering and Education, 3(1), 1-5.

Rahimi, N. A. Z. N. M., Hanif, N. H. H. M., & Janin, Z. (2018, November). Mobile Applications for Teaching and Learning Arabic Braille. In 2018 IEEE 5th International Conference on Smart Instrumentation, Measurement and Application (ICSIMA) (pp. 1-4). IEEE.

Rapp, D. W., & Rapp, A. J. (1992). A survey of the current status of visually impaired students in secondary mathematics. Journal of Visual Impairment & Blindness, 86(2), 115-117.

Rex, E. J., Koenig, A., & Baker, R. (Eds.). (1994). Foundations of Braille literacy. American Foundation for the Blind. p 6

Richardson, J. T. E. & Roy, A.W. N. (2002) The representation and attainment of students with a visual impairment in higher education. British Journal of Visual Impairment, 20, 37 – 48.

Ringlein, E. (1998). 101 Ways to Use Braille,". The Braille Spectator.

Risjord, C., Wilkinson, J., & Stark, M. L. (2000). Instruction manual for braille transcribing. National library service for the blind and physically handicapped.

Roberts, R., & Wing, A. M. (2001). Making sense active touch. British Journal of Visual Impairment, 19(2), 48-56.

Rogers, S. (2007). Learning braille and print together—the mainstream issues. British Journal of Visual Impairment, 25(2), 120-132.

Rohwerder, B. (2018). Disability stigma in developing countries.

Rosner, Y., & Perlman, A. (2018). The Effect of the Usage of Computer-Based Assistive Devices on the Functioning and Quality of Life of Individuals who are Blind or have low Vision. Journal of Visual Impairment & Blindness, 112(1), 87-99.

Rowland W.(2007) Library Services for Blind People: an African perspective. Paper presented at the IFLA Libraries for the Blind Section Conference, Grahamstown,South Africa , August 2007

Rowland, W. (2008). Library services for blind people: An African perspective. IFLA journal, 34(1), 84-89.

Rule, A. C., Stefanich, G. P., Boody, R. M., & Peiffer, B. (2011). Impact of adaptive materials on teachers and their students with visual impairments in secondary science and mathematics classes. International Journal of Science Education, 33(6), 865-887.

Sacks, S. Z., Hannan, C. K., & Erin, J. N. (2011). Children's perceptions of learning braille: qualitative and quantitative findings of the ABC Braille Study. Journal of Visual Impairment & Blindness, 105(5), 266-275.

Saiegh-Haddad, E., & Joshi, R. M. (Eds.). (2014). Handbook of Arabic literacy: Insights and perspectives (Vol. 9). Springer Science & Business Media.

Salih, H. E. B., & Kakizawa, T. (2016). Evaluating the learning setting and identifying the study needs for students with visual impairment at the University of Khartoum in Sudan. Journal of Special Education Research, 4(2), 29-37.

Salleh, N. M., & Zainal, K. (2018). Instructional model for social skills intervention children with visual impairment. Creative Education, 9(14), 2325.

Salleh, N. M., Jelas, Z. M., & Zainal, K. (2011). Assessment of Social Skills among Visually Impaired Students. International Journal of Learning, 17(12).

Savich, C. (2008). Inclusion: The Pros and Cons--A Critical Review. Online Submission.

Selway, D., & Ashman, A. F. (1998). Disability, religion and health: A literature review in search of the spiritual dimensions of disability. Disability & Society, 13(3), 429-439.

Simon, C., & Huertas, J. A. (1998). How blind readers perceive and gather information written in braille. Journal of Visual Impairment & Blindness, 92(5), 322-330.

Sinead W., (1996). Library services to the blind in the United Kingdom and Ireland: a comparative study five years on. Journal of Librarianship and Information Science, 28(3), 133-140.

Sisalem, K. S, (1997). Characteristics of the Visually impaired and their approaches (in Arabic). Egyptian Lebanese of Dar Alnashr pp. 90-95

Sivan, S., & Darsan, G. (2016, July). Computer vision based assistive technology for blind and visually impaired people. In Proceedings of the 7th International Conference on Computing Communication and Networking Technologies (pp. 1-8).

Sodnik, J., Jakus, G., & Tomažič, S. (2012). The use of spatialized speech in auditory interfaces for computer users who are visually impaired. Journal of Visual Impairment & Blindness, 106(10), 634-645.

Spungin, S. J., & Ferrell, K. A. (2007). The role and function of the teacher of students with visual impairments: A Position Paper of the Division on Visual Impairments Council of Exceptional Children.

Stanfa, K., & Johnson, N. (2015). Improving Braille Reading Fluency: The Bridge to Comprehension.

Stangl, A., Kim, J., & Yeh, T. (2014, June). 3D printed tactile picture books for children with visual impairments: a design probe. In Proceedings of the 2014 conference on Interaction design and children (pp. 321-324).

Steinman, B. A., LeJeune, B. J., & Kimbrough, B. T. (2006). Developmental stages of reading processes in children who are blind and sighted. Journal of Visual Impairment & Blindness, 100(1), 36-46.

Stephens, O. (1989). Braille—implications for living. Journal of Visual Impairment & Blindness.

Stepien-Bernabe, N. N., Lei, D., McKerracher, A., & Orel-Bixler, D. (2019). The Impact of Presentation Mode and Technology on Reading Comprehension among Blind and Sighted Individuals. Optometry and Vision Science, 96(5), 354.

Stone, J. (1988). Can't I finish the story? Teaching braille to infants. British Journal of Visual Impairment, 6(2), 51-53.

Stone, J. (1995). Has braille had its day?. British Journal of Visual Impairment, 13(2), 80-81.

Stone, J. (1997). Chapter 9 The Pre-school Child. In McCall, S. (Ed.). Visual impairment: Access to education for children and young people (pp. 87-96). Routledge.

Strickland, D. S., & Riley-Ayers, S. (2006). Early literacy: Policy and practice in the preschool years. Preschool policy brief, 10, 1-12.

Sue, K. & Nicola, C. (2008) Post-16 and post-18 transitions of young people with visual impairment in Wales. The British Journal of Visual Impairment, 26(2), 190 – 201.

Sullivan, E. J. (1996, December). What the future holds for braille. In Asian and Pacific Regional Seminar on Information Technology for Visually Impaired People (pp. 2-6).

Sutton, J. (2002). A Guide to Making Doucments Accessible to People who are Blind Or Visually Impaired. American Council of the Blind.

Suvak, P. A. (2004). What do they really do? Activities of teachers of students with visual impairments. RE: view, 36(1), 22.

Swallow, R. M., & Huebner, K. M. (1987). How to Thrive, Not Just Survive: A Guide to Developing Independent Life Skills for Blind and Visually Impaired Children and Youths. American Foundation for the Blind pp 3-4.

Swenson, A. M. (1991). A process approach to teaching Braille writing at the primary level. Journal of Visual Impairment & Blindness, 85(5), 217-221.

Swenson, A. M. (1999). Beginning with braille: Firsthand experiences with a balanced approach to literacy. American Foundation for the Blind.

Tank, E., & Frederiksen, C. (2007). The DAISY standard: entering the global virtual library. Library trends, 55(4), 932-949.

Thomsen, P. (1985). The establishment of a library service to visually handicapped people in African developing countries. IFLA journal, 11(1), 36-42.

Thornberry, C., & Olson, K. (2005). The Abuse of Individuals with Developmental Disabilities. Developmental Disabilities Bulletin, 33, 1-19.

Tobin, M. J., & Hill, E. W. (2015). Is literacy for blind people under threat? Does braille have a future?. British Journal of Visual Impairment, 33(3), 239-250.

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.

Towles-Reeves, E., Kearns, J., Kleinert, H., & Kleinert, J. (2009). An analysis of the learning characteristics of students taking alternate assessments based on alternate achievement standards. The Journal of Special Education, 42(4), 241-254.

Towles-Reeves, E., Kearns, J., Kleinert, H., & Kleinert, J. (2009). An analysis of the learning characteristics of students taking alternate assessments based on alternate achievement standards. The Journal of Special Education, 42(4), 241-254.

Trent, S. D., and M. B. Truan. "Speed, accuracy, and comprehension of adolescent braille readers in a specialized school." Journal of visual impairment and blindness 91 (1997): 494-500.

Trief, E., & Feeney, R. (2005). College bound: A guide for students with visual impairments. American Foundation for the Blind. pp. 66-100

Tripathi, M., & Shukla, A. (2014). Use of assistive technologies in academic libraries: A survey. Assistive Technology, 26(2), 105-118.

Ungar, S., Blades, M., & Spencer, C. (1995). Mental rotation of a tactile layout by young visually impaired children. Perception, 24(8), 891-900.

Urwick, J., & Elliott, J. (2010). International orthodoxy versus national realities: inclusive schooling and the education of children with disabilities in Lesotho. Comparative Education, 46(2), 137-150.

Veispak, A., Boets, B., & Ghesquiere, P. (2012). Parallel versus sequential processing in print and braille reading. Research in Developmental Disabilities, 33(6), 2153-2163.

Veispak, A., Boets, B., Männamaa, M., & Ghesquiere, P. (2012). Probing the perceptual and cognitive underpinnings of braille reading. An Estonian population study. Research in developmental disabilities, 33(5), 1366-1379.

Vik, A. K., & Fellenius, K. (2007). Coping strategies in reading: Multi-readers in the Norwegian general education system. Journal of Visual Impairment & Blindness, 101(9), 545-556.

Wang, P., Michaels, C. A., & Day, M. S. (2011). Stresses and coping strategies of Chinese families with children with autism and other developmental disabilities. Journal of autism and developmental disorders, 41(6), 783-795.

Warren, D. H. (1977). Blindness and early childhood development. American Foundation for the Blind.

Whitburn, B. (2014). 'A really good teaching strategy': Secondary students with vision impairment voice their experiences of inclusive teacher pedagogy. British Journal of Visual Impairment, 32(2), 148-156.

Wiazowski, J. (2014). Can Braille be revived? A possible impact of high-end Braille and mainstream technology on the revival of tactile literacy medium. Assistive Technology, 26(4), 227-230.

Withagen, A., Vervloed, M. P., Janssen, N. M., Knoors, H., & Verhoeven, L. (2010). Tactile functioning in children who are blind: A clinical perspective. Journal of Visual Impairment & Blindness, 104(1), 43-54.

Wolffe K. E. and Rosenblum L. P., (2014). CHAPTER 12 Self-Determination. In Allman, C. B., Lewis, S., & Spungin, S. J. ECC essentials: Teaching the expanded core curriculum to students with visual impairments (pp. 72-76). American Foundation for the Blind Press.

Wolffe, K., & Kelly, S. M. (2011). Instruction in areas of the expanded core curriculum linked to transition outcomes for students with visual impairments. Journal of Visual Impairment & Blindness, 105(6), 340-349.

Wolfson, G. (2008). Using audiobooks to meet the needs of adolescent readers. American Secondary Education, 105-114.

Wong, M. E., & Tan, S. S. (2012). Teaching the benefits of smart phone technology to blind consumers: Exploring the potential of the iPhone. Journal of Visual Impairment & Blindness, 106(10), 646-650.

Wormsley, D. P. (2004). Braille literacy: A functional approach. American Foundation for the Blind.

Wurzbach, L. (1988). Teaching Reading to Braille, Print, and Aural Readers. Education of the Visually Handicapped, 19(4), 167-82.

Zaghloul, R. I., & Bani-Ata, T. J. (2011). Braille Recognition System–With a Case Study Arabic Braille Documents. European Journal of Scientific Research, 62(1), 116-122.

Zebehazy, K. T., & Wilton, A. P. (2014). Quality, importance, and instruction: The perspectives of teachers of students with visual impairments on graphics use by students. Journal of Visual Impairment & Blindness, 108(1), 5-16.

Zhou, L., Ajuwon, P. M., Smith, D. W., Griffin-Shirley, N., Parker, A. T., & Okungu, P. (2012). Assistive technology competencies for teachers of students with visual impairments: A national study. Journal of Visual Impairment & Blindness, 106(10), 656-665.

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

APPENDICES

Appendix A: Interview Concerning Support of the Students with Visually Impairment at the University Of Khartoum

The questions that will be asked will be used to investigate the ideal way of the support that should be offered for the visually impaired students at the University Of Khartoum. The way of support toward the visually impaired in the higher education should be improved, hence the purpose of this interview is to examine the way of support for the visually impaired based on your honest opinions, and for this we seek your cooperation.

1. Personal information's

(1) Name, age, sex, residence before entering to university.

(2) Please tell the degree of disability and the appearance time of the disease.

(3) Please tell the name of the university you are currently admitting or you have admitted and the faculty; institute etc.

(4) What type of character are you using now? And how and when you acquire it?

(5) At your local area or at school before entering to the university, what kind of support did you receive to study? (Please answer in details).

(6) What is your hope or your plan to do after you graduate? For those who have already graduated, please tell the present situation and the way for which you was hoping at university period.

2. This question concerning your economic situation during enrolment at the university, so did you receive any kind of economical support? If so, please tell in details the content such as the offer or any useful information's.

3. The following questions are to investigate the way of support during the admission procedures to the university

(1) When you have submitted the application registrations form, what procedures you were ask to do besides the documents and the procedures that a usual students submitted?

(2) When admitting to the university, what kind of action upon understanding the needs of the disabled student generally and the visually impaired particularly did the university have taken?

(3) Before entering to the university, what kind of action toward promoting the visually impaired students admission to the university or their education in generally, such as information exchange or dissemination did you received at the area you had resident?

4. The following questions are about the support during university years

(1) Please tell me in details your way of studying at the university?

(2) In the university what kind of specialist or staff that take care of the visually impaired students? In case of existence of such staff:

①. In fact, what role do the support staff is playing?

②. What procedures you have to follow since you seek for support and till you receive it?

③. Please tell me if you know what training and seminars are held to enhance the disability staff skills?

④. Please tell me whether you are satisfied toward the support system for the visually impaired student at the university or not, and what the reason for that?

5. In case of there are no neither specialist nor staff that takes care of support for the visually impaired students at the university, please tell me more about the present situation, the type of support you wish to receive and the system of support you hope to be exist at the university?

(1) Please tell me in details what kind of support do you wish?

(2) Who is supporting you in your activity of daily life and during your studying and what kind of support did you have received actually, please tell me in details?

6. Please tell me the study assistance that you were able to be received actually from the following: magnifying of print and books etc or transferring them into Braille; converting books or other teaching materials into text data; reading out; prior distribution of books or other teaching material that used in lectures into E-format and making it available in advance; special consideration of class room such as situating Braille labels; preparation of study room with special equipments installed that can be used by the visually impaired students; support of writing reports; literature review assistance; secure of individual disk and space; other, please teach in details.

7. From your point of view, what type of support do you think it is necessary in promoting the environment of study for the visually impaired at the university (please tell me your hope)

We come to the end of this interview, thank you for your cooperation finally, let me hear your opinion and your impression and if you have any other thing to add.

Appendix B: Interview for comparing placement of students with visual impairment in specialized versus integrating them at regular schools

The interview questions were as follows:

- What experience does the participant have with the schools for the blind?
- What is the participant's view on the characteristics, advantages and disadvantages of specialized schools for the blind?
- What necessary support does the participant believe is required in order to ensure the success of the inclusion practice within the regular schools?
- What support do students get from the school, government to enable them to fully participate in the integrated education?
- What are the participant views that make inclusive education meaningful?
- What are the challenges that prevent providing proper inclusive education for students with visual impairment in Sudan?
- What are the advantages and disadvantages of inclusive education in Sudan?
- What suggestions does the participant offer for the enhancement of the education of the visually impaired in Sudan?

Appendix C: Forms and applications

As ethical procedures several forms have been directed to the participants and their grantors included explanation form for child's parents/guardians, consent form for child's parents/guardians and Explanation letter to child's parents/guardians.

Here are samples of the used forms:

Request for assistance in Recruiting Participants

To: Dean of El-nour Institute for those who are blind in Sudan

Graduate School of Comprehensive Human Sciences, University of Tsukuba

Department of Disability Sciences Hisham Elser Bilal Salih

Human Sciences, University of Tsukuba

Professor Toshifumi Kakizawa

Dear sir-madam

We are currently conducting a study on the evaluation of Braille literacy for students who are with visual impairment in Sudan. We would be very grateful if you could ask the students who are enrolled at the school to participate in a Braille literacy test and interview. If you are willing to cooperate, we would be very grateful if you would allow us to conduct the survey at the school building.

Please take a moment to review the enclosed documents and confirm that the content does not overstep on the human rights of any members of your organization.

The enclosed documents are as follows.

1. survey request form

2. Braille reading test materials
3. consent form
4. Explanation letter to students

Explanation letter to students

Hello dear all,

My name is Hisham Elser Bilal Salih. I am PHD student at the Graduate School of Comprehensive Human Sciences, University of Tsukuba Japan.

I am contacting you to ask for your cooperation to participate in my research project on "Assessment of Braille Literacy Skills of the Visually Impaired in Sudan".

I am currently conducting research on the use of Braille literacy and the use of audio media to access information among those who are visually impaired in Sudan. We would like to ask for your cooperation in conducting Braille reading and writing test, listening test, and an interview survey.

1) Braille writing test

- Six dots test: In this test, you will be asked to write as many as six dots in one Braille cell in two minutes, using a regular Braille stylus and Braille paper.
- Alphabet writing test: In this test, you will write as many Arabic Alphabets as possible in 2 minutes. The total time is 2 minutes.

2) Braille Reading Test

You will be given 3 minutes to read the Arabic (Braille Level 1) text. Total time is 3 minutes.

3) Audio listening test

In this test, a recorded Arabic text will be played back at four different speeds, each will last for one minute. You will be asked to select the appropriate speed for understanding the text contents. The total time is 4 minutes.

4) Interview survey

You will be asked to answer several questions pertinent to the use of audio media to access written information during school. The interview will take approximately 5 minutes.

(1) Please explain in details when you have started relying on audio media to access written information such as tape recorders and reading aloud by another person?

(2) Please also explain why you choose to use audio media to access written information?

(3) What kind of instruction did you receive regarding the use of audio media?

(4) Which medium do you prefer as a learning method, audio or Braille? Please also tell us why.

We appreciate your cooperation.

Ethical Considerations

Participation in this survey is voluntary and the results obtained from the survey will not cause any disadvantage to the participants.

The participation is free and should be based on the participants' willingness to participate. Also, the individual who has participated in the research has the right to withdraw his/her consent to participate in the research at any time, even during the implementation of the research.

The individual who does not agree to participate in the research will not be disadvantaged.

The data obtained from the research will be handled in a manner that will make it impossible to identify each individual by a third party.

The data will not be made public in a form that would allow identification of individuals without the consent of the individual concerned or his or her representative.

Consent Form

Dear Dean of the Faculty of Human Sciences, University of Tsukuba,

I hear by acknowledged that I have given written and oral explanations of the "Study on the Evaluation of Braille Literacy Skills for the students with visual impairment in Sudan" and have given my consent as indicated above.

I have also been fully informed of the purpose, methods, and results of the mentioned study including the above information. I have also confirmed that I will not be disadvantaged in any way if I do not agree to participate in this study, and I agree to participate.

However, I confirm that this consent is of my own free will and that I can withdraw it at any time without any disadvantage.

I also agree that the data collected for the study may be published in research journals, conferences, etc., provided that anonymity is strictly maintained and that the data is used purely for research purposes.

Year Month Day

Affiliation (name of school)

Signature