THE USE OF TECHNOLOGY FOR CHILDREN WITH HEARING, VISUAL AND INTELLECTUAL DISABILITIES IN SAUDI ARABIA: EDUCATORS' PERCEPTIONS AND EXPERIENCES

A thesis submitted in fulfilment of
the requirements for the degree of
Doctor of Philosophy

by
Areej Alfaraj
B.A. Ed, M.Is

School of Education
University of New England

16th October 2018

Abstract

Students with different types of disabilities face challenges that limit their ability to actively participate in educational activities on an equal level with their peers who do not have disabilities. The use of assistive technologies is one of the ways students with disabilities can be helped in the classroom. This study investigated how technology is used to assist students with hearing, visual and intellectual disabilities in selected schools in Saudi Arabia.

The objectives of the study were: to investigate how technology is used to help students with disabilities; to determine challenges that schools face in the use assistive technology for students with disabilities; and to evaluate the perceptions of teachers in the sampled schools with regard to the use of technology. The study employed a pragmatic research paradigm that involved combining qualitative and quantitative research methods. The research design was a case study methodology that applied a sequential exploration strategy entailing quantitative followed by qualitative research methods. The study participants were 266 male and female educators from nine schools that cater for students with hearing, visual and intellectual disabilities in three cities in Saudi Arabia. The research participants completed a survey questionnaire and also answered interview questions. The collected data were analysed using SPSS and Leximancer for the quantitative and qualitative data respectively.

The main findings of the study are as follows. First, the assistive technologies that are commonly used in the sampled schools include computers, smart boards and iPads. The educators who took part in the study were of the view that assistive technologies help in the delivery of content and communication with students. From the perspective of the study's participants, the challenges that the sampled schools face with regard to technology use include lack of sufficient training for teachers, limited access to assistive devices, and limited finance to

support technology programs. These challenges can be addressed by providing adequate training for educators, providing the necessary assistive devices, and providing resources such a finance to support assistive technology programs. The main conclusions of the study are as follows: (1) the schools that were sampled use a variety of assistive technologies; (2) educators' gender and level of training influence the perceptions of educators towards assistive technologies; and (3) educators have positive attitudes towards assistive technology based on their experience with various assistive devices. Recommendations have been made on the need to train educators, provide the necessary assistive technologies, and focus on making teachers see the benefits of these technologies.

Certification of Originality

I certify that the work in this thesis is an original work of the student and is being submitted for the degree of Doctor of Philosophy from the University of New England. This thesis has not been submitted earlier, either to this university or to any other university. I also declare that the intellectual content of this thesis is the product of my own work, except where due acknowledgment is made in the thesis.

Signature of Candidate: 

Date 27/02/2019

Dedication

I dedicate this PhD thesis to my country, the Kingdom of Saudi Arabia, and to all educators in special education, especially those who are interested in hearing impairment, visual impairment and intellectual disabilities experienced by children.

Acknowledgments

First and foremost, I would like to express my deepest thanks and gratitude to the Kingdom of Saudi Arabia, which granted me the opportunity to finish my doctorate degree.

In my journey towards the degree, I have found a role model, and pillars of support in the guidance of my principal supervisor, Associate Professor Charles Kivunja, and my co-supervisor, Associate Professor Ahmed Bawa Kuyini. Their encouragement and endless support helped me to overcome difficulties during my studies. Without them, this research would not have been possible.

Finally, my acknowledgement would be incomplete if I did not express my gratitude to my beloved family; their support has helped me to pursue and achieve my dreams.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

AAIDD – American Association on Intellectual and Developmental Disabilities

ANOVA – Analysis of variance

ASNE – Administration for Special Needs Education

CDC – Centres for Disease Control and Prevention

CRPD – Convention on the Rights of Persons with Disabilities

dB HL – Decibels Hearing Level

DGSE – Directorate General of Special Education

GDP – Gross domestic product

ICT – Information Communication Technologies

IQ – Intelligence Quotient

KMO – Kaiser-Meyer-Olkin

LAD – Language Acquisition Device

LD – Legislation of Disability

M – Mean

OECD – Organisation for Economic Cooperation and Development

SD – Standard Deviation

SPSS – Statistical Package for Social Sciences

TDD – Telecommunication Devices for the Deaf

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNICEF – United Nations International Children's Emergency Fund

WHO – World Health Organisation

Chapter 1: Introduction

1.1 Introduction

This thesis reports the results of a study that was conducted to investigate how technology is used to help students with hearing, visual and intellectual disabilities in selected schools in Saudi Arabia. The thesis is divided into six chapters starting with this introductory chapter, which comprises ten sections. The second section provides background to the study, including information about disabilities, specifically hearing impairment, visual impairment and intellectual disability, and how they influence the lives of the affected individuals. Given that the study is about how technology is used to help students with the aforesaid disabilities to learn, the background to the study also provides details about the challenges that are associated with the disabilities and how the challenges can be overcome through the use of technology.

In the third section, I have provided definitions for the assistive technology and the disabilities (Hearing impairment, Visual impairment and intellectual disability) that my study focuses on. In the forth section, the context of the study, including information about Saudi Arabia, the setting of the study, the historical and current perspective of education in the country, and the state of special education in Saudi Arabia, is provided. The fifth section presents information about how technology is used to improve learning outcomes for students in different countries across the world. This links to the sixth section, which articulates the problem being investigated, this section highlights how technology is used to assist students with the aforementioned disabilities to achieve their learning outcomes. The research questions that guided the study in section seven, followed by the purpose of the study in section eight, and the objectives of the study stated in section nine. This is followed by section ten which provides

information about the significance of the research. Finally, the last section of this chapter outlines the structure of the entire thesis.

1.2 Background to the Study

According to article 1 of the Convention on the Rights of Persons with Disabilities (CRPD), "persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others" (United Nations, n. d.). This implies that with regard to education, children with disabilities are children who have long-term mental, physical, sensory or intellectual impairments that act as barriers that hinder their full and effective participation in educational activities on an equal basis with other children who do not have disabilities.

Depending on how disabilities are measured and defined, estimates of the incidence of children who have disabilities varies significantly across and within different countries (UNICEF & World Health Organization (WHO), 2015). By 2004, WHO estimated that there were approximately 93 million children aged 14 years and below living with severe or moderate disabilities (WHO, 2011). In the year that followed, an estimate by the United Nations Children's Emergency Fund (UNICEF) suggested that the number of children under the age of 18 who had disabilities was 150 million (UNICEF & WHO, 2015; WHO, 2011). Examples of the common disabilities that children across the world have include blindness, autism, visual loss, cerebral palsy, brain injury, hearing loss, learning and intellectual disabilities, Down syndrome, congenital anomalies, spina bifida, traumatic spinal cord injury, muscular dystrophy, and speech impairments (UNICEF & WHO, 2015; WHO, 2011).

In my role as an educator, I interact with students who have different types of disabilities that affect their ability to learn. I am also aware that various types of technologies have been developed across the world to help students who have disabilities achieve their learning objectives. I decided to focus on three types of disabilities – hearing, visual and intellectual disability. The three disabilities have been widely recognised in the government of Saudi Arabia, which has established special schools to cater to the learning needs of students with disabilities. Therefore, my focus was on getting an in-depth understanding about these disabilities; in addition, I sought to understand and how assistive technologies are used to help students who have these disabilities in schools in Saudi Arabia.

As mentioned above, students with any type of disability face challenges that hinder them from being fully and effectively involved in educational activities on an equal level with their peers who do not have disabilities. In addition, students with disabilities are more likely to be subjected to social exclusion and discrimination based on factors such as their gender, age, language, social status, religion, ethnicity (UNICEF & WHO, 2015). In some countries, children with disabilities also face challenges such as stigmatisation, poorly equipped schools, inappropriate curricula, and teachers who are insufficiently trained (Global Campaign for Education UK, n. d.). To ensure that children with disabilities have better opportunities to access education and attain the required educational outcomes, they need to be assisted. One way to help children with disabilities at home or school is the use of assistive technology (UNICEF & WHO, 2015).

Many of the learners who are affected by the disabilities that have been mentioned above are not able to benefit from the general public education systems that exist in most countries (Aldabas, 2015). Students with any of the aforementioned disabilities (hearing, visual

impairment, and intellectual disabilities) or other types of disabilities such as autism, spina bifida, Down syndrome and cerebral palsy can be said to have special educational needs. As a result of recognising such educational needs, the field of special education has been introduced in many countries to assist with the specific learning needs of children with disabilities (Aldabas, 2015).

A child is said to have special educational needs if she or he has a learning difficulty that makes it necessary for special educational provisions to be made (Frederickson & Cline, 2009). One of the characteristics that define a child who has a learning disability is a "disability which either prevents or hinders the child from making use of educational facilities of a kind provided for children of the same age in schools within the area of the local education authority" (Frederickson & Cline, 2009, p. 39). Notably, disabilities such as hearing impairments, visual impairments, and intellectual disability do hinder the ability of the affected students to use the educational facilities that are used by other students of comparable ages who do not have any form of disability.

As a result of realising the challenges posed by various types of learning difficulties, many countries across the world are making efforts to come up with systems of providing special education services to their students. In addition, different countries are making efforts to improve their special education systems each year (Aldabas, 2015). For instance, countries such as Brunei, Samoa, Vietnam, and Thailand have various legislations to ensure that children with disabilities not only have access to education but also get the support that they need to achieve their educational goals (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2009). Among the aforementioned countries, Thailand is a good example of the countries that have put in place measures to ensure that children with disabilities

get adequate support so that they can achieve the intended goals of education. In particular, Thailand has, through its Ministerial Regulations, issued in 2002, laid down conditions that, among other things, determine budget allocation for special education and mandate the provision of assistive technology devices and Braille as well as other appropriate teaching materials that are required for facilitating the education of children with disabilities (UNESCO, 2009).

Organisations such as UNESCO have also been at the forefront of advocating that children with disabilities be supported in their education. For instance, UNESCO has called on governments of countries across the world to lay appropriate modes of communication and support learners with disabilities by enabling access to the different types of technology and support that such learners require, such as computers and Braille for children with visual impairment (UNESCO, 2009). Also, one of the recommendations made by UNESCO in its 2009 report titled "Towards Inclusive Education for Children with Disabilities: A Guideline" is that governments should allocate adequate budgets to cater for the purchase and maintenance of the necessary technologies and assistive devices for children with different types of disabilities (UNESCO, 2009). UNESCO (2009) advocates that "teacher training must include a strong component of the most current information internationally including on technology and assistive devices for the success of education" (p. 97). This means that, in addition to providing the required technologies and assistive devices to help students with disabilities in learning, governments need to ensure that teachers have adequate knowledge of how to meet the needs of students with disabilities and how to use assistive devices to teach them.

Despite the efforts made by different governments to promote education for children with disabilities, and in spite of concepts such as inclusive education being promoted by international organisations such as the UNESCO and UNICEF, many barriers still hinder the full involvement

of children with disabilities in education (UNESCO, 2009; UNICEF, 2013). Inclusive education means "the placement of children with disabilities in regular education classrooms with children of the same age who do not have disabilities" (Dash, 2006, p. 21). The underlying premise of inclusive education is that it makes it possible for all children to learn and have a sense of belonging to the mainstream school as well as to community life (Dash, 2006). However, implementing inclusive education has remained a challenge in many countries because of issues such as lack of information and discriminatory attitudes towards people with disabilities at all levels of society (UNESCO, 2009). Despite the fact that the United Nations, through the CRPD, defines inclusive education as a human right (Grönlund, Lim & Larsson, 2010), there are still many challenges in providing inclusive education in many countries across the world.

Saudi Arabia is among the nations that have made efforts to develop and improve their special education systems. In particular, over the years, Saudi Arabia's special education system has changed to offer better support for the learning needs of children with disabilities by ensuring that such children get the same educational experience as those without disabilities (Aldabas, 2015; Alothman, 2014; Pinkton, 2014). In relation to this, Alnaim (2015) notes that the Saudi Arabian education system has paid attention to the area of special education needs, especially in terms of providing assistance for children with learning disabilities. It is further indicated that Saudi Arabia has paid specific attention to special education services over the last 15 years. The increased attention is reflected in the growing number of special education services that are provided (Alnahdi, 2014).

However, according to Alnahdi (2014), the notable growth in the provision of special education services has not been followed by the creation of the necessary support services that are required to ensure that the special education programs run smoothly. For instance, lack of

equipment such as computers to support the use of assistive technologies in teaching children with disabilities has been identified as one of the limitations to the use of technology in special education institutions in Saudi Arabia (Alfaraj & Kuyini, 2014). In addition, Alnahdi (2014) notes that there has not been adequate provision of appropriate educational placements to support special education services and therefore it is becoming a prevailing issue at hand.

Additionally, Alnahdi (2014) argues that the expansion of special education services in Saudi Arabia has not been evaluated with respect to how special education is applied, the quality of output, or the continued development of special education services. Further, Alnahdi (2014) states that "it remains clear that the quality of these services has not improved significantly and the outcomes associated with these services have not changed" (p. 85). On the basis of Alnahdi's statements (2014), the current study was conducted to evaluate how technology is used to help students with disabilities; to assess the challenges that schools face in their efforts to use technology in teaching students with disabilities; and to examine the perceptions that educators have towards using technology to meet the educational needs of students with disabilities.

1.3 Definition of terms in research

Assistive technology can be defined as a wide range of strategies, tools and services that suit a person's needs, tasks, abilities, and comprises an assessment of the needs of an individual with a disability or a combination of disabilities (Ahmad, 2015). In addition, assistive technology is a functional assessment of the person's environment, as well as the "selection, designing, fitting, customization, adaption, application, maintenance, repair, and replacement of assistive technology services, and their coordination with the existing education and rehabilitation plans and programs for inclusive development" (Ahmad, 2015, p. 64). In short, assistive technology entails all the adaptive as well as rehabilitative devices that can be used by individuals with

disabilities to help in compensating for the lack of certain abilities (Ahmad, 2015). The most important concept presented by Ahmad (2015) in regard to assistive technology is that appropriate use of assistive technology goes beyond simply purchasing a given technology; it involves an evaluation of an assistive technology user's needs, the use environment, and how relevant and fitting the technology is for the targeted user.

It is argued that assistive technology is the initial step in any effort to help children with disabilities (UNICEF & WHO, 2015). This is because assistive technologies are necessary for helping children with disabilities to play with other children, and to go to school and get educated, hence becoming successful citizens who can make contributions to society (UNICEF & WHO, 2015). In fact, assistive technologies are recognised by many organisations and institutions, including the United Nations CRPD, as an important concept in helping children with disabilities. As such, various CRPD articles urge member states to ensure that assistive technologies are available at an affordable cost as a first step in helping children with disabilities (UNICEF & WHO, 2015). Therefore, students with disabilities such as hearing impairment, visual impairment, and intellectual disability need to be assisted so that they can learn like their peers who do not have any of these disabilities. The type of assistance required for students living with any of these disabilities depends on how the disability affects each individual.

Hearing impairment or deafness is defined as the "reduced function or loss of the normal function of the hearing mechanism" (Inciong, Quijano, Capulong, Gregorio & Gines, 2007, p. 205). Children with hearing impairment are unable to hear and understand human speech well, and this prevents them from taking part fully in classroom activities such as expression through written language and listening, and from benefiting sufficiently from the instruction that is provided at school (National Council for Special Education, 2014; Power, 1998). Children with

hearing impairment require assistance such as hearing technology and teaching practices, including the use of sign language, to promote the participation of the affected child, (National Deaf Children's Society, 2015).

Visual impairment is a term that is commonly used to describe a wide array of types of vision loss (Zimmerman & Zebehazy, 2011). Thus, visual impairment is related to the terms "blindness" and "low vision". Blindness or total blindness implies that the affected person is unable to perceive light and is, therefore, unable to tell the difference between darkness and light (Zimmerman & Zebehazy, 2011). Low vision is a concept that is used to describe the loss of vision and, like visual impairment or blindness, is vaguely defined as a level of vision that ranges from residual vision to severely impaired (Zimmerman & Zebehazy, 2011). Low vision implies that after correction, a child or student has some level of vision that is functionally available for learning (Croser, 2015). With regard to blindness, in legal terms a person is said to be blind if, when using contact lenses or glasses, he or she can only see at a distance six metres (20 feet) or less those objects that an individual with normal eyesight can see at a distance of 60 metres (200 feet) (Pagliano, 1998). Overall, children with a visual impairment may have a visual disability that is so severe as to significantly impair their ability to see, thus hindering their capacity to perceive materials that are presented visually, such as text, diagrams and pictures (National Council for Special Education, 2014).

Intellectual disability is defined by the American Association on Intellectual and Developmental Disabilities (AAIDD) as a condition that is characterised by "significant limitations in intellectual functioning and adaptive behavior" (Brue & Wilmshurst, 2016, p. 12). Some of the aspects that characterise intellectual disability include intellectual functioning that is below average, coupled with related limitations in two or more areas of adaptive behaviour such

as self-care, communication, functional academics, self-direction, social skills, home living, work, leisure, health and safety, and community use (Ashman, 1998). These problems must have arisen during an individual's developmental period (i.e., before the age of 18) (Ashman, 1998; Brue & Wilmshurst, 2016). The most obvious attribute of children with intellectual disability is that they experience significant difficulty learning almost everything that other children learn relatively easily (Westwood, 2009). This is because children with an intellectual disability tend to be slow at thinking, unable to reason deeply, and have difficulty remembering, planning ahead and adapting to new situations. (Westwood, 2009). Support is required for children with intellectual disability to make the learning process more enjoyable, interactive and engaging for the affected children. This requires the use of assistive technologies such as computer-assisted instruction, audio recorders, and self-operated prompting devices (Gargiulo, 2015).

1.4 Context of the Study

The setting of the study was in various institutions in three regions of Saudi Arabia (Riyadh, Jeddah, and Dammam). The study involved carrying out an investigation to determine how technology is used in the teaching of students with the aforementioned types of disabilities. This section provides an overview of Saudi Arabia as a country and also discusses the historical and current information about special education in the country. The information about Saudi Arabia includes the county's geographical position and population. The historical and current information provides an overview of how special education in Saudi Arabia has evolved over time.

1.4.1 Overview of Saudi Arabia

The Kingdom of Saudi Arabia is an Asian country in the Middle East region. It borders the Red Sea and the Arabian Gulf as well as seven countries: Jordan, Iraq, Kuwait, Qatar, the United Arab Emirates, Oman and Yemen (see Figure 1.1).

Figure 1.1: Map of Saudi Arabia showing some cities and the country's borders

Saudi Arabia is the largest country in the Middle East region, with a total land area of 2,149,690 square kilometres (Trading Economics, 2018a). Based on 2018 estimates, the country's population is 32.6 million (Trading Economics, 2018b). There has been a significant population growth in the country given that the nation had just four million people in 1960 (Trading Economics, 2018b). A door-to-door nationwide census that was conducted in Saudi Arabia in 2013 indicated that approximately 0.8 percent of the country's total population had a disability (Altamimi, Lee, Sayed-Ahmed & Kassem, 2015).

With regard to education, in recent years the Saudi Arabian government has had strong budgets for the development of general education. The government also provides strong support

for the sustained growth of the education sector. According to the U.S.-Saudi Arabian Business Council (n.d.), there has been an upward trend of budgetary allocations for education in Saudi Arabia, which is indicative of the government's belief that "education is the cornerstone of sustained economic development" (U.S.-Saudi Arabian Business Council, n.d; p. 4). This is because education enhances human knowledge and capital, which are essential ingredients of social cohesion and economic growth. Saudi Arabia's public expenditure for education stands at 5.7 percent of the country's gross domestic product (GDP), which is comparatively high in relation to some countries in the developing and developed worlds. For instance, public expenditure for education as a percentage of GDP stands at 4.2 percent for South Korea, 4.3 percent for Germany and 5.3 percent for the UK (U.S.-Saudi Arabian Business Council, n.d.).

1.4.2 Historical and current perspective of education in Saudi Arabia

Saudi Arabia established the Ministry of Education in 1954. It was charged with the responsibility of establishing public primary schools for boys. This replaced the 1925 Directorate of Education, which had been under the Ministry of Interior (Pavan, 2013; Royal Embassy of Saudi Arabia, Washington DC., 2014; Wynbrandt, 2010).

The current system of education in Saudi Arabia is premised on the contents of the Education Policy Document that was issued in 1969 by the Saudi Council of Ministers. Under the policy document, there are several organisations that work in collaboration to regulate, oversee, develop and implement laws that pertain to the system of education in Saudi Arabia. The organisations involved comprise the Ministry of Education, the Technical and Vocational Training Corporation, and the Ministry of Higher Education. Saudi Arabia's education system comprises two broad categories: general education and higher education. Private and public schools follow the same curriculum, general policy, and instruction methods. General education

involves 12 years of school attendance, starting with elementary school at the age of six years while higher education comprises the training that is received at any of the various colleges, vocational training institutions, and universities. More than 90 percent of Saudi Arabian students study in public schools (U.S.-Saudi Arabian Business Council, n.d.).

Under the current Saudi Arabian education system, the Ministry of Education is in charge of primary schools up to the sixth year, years 7–9 intermediate schools and boys' secondary schools for years 10, 11 and 12. The ministry also oversees the implementation of policies and compliance requirements in Saudi Arabia's privately-owned schools while the Ministry of Higher education oversees universities (Al-Dali et al., 2013). The Technical Education and Vocational Training Corporation and the Human Resource Development Fund are responsible for vocational and competency training (Royal Embassy of Saudi Arabia, Washington DC, 2014).

The government of Saudi Arabia has made remarkable efforts in enhancing the country's educational system in recent times by coming up with new education programs, establishing research and development initiatives, and building several schools and higher education institutions (U.S.-Saudi Arabian Business Council, n.d.).

1.4.3 Special education in Saudi Arabia

Special education started in Saudi Arabia in the 1950s, with the individual efforts of three Saudis – Alswaid, Almufda, and Alhusain – who learned the Braille alphabet in Arabic to teach other Saudi Arabian citizens who were visually impaired how to read and write (AlShahrani, 2014). At this time, the government did not provide special education services for children with disabilities. As such, children with special needs relied entirely on their parents for any kind of support in terms of education (Aldabas, 2015). When the training for Braille started, the services

were only available for visually impaired adults. Children were not considered, and the special education service did not consider other disabilities (Aldabas, 2015).

An increase in the adoption of special education in Saudi Arabia was witnessed when some community colleges and schools started offering after school (evening) lessons for blind people in 1957 (AlShahrani, 2014). In 1958, after the initiative of teaching blind people had been deemed successful, the Ministry of Education in Saudi Arabia established the first formal after school class sessions at Jabrah Primary School. The classes grew rapidly, both in terms of the number of students and the spectrum of special needs that were catered for in addition to visual impairment (AlShahrani, 2014).

In 1960, the Saudi Arabian government established the first special education institution, called the Al Noor Institute for the Blind, in Riyadh (Aldabas, 2015; Al-Mousa, 2010). Al Noor Institute for the Blind was an institution that catered for the educational needs of visually impaired individuals and formed the foundation for public special education in Saudi Arabia. With the support of the Ministry of Education, Al Noor Institute for the Blind educated male individuals. The institution trained individuals of various ages from elementary school to middle school and high school. The curriculum used at Al Noor Institute was the same as the curriculum for general education, but instruction was adapted to meet the special needs of learners with visual impairments (Aldabas, 2015).

The establishment of Al Noor Institute was followed by the creation of other institutes for the deaf, intellectually disabled and blind individuals (Al-Mousa, 2010). As a result, there has been a noticeable increase in the number of special education institutions as well as the number of students studying at these institutions (Al-Mousa, 2010). For instance, in 1964 three institutes were established in Mecca, Aneaza and Alhofouf to cater for the needs of individuals with visual

impairments (Aldabas, 2015). In the same year, the Al Noor Institute for visually impaired girls was created and offered educational as well as training services for girls with visual impairments (Aldabas, 2015). Alongside the aforementioned developments, the Administration for Special Needs Education (ASNE) was established in 1962 (AlShahrani, 2014). The institution was attached to the Ministry of Education and was in charge of overseeing the provision of vocational and educational support to all students with special needs, though the organisation's initial mandate was to serve three main groups: the visually impaired, learners with hearing impairments, and learners with cognitive disabilities (AlShahrani, 2014).

The first institute to cater for the needs of learners with hearing impairments was Al Amal Institute. The Ministry of Education in Saudi Arabia established two Al Amal Institutes in Riyadh in 1964, one for girls and another for boys (Aldabas, 2015; Bin Battal, 2016). Al Amal Institute focused on teaching sign language and used an adapted general education curriculum to meet the needs of students with hearing impairments (Aldabas, 2015).

The Ministry of Education in Saudi Arabia upgraded ASNE to a full governmental organisation called the Directorate General of Special Education (DGSE) to deal with the special learning needs of people with visual impairments, hearing impairments and the learning disabled. The main roles of DGSE were to train educators, launch new programs, conduct inspections, provide teaching materials and equipment, develop and modify curriculums, and to provide educational management and improvement. Over the years, the DGSE has undergone tremendous development and now has divisions that cover developmental disabilities, physical and multiple disabilities, and learning difficulties (AlShahrani, 2014).

Concomitant with the changes that have been implemented regarding the provision and management of special education over the years, Saudi Arabia has also made changes in laws to

support people living with disabilities. Al-Mousa (2010) notes that, in regard to regulations and legislation relating to people with disabilities, the ministries of Social Affairs, Health, and Education have been making significant efforts to come up with policies and draft organisational bylaws since the initial days of special education and rehabilitation initiatives in Saudi Arabia. Notable legislation includes the Legislation of Disability (LD) that was passed in 1987 and the Disability Code that came into effect in 2000 (Alquraini, 2011). The LD contains important provisions that seek to ensure that people with disabilities have the same rights as able people in Saudi Arabia (Alquraini, 2011). Similarly, the Disability Code seeks to ensure that individuals with disabilities have rights to resources such as "a free appropriate public education" (Al-Mousa, 2010, p. 15).

Currently, there are many institutions in Saudi Arabia offering special education based on the segregation model (where there is a separation of genders) as well as mainstreaming (where children with disabilities are integrated with others who do not have disabilities) in public schools (Al-Mousa, 2010; Bin Battal, 2016). This means that currently, the provision of education to children with disabilities in Saudi Arabia is done through both mainstreaming and the use of special institutes. Special institutes are defined as "separate schools, special schools, or special education schools", and they include learning institutions for the deaf, learning institutions for the intellectually disabled and learning institutions for the blind (Al-Mousa, 2010, p. 17).

1.5 How Technology is used to Improve Learning Outcomes for Students with Disability/ Special Needs in Different Countries

There is a great potential for using technology to enable access to education for all learners, regardless of whether the children have disabilities or not (Ahmad, 2015). As noted above, assistive technology can be used to help in compensating for the lack of some abilities those children with disabilities or special needs have. Such technologies range from low-tech equipment such as special grips for pens to more advanced equipment such as glasses, hearing aids, to more sophisticated equipment like computers with specialised software to perform different tasks (Ahmad, 2015).

According to UNICEF and WHO (2015), when relevant to the user as well as the user's environment, assistive technology is a powerful tool that can help increase independence among children with disabilities and also improve their participation in different activities. This is because the technology helps children with disabilities with regard to mobility, communication, and hearing, and by enabling them to engage more fully in learning activities. Moreover, assistive technology provides the means for children with disabilities to engage in social and recreational activities, helps in increasing their self-esteem, and reduces the cost of educational services and individual support for children with disabilities (UNICEF & WHO, 2015). Some examples of assistive devices or technologies and the ways in which they help children with disabilities are highlighted in Table 1.1 below. The extent to which the use of technology improves the learning outcomes for students with disabilities or special needs varies in different countries. In particular, the developed countries in Western Europe and North America have made significant progress in inclusive education (Ahmad, 2015). In fact, most of the literature that exists about the use of assistive technology to help children with disabilities achieve the desired educational outcomes is based on studies that have been carried out in developed countries (Ahmad, 2015).

Table 1.1: Examples of assistive devices/technologies and the ways they help children with disabilities

Category of disability	Examples of assistive devices/technologies
Mobility	• Crutch, walking stick, manually powered wheelchair, walking frame and tricycle. • Artificial hand or leg, clubfoot brace, hand or leg splint. • Standing frame, supportive seat, corner chair. • Adapted cooking utensils and cutlery, shower seat, dressing stick, feeding robot, toilet frame, and toilet seat.
Vision	• Magnifier, eyeglasses, magnifying software to facilitate computer use. • GPS-enabled navigation device, white cane. • Braille systems for writing and reading, computer screen reader, audio player and recorder, talking book player. • Braille chess and balls that produce sound.
Hearing	• Hearing aid, headphone. • A hearing loop, amplified telephone.
Communication	• Communication board with symbols, pictures or letters, communication card with text. • Electronic communication gadget with synthetic or pre-recorded speech.
Cognition	• Picture schedule and calendar, picture-based instruction, talk list • Manual or automated reminders, timers, smartphones with schedules, task lists, and calendars, and audio recorder • Adapted games and toys.

Source: UNICEF and WHO (2015 p. 15).

In their study, Grönlund et al. (2010) mentioned a study that was conducted in Canada to examine how students with special needs can be helped using assistive technology to transition smoothly from elementary school to secondary school. Another study, also mentioned by Grönlund et al. (2010), was an investigation carried out in Norway to determine how Braille and other assistive technologies, as well as environmental factors, affected the literacy and learning of 11 students with severe visual impairments. The two cases show that assistive technologies are not only being used in developed countries, but studies are also being conducted to determine the impact of using such technologies on children with disabilities in those countries.

In the United Kingdom, AbilityNet, a charity organisation that helps disabled children and adults to use computers and technologies like the Internet by adjusting and adapting their technology (AbilityNet, 2017), has outlined some of the products that are used to help preschool children with disabilities and how they are used. The first kind of technology is switches that are used by young children with learning difficulties to make it easier for them to use either a computer or a battery-operated toy (AbilityNet, 2009). The switch can be controlled using any part of the body, thus making it possible for even those children with severe physical difficulties to use computers. Various types of switches are available to choose from depending on the needs that a child has, and include small and large switches, soft switches, pressure adapted switches, and touchpad switches (AbilityNet, 2009).

Another device that is used to help children with disabilities use equipment such as computers is the touch monitor. According to AbilityNet (2009), touch monitors can be particularly helpful for children who have difficulty comprehending the connection between the movement of a mouse and the position of the cursor on the screen. It is noted that some children face challenges when using switches because the switch may be too indirect. As such, pointing something is a more natural way to communicate; therefore, the use of a touch screen monitor seems more comfortable given that the user simply has to touch the screen to get a response (AbilityNet, 2009). Other devices include alternative mouse devices, large keyboards with lower case letters, and keyboards with high visibility stickers (AbilityNet, 2009).

Countries like Japan and the United States are leaders not only in the use of technology to support the needs of children with disabilities, but also in manufacturing different types of technologies to assist people with disabilities (Solomon & Bhandari, 2015). Furthermore, Solomon and Bhandari (2015) note that Japan and the United States are the major sources of

innovations related to technology. Specifically, the major strengths of the United States with regard to technology lie in technology for vision restoration, such as intraocular devices, as well as in other closely related technologies such as hardware for assistive devices. The major strengths that Japan has in regard to technology for hearing assistance include language or voice recognition technology, technology for converting sound voice to video or text, and speech recognition technology (Solomon & Bhandari, 2015). Oira (2014) argues that overall, students with disabilities in developed countries like the United States, Australia, and Canada have access to a wide range of advanced assistive technologies that enable them to work independently in various areas of academic work and socialisation and share in different areas of education.

In contrast to developed countries, developing nations face many challenges in their attempts to fulfil the requirements of inclusive education (Grönlund et al., 2010). Specifically, developing countries in Asia, Eastern Europe and Africa are said to have notable difficulties in the implementation of inclusive education, including the use of assistive technologies to support children with disabilities (Ahmad, 2015). Some of the barriers that prevail with regard to the successful implementation of inclusive education include low government support, policies and legislation that are inadequate or ineffective, insufficient funding, insufficiently trained teachers and support personnel, and ineffective and insufficient use of assistive technologies (Ahmad, 2015).

A number of developing countries show that where assistive technologies are used to assist learners with disabilities, such devices are mostly low-tech and basic equipment. For instance, a study conducted by Palmer, Groce, Mont, Nguyen and Mitra (2015) on the economic lives of disabled people in Vietnam suggested that the most commonly used assistive devices were basic equipment such as crutches, walking sticks, and spectacles. In addition, the study

found that there was a significant unmet need for assistive devices such as hearing aids, wheelchairs and prostheses. Such devices are regarded as “modern” in Vietnam and are costly and not easily accessible (Palmer et al., 2015).

A study conducted by Eunice, Nyangia and Orodho (2015) in Kenya aimed at determining the challenges that face the implementation of inclusive education in public secondary schools in one of the rural regions of the country revealed a number of issues. From their view, physical as well as critical learning and teaching resources were either insufficient or run-down. This implies that important facilities such as assistive devices that children with disabilities need for their education were missing in the schools examined in the study. This situation exists despite the fact that in 2009 the Kenyan government developed a document called “The National Special Needs Education Policy Framework” to ensure that the needs of children with special needs are catered for, including the provision of assistive technologies and devices for such children (Republic of Kenya, 2009). Furthermore, Eunice et al. (2015) found that there was an inadequate number of teachers with specialised knowledge to handle the needs of children with special needs. Eunice et al. (2015) also found that there were social and cultural issues such as stigmatisation of students with disabilities that hindered the effective delivery of teaching in many of the schools that were sampled. Past studies demonstrate that issues such as exclusion and stigmatisation of children with disabilities or special needs are rife in many countries.

Despite the abovementioned challenges, Kenya has many special needs schools that use assistive technologies and devices to help learners (Nguyo, 2015). Even then, most of the assistive devices are basic equipment such as Braillers and slate and stylus devices (Oira, 2014). Grönlund et al. (2010) also found that although Kenya, Tanzania, and Bangladesh have

legislation that advocates support for children with special needs with regard to their education, these countries only have very basic assistive technologies to support children with different disabilities. In some cases, even basic technologies or devices that are required to facilitate special needs education such as crutches, Braille and glasses are lacking (Grönlund et al., 2010).

Closer to Saudi Arabia, a study that was conducted by Dandashi et al. (2015) in Doha, Qatar proposed an education system created specifically to assist children with intellectual disability by enabling such children to receive an enjoyable learning process and helping address the need to integrate physical activity into the daily routines of such children. Among other issues, this study was informed by the fact that disabled children and youth account for 0.4 percent of the Qatari population, and nearly two million people in Egypt are disabled (Dandashi et al., 2015). As such, an edutainment system would be beneficial not only to people in Qatar, but also those in nearby Arab-speaking countries as it would help children to learn, play, communicate and be more independent in their lives. The significance of the proposed edutainment system is notable given that the assistive technology is Arabic-based. It was found that 94 percent of the children who were tested in regard to the use of the edutainment system demonstrated high levels of motivation irrespective of their coordination or score performance (Dandashi et al., 2015). Therefore, as Dandashi et al. (2015) highlight, even though developing countries face many challenges with regard to the adoption of assistive technology to support the needs of children with disabilities, efforts are being made to access such technologies and ensure that they are relevant to the needs of the targeted users.

1.6 The Problem Investigated

While many technologies have been developed to help students living with a disability overcome some of the problems that they face, they have not been adopted on an equal scale in all countries. A number of factors affect the adoption of these technologies in different countries. For instance, as a developing country, Saudi Arabia is likely to have a low level of adoption of technologies that assist in learning for students with disabilities compared to developed countries such as the United States and Australia due to the economic and technological differences that exist between developed countries and developing countries. This point was discussed in detail in the preceding section. There are also cultural factors that cause differences in the level of adoption of such technologies in various countries (Albar & Hurst, 2012).

It is also worth noting that the current literature on the use of assistive technologies in Saudi Arabia is quite limited. Only a few studies that provide an exploration of the use of technology to support student learning in Saudi Arabia have been located. These studies, which are small-scale and/or focused on one area of disability, include studies by Alkahtani (2013); Alfaraj & Kuyini (2014); and Alnahdi (2014), all of which found that technology is not adequately used for various reasons. For example, Alnahdi (2014) observes that high-tech assistive devices are not regularly used in the Saudi Arabian context because, in addition to the accessibility challenges (due to language barriers and high costs), most teachers are not well trained to help their students use them in a classroom setting. In addition, a review of teachers' knowledge about the use of assistive technologies conducted by Alkahtani (2013) revealed that 72.4 percent of all the sampled teachers did not have any knowledge on how to use assistive technologies. This revelation emphasises the need to have more training for teachers in Saudi

Arabia so that they can embrace the assistive technologies and even encourage their schools to purchase the same for students.

Furthermore, the use of assistive technologies in Saudi Arabia can be described as wanting. Seemingly, there are several factors that jointly disadvantage the kingdom from fully utilising assistive technologies. However, most of such challenges can be overcome through, for example, working with the developers of technologies to custom-make them for the Arab speakers, or training teachers in order to make them more competent in training their students in their use. It is worth noting that despite the challenges, some schools in Saudi Arabia have embraced the use of simple yet effective assistive technologies. Such technologies include projectors, hearing aids, and loudspeakers. This situation could be interpreted to mean that there is a willingness to adopt the use of assistive technologies subject to accessibility and ease of use. Against this background, it is important for a study to be conducted to explore how schools use technology in relation to assisting students in Saudi Arabia with the aforementioned impairments.

1.7 Research Questions

The study was guided by the following questions:

1. What types of technological tools are used in the selected schools for students with a disability (hearing impairment, visual impairment, and intellectual disability)?
2. How do variables such as gender, training, and teachers' experience affect the educators' perceptions about the use of technology to support the learning of students with disabilities?

3. What experience do educators have with regard to the use of technology to support the learning of students with disabilities?
4. What challenges do educators face when using different assistive technologies while teaching students living with any of the three types of disabilities (hearing impairment, visual impairment, and intellectual disability)?
5. What can be done to improve the use of technology to support the education of students with these disabilities?

1.8 Purpose of the Study

As noted above, the aim of this study was to investigate how technology is used to help students with hearing impairment, visual impairment and intellectual disability in Saudi Arabia. These three disabilities were selected for the study because they are the most recognised groups and the Saudi Arabian Ministry of Education has provided more e-services to schools with these groups than other disability groups (Al-hano, 2006; Miller & Kiani, 2008); hence, it was deemed important to study the disabilities together.

1.9 Objectives of the Study

The specific objectives of the study were as follows:

1. To investigate how technology is used to enhance learning for students with hearing impairment, visual impairment and intellectual disability in Saudi Arabia.
2. To examine the challenges faced by schools in the implementation and/or use of technology for learning by students with the aforementioned disabilities in Saudi Arabia.

3. To examine the perceptions that Saudi Arabian teachers have in relation to the use of technology while educating students with the said disabilities.

1.10 Significance of the Research

This study will help fill a gap in knowledge regarding the use of assistive technologies in learning in Saudi Arabian schools. Based on the information provided by Alfaraj and Kuyini (2014), it is evident that children with disabilities are not always given the same consideration as their peers who do not have disabilities with respect to the use of technology in learning, despite the Saudi Arabian government's efforts to ensure equality. In addition, as argued by Alnahdi (2014), it is not clear whether the provision of services to help individuals with disabilities obtain their educational needs has improved or changed despite the increase in the level of attention that the Saudi Arabian government gives to special education.

Through the findings of this research, policymakers should be able to determine which of the suggested issues need urgent action. For example, the literature review section identified that the language barrier hinders usage of some assistive technologies since most are designed and developed for English and Spanish users. The findings of this study can, therefore, confirm to policymakers that the language barrier is actually a challenge. It will, therefore, be upon the policymakers to decide whether to work with established assistive technology developers or try homemade solutions to develop assistive technologies in the Arabic language.

Arguably, current literature on the use of assistive technologies in Saudi Arabia (Chapter 2) is not fully comprehensive. For example, it is difficult to find the exact types of assistive technologies that are in use and their efficacy. Therefore, the study findings will considerably help to fill the gap in existing knowledge.

Overall, the study findings constitute a comprehensive document that details the existing assistive technologies that are in use in Saudi Arabian schools, the skills needed in order for students to effectively use particular assistive technologies, educators' perceptions about existing and other assistive technologies, the challenges faced in the usage of assistive technologies, and the improvements needed in order to enhance the use and efficacy of assistive technologies in schools across Saudi Arabia. The comprehensive nature of the study acts as a major resource for educators, policymakers in the education sector, and other stakeholders, including parents of students living with hearing impairments, visual impairments and intellectual disabilities.

1.11 Structure of the Thesis

As stated earlier, the thesis comprises six chapters. These are organised as follows. The first chapter, presented here, is the introduction and provides background information about the study topic. It also identifies the research problem, the context and aims of the study, and the research questions. It also presents the significance of the research. The second chapter presents the literature review. The chapter reviews some of the existing literature that relates to various types of disabilities (hearing impairment, intellectual disability, and visual impairment) and how they affect individuals, as well as features of the learning problems associated with the disabilities. The literature review chapter also discusses the situation in Saudi Arabia as it pertains to the three kinds of disabilities, whereby the various types of assistive technologies used in helping individual affected by the disabilities are discussed. The third chapter discusses the research methodology that was used in the study. This includes the research paradigm, research design, the study's participants, the data collection instruments that were used, how data were collected, and how the data were analysed. Chapter four presents the results and the data

that were collected regarding demographic characteristics. It includes both the quantitative results and qualitative results. The fifth chapter presents a discussion of the findings in terms of relevance and implications. The sixth chapter summarises the details of the thesis, outlines the limitations of the study, and provides recommendations based on the implications of the findings.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews some of the existing literature that relates to various types of disabilities (hearing impairment, visual impairment and intellectual disability) and how they affect individuals, as well as features of the learning problems associated with the disabilities. The chapter also discusses the situation in Saudi Arabia as it pertains to the three kinds of disabilities, discussing the various types of assistive technologies used in helping individuals affected by the disabilities. Five specific areas are covered in the literature review. First is the nature of hearing, visual and intellectual impairment. This section contains a discussion on the definition as well as the nature of each of the three disabilities and the characteristics of the individuals who are affected. The second area is the characteristics of learning difficulties associated with the three disability types. This section presents a review of literature relating to how each of the three disabilities impairs the ability of the affected students to attain learning outcomes as compared to students who do not have any of these disabilities. The third section is a discussion of the different types of assistive technologies used to support learning for children with any of the three disabilities that are the focus of this study, and the benefits of using these technologies. The fourth section presents the context of the study by discussing how various research studies have reported on the use of technology to assist students with disabilities in Saudi Arabia. Finally, the fifth section addresses the gap in the literature stating that assistive technologies have not become widely entrenched in schools.

2.2 Nature of Hearing, Visual and Intellectual Disabilities

Individuals living with hearing, visual and intellectual disabilities face different challenges depending on the severity of disability that they have. While there are many studies about hearing impairment and visual impairment (e.g. Jamal, Daghistani & Zakzouk, 2001; Fageeh, 2003; Al-hano, 2006; Alfaraj & Kuyini, 2014), there are not many studies focusing on intellectual disability in Saudi Arabia. Therefore, a study of the three disabilities is essential.

It is important to understand each of the three disabilities in terms of how each one impacts the affected individuals and the challenges that these individuals face with respect to learning and interacting with others, including teachers and their colleagues. Overall, it has been noted that people who are born with any kind of disability or who become impaired at some stage of their life encounter many problems in comparison to individuals who do not have any disability (Kbar, Al-Daraiseh, Aly, Abidi & Mian, 2016; Kbar, Bhatia, Abidi & Alsharawy, 2016). The nature of the three disabilities that are the focus of this review is described below.

2.2.1 Hearing impairment

Hearing impairment is a condition that affects people of all ages and can occur at any point in the lifespan of an individual, from infancy to old age (Ollendick & Schroeder, 2003). As noted by Hasselbring and Glaser (2000), students who have a hearing impairment are those who have a hearing problem that interrupts their capacity to process linguistic information via the normal auditory processes or without amplification of the information. The hearing disability or impairment reduces the affected individual's ability to perform tasks such as listening, comprehending speech, and speaking (Inciong, Quijano, Capulong, Gregorio & Gines, 2007, p. 205). Northern and Downs (2002, p. 341) define hearing impaired children as "all children with hearing loss who are handicapped to such an extent that some form of special education is

required" to enable them to learn (p. 341). This definition takes into account the broad features of profound hearing loss in which the affected individuals are traditionally referred to as "deaf".

Inciong et al. (2007) also describe hearing impairment and the various forms in which it occurs. They state that, that with reference to the age at which the problem starts, hearing disability can be termed congenital if the condition is present when a baby is born or adventitious when the individual acquires it after birth or at an older age. Inciong et al. (2007) also note that the time at which a hearing impairment arises in regard to the normal development of speech when a child is aged two years or thereabouts is another factor that is used to classify the hearing disability. They state that when hearing loss occurs prior to a child learning to talk, the condition is described as prelingual hearing impairment. Conversely, when a hearing disability occurs after the child has learned to talk, usually at the age of two, it is termed post lingual. Prelingual hearing impairment is considered as profound hearing loss while post lingual is considered as a mild hearing loss. Therefore, the use of telecommunication devices for the deaf (TDD) are suitable for both prelingual and post lingual forms of hearing loss.

According to Inciong et al. (2007), there are also differences in terms of how a hearing impairment affects an individual. From this point of view, a person who is deaf is one who is unable to use hearing to listen, comprehend speech or speak without the use of special adaptations, especially in the visual form. This is because whereas a hearing device amplifies sound by raising the volume to make it louder, an individual who is deaf is not able to comprehend speech using the ears alone. Inciong et al. (2007) indicate that such individuals may be capable of making sense of some words, but their sense of hearing is not adequate or is not functional for the normal uses in life. There are also individuals who are hard of hearing or have partially hearing (Westwood, 2008). Inciong et al. (2007) further argue that hard of hearing

individuals have a considerable hearing loss but can perceive sounds and respond to speech as well as other auditory stimuli with or without the aid of a hearing device. In the strictest sense of the word “deaf”, the aforementioned people whose disability is categorised as hard of hearing cannot, therefore, be described as being totally unable to hear since they can use audition or listen to auditory actions (Heckendorf, 2009). Conversely, people whose hearing disability is categorised as “deaf” have to largely depend on visual stimuli while taking part in activities such as learning or interacting with other people (Heckendorf, 2009).

Hearing impairment can be categorised with regard to the severity as well as the degree to which the impairment impacts a person’s reception of sound. The degree of hearing impairment is measured by an audiogram and the measurement is recorded in terms of decibels hearing level (dB HL), which is a measure of sound in dB relative to the lowest level of sound that a young and healthy person should be able to hear (Lim & Simser, 2005). Based on this measurement, children with a normal level of hearing sensitivity are capable of perceiving sound intensities in the range between 20 dB HL and 25 dB HL, or softer in a room that is quiet (Lim & Simser, 2005). Further information about the levels of hearing impairment and the effects that characterise each level is provided later in the literature review under the subsection titled “Learning problems for the hearing impaired”.

2.2.2 Visual impairment

The term “visual impairment” or “vision impairment” is widely used to describe a wide range of types of vision loss (Zimmerman & Zebehazy, 2011). In general terms, children and adults with vision impairments have restricted or no use of their vision (Poon-McBrayer & Lian 2002). Visual impairment is thus described in relation to the terms “blindness” and “low vision”. Blindness or total blindness means that the affected person is not capable of perceiving light and

is thus not able to tell the difference between darkness and light (Zimmerman & Zebehazy, 2011). In contrast, low vision is a term that is used to describe the loss of vision, and in the same way as blindness or visual impairment, is loosely defined as a level of vision that ranges from limited vision to severely impaired (Zimmerman & Zebehazy, 2011). The term low vision means that after correction, the affected person has some level of vision that is functionally available for doing activities such as those that involve learning (Croser, 2015). Regarding blindness, in legal terms, a person is said to be blind if, when making use of glasses or contact lenses, he or she is only able to see at a distance six metres or (about 20 feet) or less those things that a person with normal eyesight can see at a distance of 60 metres (about 200 feet) (Pagliano, 1998). In general, children who have visual impairment may have a visual disability that is so serious that it considerably limits their capacity to see, thereby encumbering their ability to distinguish materials that are presented to them visually, such as written words, drawings, and pictures (National Council for Special Education, 2014). Therefore, children who have a visual impairment need assistance to enable them to perceive things like pictures, words and other illustrations.

Visual impairment can also be defined in relation to visual efficiency. Poon-McBrayer and Lian (2002) point out that the classification of visual impairment is based on a person's visual efficiency. Visual efficiency refers to the measure of how well people can use their sight. It is affected by two factors, namely peripheral vision and acuity. Vision acuity refers to how well an individual is able to see at different distances while peripheral vision helps one to know their level of vision. Based on the two measurements, visual experts categorise people with vision impairments into two classes: low vision and blindness. Partially sighted or people with low vision are those with a visual acuity that is higher than 20/200 but not more than 20/70 in the

better eye after attempts to correct the vision. Blindness refers to people who have a visual acuity of 20/200 or less and field of vision not exceeding 20° in the better eye after correction of the eyesight (Dash & Dash, 2005). Further, there is educational blindness, which is defined as a student's inability to use their eyesight as their primary means of learning (Dash & Dash, 2005). The aim of such a definition is to ensure that the affected child receives a suitable instructional aid and other support mechanisms to facilitate learning (Poon-McBrayer & Lian, 2000).

Just like hearing impairments, vision impairments can occur at any phase of life. According to Poon-McBrayer and Lian (2002), children who are born having severe vision impairment are said to have a congenital vision impairment, while those who become severely visually impaired after birth (usually after attaining the age of two years) are said to be adventitiously blind.

2.2.3 Intellectual disability

Individuals with an intellectual disability account for about three percent of the world's population (Ageranioti-Bélanger et al. 2012). The American Association on Intellectual and Developmental Disabilities (AAIDD) defines intellectual disability as "a disability characterised by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills" (Cheung, 2013). This definition means that a person with an intellectual disability is likely to have a considerably sub-average intellectual performance with regard to social skills, communication, home living, self-care, self-direction, community use, functional academics, safety and health, work and leisure (Cheung, 2013). According to the CDC (2015) website, a person is said to have an intellectual disability if they have "an IQ (intelligence quotient) of 70 or less on the most recent psychometric test performed

by a psychometrics" (para. 19). Ageranioti-Bélanger et al. (2012) also state that someone is said to have an intellectual disability if his or her IQ is less than 70% of the normal psychometric test.

However, the use of IQ as a measure of intellectual disability has been questioned in the literature. For instance, according to Deiner (2010), it is argued that relying solely on IQ as a way of determining a person's intellectual functioning presumes that 95% of the human population is in the "normal or average range", with 2.5% being below "normal" and another 2.5% above "normal". Such estimates and the related errors and differences suggest that there is a need to use more than one measure to assess individuals. Therefore, much as an IQ value between 70 and 75 is regarded below average, there is agreement that other measures need to be used to verify intellectual disability measurement results. For instance, it is difficult to determine the IQ of young children due to the poor predictive validity of psychological tests for children and other concerns such as cultural bias. Therefore, the term "intellectual disability" can also be used broadly to describe children who have differing levels of delays and variations in cognitive development (Deiner, 2010).

2.3 Characteristics of Learning Problems Associated with the Three Types of Disabilities

2.3.1 Learning problems for individuals with hearing impairment

Hearing impairment affects a child's capacity to learn differently depending on the nature of the impairment (Matkin & Wilcox, 1999). However, it has also been argued that in some respects, most children with a hearing impairment do not appear to be different from their counterparts who do not have a hearing difficulty (Edwards & Crocker, 2008). Edwards and Crocker (2008) go further to note that, despite the language delay that many of the children with hearing impairment experience, most of such children usually develop in a typical way that

follows a normal development trajectory in regard to their fine and gross motor skills, reasoning abilities, visual perception, and daily living skills. As implied by Edwards and Crocker (2008), one of the common learning problems that children with hearing impairment face is the delay in language development. This point is supported in the earlier literature by Matkin and Wilcox (1999), who argue that one of the effects is that a hearing loss causes an interruption in a child's ability to detect and recognise speech (Matkin & Wilcox, 1999).

Various studies have been conducted on the relationship between hearing impairment and language development or speech problems. Thus, the relationship between hearing impairment and language development or speech problems has been widely discussed (Deaf Children Australia, 2012; Edwards & Crocker, 2008; José, Mondelli, Feniman & Lopes-Herrera, 2014; Mogford-Bevan, 1993; Oliveira, Penna & Lemos, 2015; and Pratt, 2003 among others).

Among the various sources of literature on the correlation between hearing impairment and language development, there is a general agreement that having a hearing loss affects the ability of an individual to develop language skills. For instance, Mogford-Bevan (1993) argues that "the degree to which the language and social development of a child is affected by a hearing impairment depends mostly, but not entirely, upon the type and severity of the hearing loss" (p. 22). The implication of this statement is that the more severe the hearing impairment, the more difficult it will be for the affected individual to develop their language skills. Barry (2002) also noted that impairments such as hearing loss occur in different degrees, such that their effect on language development will be premised on the degree and nature of the impairment. Pratt (2003) elucidates this point further by noting that, even though children with hearing impairment are at a significant risk of having a delay in language development, the correlation between hearing impairment and language development is not straightforward. Pratt (2003) further adds that the

severity of hearing loss most likely predicts the extent of delay in language development, especially if the child presents the full array of attributes that characterise hearing loss. The result is that the delay in language development usually manifests at a lower level in children with less severe hearing loss than in children with profound hearing loss (Pratt, 2003).

Citing a study that was conducted by Moeller et al. (1986), Lim and Simser (2005) note that Moeller's study involved examining the receptive language of a grouping of children of school-going age who were hard of hearing or deaf, with the children's age range being between four and a half years and twenty years. The children who were involved in the study showed receptive vocabulary skills that were comparable to those attained by children with a typical hearing ability aged between five and seven years. According to Lim and Simser (2005), Moeller et al. (1986) postulated that there were notable delays in the development of receptive vocabulary in children with hearing impairment compared to children with a typical hearing ability. Further, according to Lim and Simser (2005), Moeller et al.'s (1986) study is consistent with other studies that have been conducted on children of school-going age who are hard of hearing or deaf. In addition, Lim and Simser (2005) argue that children with hearing impairment have, or possibly have, difficulties getting access to regular and consistent information via spoken language. The outcome is that children with hearing impairment have poor early learning outcomes, which consequently result in the creation of a weak foundation for the development of language skill and acquisition of knowledge (Lim & Simser, 2005).

In another study, Kennedy et al. (2006) noted that bilateral permanent hearing impairment in children is associated with numerous challenges such as difficulties in learning, impaired speech development and impaired acquisition of language. With respect to speech, Willis (2009) argues that children with hearing loss who are able to speak often find it difficult

or impossible to speak clearly or eloquently. This is due to the fact that children with hearing impairments often cannot perceive soft speech sounds. According to Willis (2009), such sounds are usually found in words and sounds that contain “sh”, “s”, “t” “k” and “f”. Given that children with severe hearing impairments cannot hear their own voices when they speak, their speech may appear too loud and, in most cases, their pitch is higher than usual. Studies conducted to evaluate syntactic advancement in the speech of children with hearing impairments have suggested that the occurrence of errors in the grammar of the affected children was related to the extent of the hearing impairment (Moeller et al., 2007).

Based on the discussion above, it is important to discover why hearing loss is associated with a delay in language development or poor speech and language development. To achieve this, it is important to examine the difference between speech and language. According to Deaf Children Australia (2012), language refers to the words, thoughts, structures and concepts that people have in their minds. Speech is one of the ways in which people communicate their language to other people. People also convey their language through writing or sign language. Deaf Children Australia (2012) also points out that it is worth noting that any kind of hearing impairment will have an effect on both speech and language development, and that language development is more critical than speech development. This, according to Deaf Children Australia (2012), is because nearly all learning is dependent on language, and the better the language a child has, the wider the array of the child’s mental concepts and the more the child will be able to learn.

Since hearing impairment is believed to affect the level of a child’s language development, it is also important to examine how children acquire language. According to Noam Chomsky (1957, cited by McKirdy, 1985), children are born with an innate capacity for language

development. It is not clear how people learn the language, but Chomsky (1957, cited by McKirdy, 1985) studied language development and suggested that children possess a language acquisition device or LAD. Chomsky posited that children make use of LAD when they take large quantities of language from birth, process the language in their minds, and then produce words or sentences that they have not heard previously. According to Chomsky, children experiment with grammar by making use of the rules of the language that they are learning.

Deaf Children Australia (2012) points out that, in order for LAD to work properly in children, some conditions must be met. The first condition is that children need people to talk to them or to use signs with them consistently so that they can hear and perceive words and phrases over and over. Another condition is that children need the people around them to talk to them or use signs with them in conversations (i.e. to engage the children in conversations through talk and signs) so that the children can hear or see what others are saying or signalling. Another requirement for LAD to work properly is that children need people to interact with them in a meaningful manner that is regular and consistent. Children also need people to help them extend their language (the children's language) by asking questions, making comments, and creating new words and phrases. Also, for LAD to work effectively, children need to have people around them who use interactions that make sense so that the children can learn how to use interactions on their own. In addition, children need to have people around them who reinforce their attempts at making use of language (Deaf Children Australia, 2012).

The link between hearing impairment and language development is based on the point that children who are hearing impaired cannot hear or only hear fractions of what the people who are around them say at any given time (Deaf Children Australia, 2012). Often, the only input that children with hearing impairments can recognise is when the people around them use signs or

talk to them directly, on a one-to-one basis. However, in most cases, because children with hearing impairments cannot hear things clearly, they often miss out on a lot of incidental learning. Also, the input that children with hearing impairments receive will often be much less than what children with a normal hearing ability will receive, and this affects their communication processes and learning in general (Deaf Children Australia, 2012).

The level of language development in children with hearing impairment depends on various factors. One of these factors is the age of onset of the hearing impairment (Deaf Children Australia, 2012). It is argued that children who have hearing impairments prior to the development of their language will have more pronounced language difficulties than those who lose their ability to hear when they are much older. Thus, even if the loss of hearing occurs during the early childhood stage, the impact of the disability on the development of language will be much less than compared to children who have hearing impairments right from birth or just after being born.

Another attribute of the hearing impairment that has an impact on language development is the degree of the hearing impairment (Deaf Children Australia, 2012). It is indicated that the more pronounced the hearing impairment, the more the disability will have an impact on a child's language development (Deaf Children Australia, 2012). This indicates that children with more severe impairments are more likely to experience more severe language development difficulties. A detailed account of how the nature of hearing loss affects a child's language development is provided by Northern and Downs (2002) who state that a mild hearing loss will have a notable effect on language learning and communication and will thus affect a child's educational achievement. With a mild hearing loss, vowel sounds can be heard clearly; however, voiceless consonants may be missed. In children whose hearing loss is 15 to 30 decibels,

dysfunction in auditory learning may lead to inattention and moderate language delay, as well as speech problems. Such a hearing impaired child is able to hear only sounds that are made in a louder voice. For such a child, less intense speech sounds like fricatives and voiceless stops, as well as short unstressed words, are not audible.

According to Northern and Downs (2002), with regard to moderate hearing loss (i.e. 31–50 decibel hearing loss), the affected children miss most speech sounds in conversations. However, they normally respond well to language and educational activities when they are supported with hearing aids. Children with a moderate hearing loss have also been noted to show inattention with respect to language, language retardation, problems relating to speech, and general learning problems. In addition, such children are likely to exhibit problems in deciphering the meanings of words and in making use of the rules of grammar since they do not accurately hear some of the sounds or words that they are supposed to be learning. Children with moderate hearing loss also have problems with regard to the use of consonants. Specifically, they hear vowel sounds better than consonant sounds. In addition, children with moderate hearing impairment have difficulty hearing unstressed words like relational and prepositional words and words that end in –s and –ed. This reduced ability to use cues and information results in confusion for the affected children with regard to speech sounds and meanings of words. Such children also face learning-related challenges such as difficulty with words that have multiple meanings, limited vocabulary, difficulties in creating object class, confusing grammatical rules, the omission of articles, prepositions and conjunctions, and mistakes in placing words. Children with mild hearing impairment also encounter various challenges such as distortion and omission of consonant letters that generally define and characterise the articulation of the individual's

speech. For this reason, people who are not familiar with a child who has a moderate hearing loss may have difficulty comprehending such a child's speech (Northern & Downs, 2002).

In children with the severe hearing loss (that is a 50–70 dB HL), the level of language difficulty is more pronounced; language and speech do not develop spontaneously in such children. However, if intervention is initiated early, such as the use of hearing aids that fit properly and providing special education to the affected children, children with severe hearing loss may ultimately function well. Without assistive devices for amplifying sound, children with severe hearing loss are not able to hear normal conversations or sounds. However, they can hear their own voices or sounds, albeit unclearly, some very loud external sounds, and only the most intense speeches when the words are spoken from a close range and loudly. When hearing aids are used, children with severe hearing loss can make sense of vowel sounds and notice differences in the manner in which consonants are articulated. In general, severe hearing loss usually leads to severe language difficulties, speech problems, and related problems with regard to learning in school or elsewhere (Northern & Downs, 2002).

In regard to profound hearing loss (a hearing loss of 71 decibels or greater), the affected children can only learn language and speech when they are provided with intensive special education. Therefore, the success of children with profound hearing loss can be greatly improved when the hearing loss is identified and addressed early. Without devices such as hearing aids to help in the amplification of sound, children who have a profound hearing impairment are generally not able to hear sounds. However, when such children are fitted with appropriate amplification devices, they may be able to hear speech rhythm patterns, their own sounds, and external sounds. Profound hearing impairment leads to severe retardation in language

development, speech difficulties, and possible associated learning problems (Northern & Downs, 2002).

The speech of children who have profound hearing impairment is characterised by "voice, articulation, resonance, and prosody problems" (Northern & Downs, 2002, p. 23). What this means is that such children have a vocal pitch that is, in most cases, higher than that of people who have a normal hearing ability. In addition, children with profound hearing impairments have a speech whose prosodic features of stress and intonation are missing, which gives their voice a monotone quality. The speech of children with a profound hearing impairment is characterised by the following features slow temporal patterning; ineffective utilisation of the breath stream; prolongation of vowels; distortion of vowels; abnormal speech rhythm; excessive nasality; and an addition of an "undifferentiated neutral vowel between abutting consonants" (Northern & Downs, 2002, p. 23).

Children with severe to profound hearing impairment have an articulation of voice that is characterised by excessive movement of the mandibles, lack of movement of the tongue, the posterior positioning of the tongue, voiced-voiceless mixing of consonants, and difficulties in co-articulation (Northern & Downs, 2002). It is these problems that make it difficult for children with hearing impairments, especially those with severe and profound impairment, to participate in the learning process in class like their colleagues who have an ability to hear that is not impaired. A summary of the various levels of hearing impairment and their effects on the affected children is presented in Table 2.1 below.

Table 2.1: The different degrees of hearing impairments and their impacts on affected children

Level of hearing loss	Type of hearing impairment	Effects
26–40 dB HL	Mild hearing impairment	The affected child may have problems in hearing distant

		or faint speech. If there is no audiological management, a child who has a 35 dB HL hearing impairment may not hear between 25 and 40 percent of the speech signal. This depends on the level of noise in the room as well as the distance between the child with the hearing impairment and the speaker. If no hearing technology is used, a child whose hearing impairment is in the range of 35–40 dB HL may not hear up to 50 percent of the content that is discussed in class.
4 1–55 dB HL	Moderate hearing impairment	A child who has a hearing impairment at this level may fail to get between 45 and 75 percent of any speech signal. When such children do not use hearing technology or any other form of intervention, they are likely to have imperfect speech production and limited vocabulary.
56–70 dB HL	Moderately severe hearing impairment	At this level of hearing impairment, if no amplification technology is used to support the affected child, any spoken language that is targeted for the child must be extremely loud and the speaker needs to be very close to the child. Also, if the child does not get the required support early and also lacks continuing intervention, he or she will experience notable difficulty in school. For instance, the child will exhibit problems in speech intelligibility as well as delays in language development.
71–90 dB HL	Severe hearing impairment	At this level of hearing impairment, the affected child is unable to hear all conversational speech unless he or she uses hearing assistive technology. The child may still be able to perceive vowel sounds but he or she may not be able to perceive consonant sounds.
90 dB HL	Profound hearing impairment	A child with a profound hearing impairment is not able to hear any sound if no amplification device is used.

Another factor that affects the language development of children with hearing impairments is the quality and quantity of language input that they receive (Northern & Downs, 2002). The quality of language input refers to the consistency of information that a child receives and is, therefore, able to absorb with regard to the language being used by the people around them (Northern & Downs, 2002). The quality of language is very important because it determines how quickly the child can become familiar with, and hence grasp, the language that they are learning, while the quantity of language is about the volume of communication that a child with a hearing impairment is involved in, observes, or listens to. The more the opportunities to be involved in different kinds of communication, the more opportunities

children with hearing impairments will have to boost the development of their language skills (Northern & Downs, 2002). The quantity of language that children with hearing impairments have access to is affected by factors such as the hearing ability of the parents of the child, early intervention, and the age at which the disability is diagnosed (Deaf Children Australia, 2012). According to Deaf Children Australia (2012), research has suggested that children with hearing impairments who have parents with the same disability perform better in school compared to children with hearing impairments whose parents have a normal hearing ability. This is because parents with hearing impairments naturally communicate with their children who have the same problems and, in most cases, have an optimistic attitude towards the child's disability. Therefore, parents who have a normal hearing ability but have children who are hearing impaired need to create opportunities for their children to ensure that they have the support that they require to boost their learning outcomes (Deaf Children Australia, 2012).

The issue of the quality and quantity of language input that children with hearing impairment receive is very important for the development of language in children. This is because the nature of communication through spoken word and other forms will determine the frequency and consistency of sensory stimulation that the affected children receive, which in turn has an impact on brain and language development. The implication is that if the information that children with a hearing impairment receive is not regular or consistent, it will affect the level of development of their language skills. This point was captured in the preceding sections of this literature review, where it was noted that children with hearing impairment have, or possibly have, problems getting access to regular and consistent information via spoken language and that this leads to poor early learning outcomes as well as the children having a weak foundation for language development and knowledge acquisition (Lim & Simser, 2005).

Deaf Children Australia (2012) also noted that research has established that early intervention programs are very important for supporting the language development of children with hearing impairments and hence improve their communication and learning outcomes. Early intervention is defined as the intervention services that are offered to children between the time they are born and when they start schooling (Australian Hearing, 2014). It has also been defined as "a set of services for children six years of age or younger who are at risk of or who currently have developmental delays or social-emotional problems" (Guralnick, 2005 – cited by Turan, 2012, p. 117). The need for early intervention is premised on the notion that the socio-emotional or developmental problems that children face can be either averted or mitigated through specialised activities and services that are designed to maximise the children's developmental learning (Al-Rowaily, AlFayez, AlJomiey, AlBadr & Abolfotouh, 2012).

Furthermore, early intervention is premised on the belief that the first five years of a child's life are a period during which there is a unique chance to stop or reduce the developmental problems that children may face (Turan, 2012). The fast brain growth and development that occurs during children's early years are thought to be connected with critical phases during which children are distinctively geared to gain from developmental stimulation that is linked to their individual ability and needs (Turan, 2012). Most early intervention programs focus on assisting parents to help their children (Australian Hearing, 2014). The same point is emphasised by Turan (2012), who notes that many early intervention programs, especially programs that target children of ages up to three years, offer wide-ranging services to families, including service coordination, social support, and information about children's development.

It is generally believed that services that reduce the stressors and burdens that parents experience make things easier for parents of children with disabilities and allow them an opportunity to focus on the care and needs of their children (Decker & Vallotton, 2016; Turan, 2012). In addition, it is argued that parents have to play an active role in the development of their children since research has established that the efficacy of early intervention programs is dependent on the effect of the programs as well as the manner in which parents take care of or interact with their children (Turan, 2012). This point can be linked the point that parents need to create opportunities for their children who have a hearing impairment to ensure that they get the support that they require to boost their learning and development (Deaf Children Australia, 2012).

For children who have a hearing impairment, the focus of early intervention programs is to give the parents of the children the knowledge, technology, skills and strategies that they need to support their children's language development and mitigate the impact of the hearing impairment (Australian Hearing, 2014). Australian Hearing (2014) also notes that, for young children who have hearing impairments, the focus of early intervention services tends to be on one of two strategies to develop the language and communication skills of the children: auditory-verbal and total communication (Australian Hearing, 2014). The auditory-verbal approach involves the use of hearing aids or implants to develop the language and speech of the child in a natural way via listening. The assistive devices help the children with hearing loss to learn to listen, comprehend spoken words, and communicate through speech using their residual hearing ability (Australian Hearing, 2014) while the total communication approach involves the use of a wide array of communication methods including lip-reading, speech, listening, finger spelling and signing (Australian Hearing, 2014).

Thus, intervention programs such as the use of assistive devices or models and options that improve communication skills need to be initiated as early as possible to give children with hearing impairments the best opportunities to learn (Deaf Children Australia, 2012). The same can be said of early intervention in schools, where children with hearing impairments need to be given the assistive devices and other forms of support that they need as early as possible (Nittrouer, 2010). The importance of providing the assistance that children with hearing loss require in school as early as possible is that doing so can help to maintain the gains made during early intervention – (i.e. in cases where the child with a hearing loss has previously been involved in an early intervention program prior to attaining the school-going age) (Nittrouer, 2010).

In addition, research has shown that the age at which a child is diagnosed with a hearing impairment is important for improving the child's language development skills (Deaf Children Australia, 2012). In particular, it has been demonstrated that children who are diagnosed before they attain the age of six months perform better than those who are diagnosed later in all the areas of learning language (Deaf Children Australia, 2012; econtext, 2011). Lim and Simser (2005) explain the importance of early intervention for children with hearing impairment by noting that the longer the brain does not receive any auditory input, the more significant the resulting sensory deprivation, which causes limited or no sensory stimulation to the brain. As argued by Lim and Simser (2005), the lack of sensory stimulation to the brain prevents auditory learning. Further, in the absence of normal stimulation to the brain, there is a sensitive phase of about three and a half years during which the central auditory system of a human being stays maximally plastic (meaning that it can be greatly modified). However, after the age of seven years, the plasticity of this system is significantly reduced (Lim & Simser, 2005). Therefore, the

longer there is a lack of auditory stimulation to the brain, the more reduced the growth of the auditory brain. Lim and Simser (2005) also assert that when there is no auditory stimulation during the period when the central auditory system is still plastic, the auditory centres of the brain do not grow, and in addition, the existing pre-formed auditory tracts may also degenerate. Therefore, early diagnosis of hearing impairment is important not only because it helps improve the child's auditory-language development at an early stage, but also due to the fact that when the hearing impairment is diagnosed early, intervention measures to support the child through approaches such as use of assistive devices and other programs are also likely to start early.

Overall, the disruptions to language and speech in children due to hearing impairment affect their learning at school (Reddy, Ramar & Kusuma, 2004). For instance, reading and mathematics concepts are likely to be particularly difficult for children with hearing impairments to undertake because of problems in processing sounds and hence challenges in reading and listening (Willis, 2009; Reddy et al., 2004). Because of these problems, it has been posited that children with low to moderate hearing impairment are likely to perform considerably poorly compared to their peers without the hearing impairment; additionally, the gap in achievement is even larger for those with profound hearing impairments (Willis, 2009). Therefore, if children with hearing impairments are left without any form of assistance to improve their learning capacity, they are likely to fail in school, as noted by Reddy et al. (2004).

2.3.2 Learning problems associated with visual impairment

According to various studies on visual impairment, approximately 14–65 percent of students who have a visual impairment also have learning difficulties (Erin & Koenig, 1997, Taylor, 2014). Where children with visual impairment also have learning difficulties, the

disability is usually difficult to detect because of the fact the visual impairment tends to mask the presence of learning difficulties (Erin & Koenig, 1997).

With regard to learning difficulties that are associated with having visual impairments, most stem from the fact that visual impairment interrupts the process of reading (Handler et al., 2011). However, even though visual impairment causes difficulties in reading, Handler et al. (2011, p. 831) indicate that the condition itself has not been proven to be a predictor of reading disability. This implies that the reading difficulties presented by visual impairments can be corrected using the appropriate assistive technologies. Nonetheless, it is generally agreed that students with visual impairments have visual acuities that are not adequate for them to participate easily in daily activities (Organisation for Economic Cooperation and Development (OECD), 2007). Notably, the disability impedes optimum learning and learning outcomes and can cause a considerable educational disadvantage for those affected unless necessary adjustments are made to assist them (OECD, 2007).

The impact of a visual impairment can be understood in relation to how the disability affects the development of a child, especially during the child's early stages. According to Barclay and Staples (2012), the effect of visual impairment on a child's development varies among different individuals and is dependent on various factors. These factors include the degree of visual impairment, existing environmental opportunities for support and stimulation, and the existence of additional disabilities. Since the needs of many children who have visual impairment as well as other disabilities are complex and intense, there are attempts to minimise the effects of these disabilities. However, for children who have additional disabilities that affect movement, memory or communication (which is likely, as noted above), the impact of a visual impairment can be pronounced. In general, as noted by Barclay and Staples (2012), a visual

impairment impacts a number of areas for a student and this affects their learning ability. The student areas that are affected by visual impairment are: (1) awareness of the surroundings and objects that exist in the surroundings; (2) opportunities to create an understanding as well as knowledge through casual observation and imitation, which is also known as incidental learning; (3) curiosity about, as well as movement towards, something that is not within reach; and (4) opportunities to expect interaction or to prepare for change.

Awareness of the surroundings and existing objects

Vision brings together information from many sensory systems, combining or synthesising different perceptions. Vision enables a child to both comprehend what is taking place in a given environment and simultaneously interpret the importance of the thermal, auditory and tactile input. When the integrating function of vision does not exist (i.e. when a person has a visual impairment), each element of the sensory information that a person receives may be experienced as separate and therefore be perceived sequentially. Sensory responses need to be woven together so that they can create an impression of a "whole" event; for instance, a door opens and someone enters the room. This analysis of the separate parts of the sensory experience is a cognitive task that is different to interpreting the event visually. For instance, a person with a visual impairment may not know that someone entered the room when the door opened. For a child with a visual impairment, processing information about various activities relating to an event requires more processing time as well as the memory of past experience about a given event, especially for a child who also has other disabilities that make learning complicated (Barclay & Staples, 2012). Children with visual impairments coupled with other impairments are likely to have disjointed impressions of the world around them, and their perception may be restricted to the separate pieces of sensory information that are available to

them. This is a major problem when it comes to learning because it is difficult for such children to complete a picture of the different activities that they learn.

Incidental learning

Vision is a distance stimulus that allows children to access objects that are not directly in contact with their bodies. Vision is regarded as a fundamental sense that facilitates the learning process. It also provides an opportunity for incidental learning or learning that is achieved or absorbed in a casual manner by looking at what someone is doing or by mimicking what one has seen someone else doing. In the classroom, information is usually presented using an approach that is referred to as "watch-and-then-do"; as such, a student attempts to learn by observing and then mimicking a demonstration of the actions of another person. Children with visual impairments, whether they have other additional impairments or not, need to learn from meaningful experiences through listening and touch, as well as through instructional strategies like tactile modelling, to enhance their incidental learning capability (Barclay & Staples, 2012).

Curiosity and movement

The visual world entices and beckons, eliciting curiosity and providing children motivation to reach out and make use of their hands to touch and play around objects, to reach for items that are beyond the reach of their bodies, and to initiate movement. By being involved in these actions, children develop concepts about their surrounding as well as an awareness of different objects and people. Without the ability to see, children are not able to be involved in the aforementioned activities, and this affects their active learning, reaching for different objects and exploring the world around them (Barclay & Staples, 2012).

Anticipation

The ability to see things enables interaction with other people from a distance and also provides an opportunity for one to get ready for change (Barclay & Staples, 2012). For instance, children with a typical visual ability can see things and prepare to react to them. In contrast, children who are visually impaired, whether they have other disabilities or not, miss the opportunity to use visual cues. As such, the children with a visual impairment may be unprepared for cues such as being touched, being given different materials or objects, or a change in a given activity. All these issues have a negative effect on their ability to take part in learning activities in class or other places without assistance (Barclay & Staples, 2012).

2.3.3 Learning problems for children with intellectual disability

Intellectual disability in children is associated with learning difficulties, below average intellectual functioning, and the slow progression of adaptive behaviour – all of which have an impact on the child's educational performance (OECD, 2007). From an educational perspective, learners with an intellectual disability often exhibit more difficulties compared to their peers in understanding instructions, figurative or metaphorical language, and abstract concepts (OECD, 2007).

The specific difficulties that children with intellectual disability have, especially with regard to learning, are as follows. Firstly, intellectual disabilities cause social problems, learning difficulties, impairment of motor skills, and negatively impact on the capacity to perform well in daily life. These adversely affect the ability of a child to learn in an ordinary educational setting (Healthy Place, 2017). The learning outcomes of children with an intellectual disability are negatively affected because of the manner in which the disability affects each individual. In

particular, children with intellectual disability have difficulty comprehending and following simple instructions. They also have trouble remembering what someone has just said and fail to understand what they read. Children with intellectual disability also have delayed speech development and struggle to express ideas in writing. They also have difficulties with writing and spelling and may lack proper coordination in activities such as walking (Healthy Place, 2017).

Because of the aforementioned issues, it follows that intellectually disabled children would naturally exhibit deficient learning behaviour. Consequently, they would need support to complete any learning activity, particularly when it encompasses new concepts. As OECD (2007) further notes, such children require more interactivity with their surroundings in order to comprehend concepts and to gain extended periods of concentration and attention.

2.4 Saudi Arabia's Local Context

For the purpose of this dissertation, the situation in Saudi Arabia will be based on previous studies. In a national survey documented by Nounou, Ali, and Shalaby (2012) for example, it was found that there was 6.33 percent disability prevalence among children in the country. While motor disability was the commonest form of physical incapacity, visual impairment, auditory impairment and intellectual disabilities were also relatively common. In a smaller survey conducted in the rural regions of Riyadh, Nounou et al. (2012) found that of the sampled population segment of children, 13.8 percent presented with visual disabilities, 9.8 percent with auditory disabilities and 20 percent with educational (intellectual) disabilities. Nounou et al. (2012) noted that, while there are good interventions that the Saudi Arabia government has implemented in urban areas to integrate children living with disabilities into the

society, not much has been done in the rural areas. In other words, basing their arguments on 450 children who had attended a day care centre in Riyadh, Nounou et al. (2012) suggest that having a disability while living in a rural area disadvantages a child twice over.

A major step forward in Saudi Arabia seems to be in the inclusion of children with intellectual disabilities into schooling. According to Alnahdi (2013), Saudi Arabia had 11 mainstream schools that were dedicated to catering for students with intellectual disabilities in 2008. Additionally, the country had 718 mainstreaming programs for a school with intellectual disability students. Al-Mousa (2010, p.17) defines the mainstreaming programs as "Self-contained classroom programs, resource room programs, itinerant teacher programs, teacher-consultant programs, and follow-up programs". Moreover, the Kingdom had 11,805 students with intellectual disabilities who had been integrated into regular classrooms across Saudi Arabia (Alnahdi, 2013).

In another study (Kashkary, 2014, p. 75), it is revealed that teachers have mixed feelings about teaching students with disabilities. Male teachers were found to be more positive, especially in their abilities to teach an integrated classroom, while most female respondents felt they were inadequately prepared to teach children with disabilities. Teachers of both genders also expressed their reservations about the use of computers in class for children with disabilities, arguing that "normal" classrooms were not structured in a manner that would fully cater for the needs and wants of children living with disabilities (Kashkary, 2014).

Alkahtani (2013) revealed that while different stakeholders acknowledge the fact that assistive technologies can enhance learning in children living with different disabilities, there are challenges of implementing such technologies. According to Alkahtani (2013), the biggest

challenge was teachers' lack of knowledge; teachers would normally be expected to assist and guide students in using the technologies. Of all teachers sampled by Alkahtani (2013), 72.4 percent were found to have little or no knowledge of the use of assistive technologies. Only 3.9 percent had some knowledge. The absence of knowledge in relation to the use of assistive technology is traced back to the teachers' training. This is because, as Alkahtani (2013) noted, only 1.6 percent of the respondents reported attending any courses in assistive technology in college. Arguably, the foregoing findings indicate the need for colleges to consider developing courses that would aid future teachers in the use of assistive technologies in order to help students living with disabilities in their learning endeavours.

2.5 Types and Benefits of Assistive Technologies Used to Support Learning

The United Nations (2004) defines assistive technologies as any technology that has been developed for the purposes of enhancing the quality of life for people living with disabilities. Mittler (2007) defines assistive technologies as "an item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability." According to the Schwab Foundation for Learning (2000), assistive technologies are either software-based or hardware-based. Hardware-based assistive technologies are the equipment that aids learners living with disabilities. They include such things as computer monitors, a computer's central processing unit, a keyboard, or a Braille machine. Software-based assistive technologies include programs installed in different hardware devices in order to make the hardware devices work as they should. Normally, assistive software makes all the difference (except for cases like Braille) because without them, the hardware would be just a normal computer, which in most cases would only be fit for use by people who do not have any disabilities.

2.5.1 Assistive technologies and their benefits for learners with visual impairment

Figure 2.1 (below) presents four examples of software-based assistive technologies for the visually impaired. JAWS for Windows reads the text for the visually impaired, while Kurzweil 1000 scans and turns text into speech. Studio recorder enables a visually impaired person to record and edit spoken word, while Zoom text magnifies written text on a computer screen to make it more readable for people with low vision (Indiana University, 2015).

Figure 2.1: Software-based assistive technologies for the visually impaired
Source: Indiana University (2015).

As illustrated in Figure 2.2 below, there are several hardware-based assistive technologies for the visually impaired. These include headsets, which allow visually impaired students to listen to audio files. Additionally, there are laptop computers that are designed for use by visually impaired learners. Large monitors are also important for reading enlarged text, while the magnifying equipment helps to enlarge text or images while enhancing their clarity. Scanners are also used to convert printed text into electronic text, which can then be converted into audio

files. Lastly, the tactile image enhancer creates images with raised impressions that allow blind students to trace and feel the contours of the image.

Figure 2.2: Hardware assistive technologies for the visually impaired
Source: Indiana University (2015).

2.5.2 Assistive technologies and their benefits for learners with intellectual disabilities

Figure 2.3 (below) illustrates three software-based programs that are ideal for use by students with intellectual disabilities. Co:Writer 4000 helps in writing, while Inspiration helps in organising the ideas and thoughts of an individual learner. Kurzweil 3000 is used to convert printed material to electronic text, which can then be converted into audio (Indiana University).

The software solutions indicated in Figure 2.3 are used together with hardware devices such as headphones and computers.

Figure 2.3: Software-based assistive technologies for people with intellectual disabilities
Source: Indiana University (2015)

2.5.3 Assistive devices and their benefits for learners with hearing impairment

Children who are hard of hearing or deaf use an array of assistive technologies that enable them to have improved accessibility in different environmental settings (Heckendorf, 2009). Most of these devices either amplify sound or provide alternative ways to access information through vibration and/or vision. According to Heckendorf (2009), the technologies that are used to assist children with hearing impairment can be categorised into three general groups: (1) hearing technology, (2) devices that produce alerts, and (3) communication support devices. The overall aim of all these devices is to facilitate improved access to what most people get through their hearing. Depending on the different needs that relate to specific situations, hard of hearing or deaf individuals may need assistive devices. In some cases, the assistive

technologies are used simultaneously. Details and examples of the different kinds of assistive technology for individuals with hearing impairment based on the three categories above are outlined below.

Personal amplification devices

These are devices that are designed to provide individuals with improved access to sound in different kinds of environments. The devices are selected based on a person's preferences, level and configuration of hearing impairment, and special features. Personal amplification devices must be identified and fitted with the help of an audiologist (Heckendorf, 2009).

Alerting devices

Alerting devices are designed to provide an amplified and/or visual vibration or signal that is used to catch the attention of individuals who are hard of hearing or deaf. Examples of such devices include computers and various computer-related technologies, clocks/watches.

Communication supports

Under communication supports, assistive technologies have been categorised into three groups: person-to-person interactions, telecommunication services, and group activities. Telecommunication devices include cell phones (including smartphones and tablets), pagers and text devices (Heckendorf, 2009). There are also amplified phones and phone amplifiers. Other devices include TDD, computers with internet support, video phones and others.

Person-to-person devices are meant to enable individuals with a hearing impairment to communicate with others (Heckendorf, 2009). These include computers, pens and paper, and cell phones (which include tablets and smartphones).

Group activities technologies are devices that enable learners with disabilities to take part in activities such as discussions, community events, and communication with educators. Such

technologies include devices that facilitate note taking, electronic note taking devices, handwriting recognition devices such as digital pens (e.g. Digital Pen™) and interactive whiteboards (e.g. SMART Board™), and voice to text signs. Digital pens are systems that allow people with disabilities to combine the use of pens and paper with the power of computers. The software converts the user's handwritten signals into text in digital format. The user can then modify the handwritten text or change it to typed text. Interactive whiteboards involve the use of a touch-sensitive display that is connected to a computer as well as a digital projector to display the computer image. The computer user can then control different computer applications directly from the display, make notes using digital ink, and save the work (Heckendorf, 2009).

The assistive technologies are utilised to support learning activities at different levels depending on need as well as the availability of the technologies. For example, according to Indiana University (2015), the most common type of assistive technologies are video captioning and remote transcription. The same source goes further to explain who the technologies are used by, noting that in video captioning, videos are made and captioned and displayed on a learner's laptop or computer. Remote transcription enables words that are spoken by a teacher (e.g. in an integrated classroom) to be transcribed in real time and displayed on a learner's computer screen (Indiana University, 2015).

Granschow, Philips, and Schneider (2001) categorised assistive technologies into low-, middle-, and high-tech devices. According to these authors, non-electronic devices that are easy to use can be labelled as low-tech devices. Such devices are also cheap (hence easy to acquire) and do not require major maintenance. Examples include the white cane that is used by visually impaired people. Mid-tech devices are electronic based, moderately priced, and need basic maintenance. Products in the mid-tech range include digital recorders and adapted keyboards.

The high-tech range of devices comprises complex electronic devices that are relatively expensive and require training and ongoing maintenance. Examples of such devices include talking calculators and assistive listening devices (Granschow et al., 2001). It is worth noting that the categorisation of low-, middle- and high-tech devices is a fluid concept because, as Cook and Hussey (2002, p.9) note, "what could be considered high-tech today will soon enough be replaced by other newer innovations, and as such, could easily be labelled low-tech in subsequent years".

As the Schwab Foundation for Learning (2000) notes, assistive technology does not intend to fix issues that learners with disabilities face. Instead, the intention of using assistive technology is to help people with disabilities to live full, rewarding and satisfying lives by enabling them to overcome particular deficits occasioned by their physical limitations. In learners, Schwab Foundation for Learning (2000) notes that assistive technologies can be used to compensate for, bypass or work around specific difficulties occasioned by physical limitations. The technologies help learners living with disabilities to compensate for their learning difficulties. Notably, assistive technologies are different from instructional software, whose main aim is to enhance students' skills in a particular area.

The necessity of using assistive technology in learning is informed by the argument that most disabilities cannot be cured or outgrown (Schwab Foundation for Learning, 2000). The foregoing realities underscore the importance of using tools that can assist students living with different disabilities to improve their performance and success in certain areas of learning. Notably, assistive technologies create independence in learners, hence setting the stage for them to become independent (and even reliable) members of the society. With independence, students gain enhanced self-esteem and possibly the ability to earn their own living and accomplish

milestones that otherwise would have been unattainable (Schwab Foundation for Learning, 2000).

2.6 The Context of the Study and the Use of Technology to Support Learning in Saudi Arabia

As a developing country, Saudi Arabia has yet to fully embrace the need to support children with disabilities to ensure that they get learning opportunities in the same way as their counterparts who do not have disabilities. This is despite the efforts that are being made to improve the situation. For example, Alfaraj and Kuyini (2014) observe that children with disabilities have not always been treated as equals to their able-bodied counterparts. Consequently, the advancement of practices such as assistive technologies is relatively lower in schools when compared to developed countries. The same scenario is experienced in many developing countries, where challenge exists with regard to the possibility to help learners with disabilities so that they can get an education and empower themselves economically (Abuzinadah, Malibari & Krause, 2017). Alquraini (2011) also notes that most assistive technologies in countries like Saudi Arabia are developed either in Spanish or English languages, hence making it hard for schools in Saudi Arabia to adopt them. Notably, Arabic is the dominant language in most schools in the kingdom. Despite the slow adoption of assistive technologies, Goldin-Meadow (2009, cited by Alfaraj & Kuyini, 2014) notes that there is the adoption of basic assistive technologies such as projectors (for children with intellectual disabilities and low vision) and hearing aids (i.e. earphones and loudspeakers) for children with mild hearing loss.

To enhance the adoption of assistive technologies in Saudi Arabia, Alquraini (2011) recommends that the developers of such technologies should recognise the needs in schools in

the kingdom. Consequently, they should design the assistive technologies in Arabic, so that most young students who can neither use English or Spanish can benefit from them. Alquraini (2011) also recommends that developers of assistive technologies should make their innovations affordable and accessible to a greater number of deserving cases, because only then can they have an impact on the targeted markets. The author laments that as long as assistive technologies remain outside the reach of most deserving students, it is unlikely that they will benefit from them.

2.7 The gap in literature

Based on the current review of literature, it is evident that even though the government of Saudi Arabia is making efforts to support the learning of students with disabilities, the use of assistive technologies has not become widely entrenched in schools that cater to the needs of students with disabilities. Also, the specific types of assistive technologies that are used in Saudi Arabia and the challenges that are associated with using these technologies have not been clearly identified. This is the gap that this research aimed to fill.

2.8 Summary

The literature review touched on four key areas: (1) the nature of the three disabilities that are the subject of this study (hearing, visual and intellectual disabilities); (2) the specifics of the learning problems that are associated with the three types of disabilities; (3) the types and benefits of assistive technologies used to support learning for children with any of these disabilities; and (4) the context of the study with a focus on the use of technology to support learning for children with any of the aforementioned disabilities in Saudi Arabia. Regarding the

nature of hearing, visual and intellectual disabilities, the literature review has addressed the features that characterise individuals with any of the three disabilities.

Hearing loss is the reduced function or loss of typical hearing. It reduces an individual's sensitivity to functions such as listening, understanding speech and speaking in the same way as individuals with typical hearing. Visual impairment is a condition that restricts or totally diminishes an individual's ability to use vision. Intellectual disability is a condition that is associated with a substantial limitation in a person's present functioning.

All three disabilities are associated with different characteristics that affect the ability of individuals to learn. Hearing impairment is commonly associated with delays in language development and this has an influence on affected individuals' learning outcomes. Visual impairments affect individuals' awareness of the surroundings, incidental learning, curiosity and anticipation. Overall, these disabilities have effects that slow down children's development, and thus affects their ability to learn. Early detection of these disabilities and intervention can help reduce the conditions' negative impacts and improve the affected children's learning outcomes.

The assistive technologies that are available are meant to reduce the impact of the various disabilities on the affected individuals and ensure that such individuals get an opportunity to learn like their peers who do not have disabilities. This review has also discussed the realisation that although Saudi Arabia has a generally low adoption of modern assistive technology, the country has invested considerably in basic assistive devices such as projectors and hearing aids.

In summation, it can be noted that in spite of the Saudi Arabian government's efforts to support the learning of students with disabilities, the level of use of assistive technologies in schools in Saudi Arabia does not adequately meet the demand. This is the gap that the current research sought to fill.

Chapter 3: Research Methodology

3.1 Introduction

This chapter discusses the methodology that was used to investigate the research questions. The chapter is divided into the following sections. The first section discusses the research paradigm within which the research was located. This includes justification for the use of the pragmatic paradigm that was selected. The second section presents the research design, which comprised a case study methodology that applied a cross-sectional, exploratory and sequential mixed method research. The third section discusses the population from which the study sample was drawn and the sampling procedure that was used. Finally, the chapter presents information about data collection, including the ethical procedures that were followed, the data collection instruments and how they were piloted, the process of collecting the data, and how the qualitative and quantitative data that were collected were analysed. To conclude the chapter, a brief summary is provided.

3.2 Research Paradigm

The term "research paradigm" refers to "a perspective about research held by a community of researchers that is based on a set of shared assumptions, concepts, values, and practices" (Johnson & Christensen, 2012, p. 31). A research paradigm can also be defined as a way of studying a social phenomenon from which a particular understanding of the phenomenon can be obtained and conclusions drawn (Hua, 2016). A paradigm can also be understood as a set of ideas regarding the manner in which a particular problem exists and a set of agreements about how such a problem can be investigated (Mukherji & Albon, 2010). Based on these definitions, it is clear that the selection of a paradigm for any research is important since the paradigm

influences the methodology to be used and also shapes the researcher's perceptions of the issue being investigated (Mukherji & Albon, 2010). As stated by Kivunja & Kuyini (2017), a research paradigm is "the conceptual lens through which the researcher examines the methodological aspects of their research project to determine the research methods that will be used and how the data will be analysed." Basically, a research paradigm is coupled with a set of beliefs and guidelines for a specific research study and associated investigation. To construct an embedded meaning in data, a research paradigm must meet set principles on the basis of a framework initialised with an ultimate indication of where the researcher is coming from and heading to (Kivunja & Kuyini, 2017)

There are four major types of research paradigms, namely the positivist paradigm, the interpretivist paradigm, the critical paradigm, and the pragmatic paradigm (Cryer, 2006; Mertens, 2010; Rubin & Babbie, 2009; Schoen, 2011). Each of these research paradigms has its own perspectives regarding the nature of reality (referred to as ontology), the theory of knowledge or what the researcher can know about the subject (referred to as epistemology), how the researcher can get information about the perceived reality (i.e. the methodology to be used) (Riazi, 2016), and the values of the researcher in relation to the meaning contained in the research data (referred to as axiology) (Klenke, 2008). A brief explanation of the different research paradigms is given below to inform the justification of my choice of the pragmatic paradigm.

3.2.1 Positivist research paradigm

The positivist research paradigm asserts that things that exist can be described factually (Denicolo, Long & Bradley-Cole, 2016). Positivist ontology (the nature of reality) is built on the belief that the world is external and that one objective truth to any research situation or

phenomenon exists regardless of the belief or perspective of the researcher (Edirisingha, 2012). Positivism follows natural principles and encompasses a researcher who attempts to take a neutral role. As such, observations of phenomena based on the positivist research paradigm must be carried out objectively. Values and biases must be eliminated as much as possible, and there must be a clear distinction between the subject and the researcher (Marlow, 2011), meaning that I had to remain detached from the participants in the research or the subject being studied.

Positivists take a structural and controlled approach to carrying out research by identifying an understandable research area, coming up with a suitable hypothesis or hypotheses, and by making use of an appropriate research methodology (Edirisingha, 2012). Positivism holds that a scientific method is the only way to establish the truth as well as an objective reality about a given phenomenon (Chilisa & Preece, 2005). This paradigm utilises the scientific method, which encompasses a cycle of research that includes observation, the discovery of underlying patterns and coming up with a theory, formulating a hypothesis, carrying out research to test the hypothesis, and rejecting or accepting the hypothesis that was tested (Mukherji & Albon, 2010). The application of quantitative research methods involves the scientific collection of data in a precise way; the data is determined by measurement and then subjected to scientific analysis with the objective of making the results generalisable (Mukherji & Albon, 2010). This involves testing and observing the "cause and effect" relationships that exist between different types of variables (Walsh & Wigens, 2003, p. 22).

With regard to ontology, epistemology and axiology, the views of positivist researchers are as follows. For ontology, positivist researchers hold the view that there is a single reality, as opposed to constructivists, who make reference to many constructed realities (Mukherjee & Kamarulzaman, 2016). For epistemology, positivist researchers regard the knower and what is

known as independent phenomena; in contrast, constructivist researchers consider the knower and what is known as being closely attached (Mukherjee & Kamarulzaman, 2016; Tashakkori & Teddlie, 1998). Lastly, with regard to axiology, positivist researchers regard inquiries to be value-free, as opposed to constructivist researchers who regard inquiry as being attached to values (Mukherjee & Kamarulzaman, 2016).

3.2.2 Interpretivist research paradigm

Research located in the interpretivist paradigm involves not seeing people as objects that can be researched like phenomena, but as individuals with the capacity to think, interpret and attach meanings to various occurrences (Magnusson & Marecek, 2015). Researchers doing research based on the interpretivist research paradigm argue that, instead of people simply perceiving their particular material and social circumstance, each individual makes sense of his or her environment or context within which they exist based on a cultural framework of "socially constructed and shared meanings", and that people's interpretation of the world influences their position in the world (Mukherji & Albon, 2010, p. 23). In particular, interpretive researchers "are interested in people's ways of making sense of their activities, experiences, and relationships" and how they intend to act in accordance with these ways of making sense (Magnusson & Marecek 2015, p. 2).

With regard to ontology and epistemology (the association between the person undertaking the research and the reality), interpretivism holds the position that reality is relative and can be understood in many ways (Edirisingha, 2012). According to interpretivism, the multiple realities are also dependent on other systems with regard to meanings, which implies that it is even more difficult to interpret the meanings by relying on fixed realities (Williamson, 2002). In addition, the knowledge that is gathered through interpretivism is not objectively

determined or perceived but is socially constructed (Edirisingha, 2012). This means that, as opposed to positivism, in which researchers have to be objective in their analysis and detached from the subject or the participants being studied, interpretivism requires an active connection between the researcher and the subject, and the meaning of what is being investigated has to be "socially and individually constructed" (Williamson, 2002, p. 30). As noted by Lin (2015), the researcher in an interpretivist paradigm "usually positions himself or herself as a participant-observer" in relation to those being researched (p. 25). Therefore, the interpretive paradigm allows the researcher to collect data that reflects how the research participants express themselves in regard to their feelings and experiences about a given phenomenon, which embodies some subjectivity (Rubin & Babbie, 2010). Instead of collecting data using a quantitative method when using a positivist paradigm, researchers who adopt an interpretive research paradigm use qualitative methods to collect data. This is based on the idea that the practical interest that underlies the interpretive approach is to develop knowledge that enriches the researcher's and others' "understanding of how people are doing what they are doing, and why, from the perspectives of the participants, i.e. the meanings they give to their actions" (Lin, 2015, p. 25).

In relation to axiology, interpretivist researchers consider inquiry to be attached to value, in opposition to the position taken by positivist researchers, who maintain that inquiries are value-free (Mukherjee & Kamarulzaman, 2016). In other words, the interpretivist paradigm maintains that studies cannot be value-free and instead asserts that it is not possible to avoid values when conducting research (Littlejohn & Foss, 2009). This is because a researcher's work is at all times led by the researcher's preferences about what to research and how best to carry out the study. In addition, it is noted that one's research may be shaped by the values observed

by an institution as well as other issues such as economic and political ideologies. Thus, according to interpretivist researchers, these influences make value-free studies impractical (Littlejohn & Foss, 2009). Writing about the axiology of interpretivism, Kivunja and Kuyini (2017) note that the interpretivist research paradigm assumes a balanced axiology. A balanced axiology posits that the outcome of a study will reflect the researcher's values, thus attempting to present a rational report of the research's findings (Kivunja & Kuyini, 2017).

With respect to methodological assumptions, the interpretivist research paradigm assumes a naturalist methodology (Kivunja & Kuyini, 2017). This means that the inquiry is done in a natural setting with the researcher playing a role as a participant observer (Kivunja & Kuyini, 2017; Miles & Jozefowicz-Simbeni, 2010). The researcher uses data collected through using real-life approaches such as discourses, interviews, reflective sessions, observation and text messages (Kivunja & Kuyini, 2017; Miles & Jozefowicz-Simbeni, 2010).

3.2.3 Critical research paradigm

In contrast to the interpretive and positivist paradigms, which have in common the attribute of having as their aim the development of descriptive theories of the social world, the critical research paradigm seeks to provide an answer to the critical questions of how the findings of a research will affect those being studied and the ways in which the research findings will be used (Lin, 2015). In addition, critical theory appreciates the point that the aim of the research is not just to describe what happens in the world, but also to provide change to the world (Lin, 2015; Wilson, 2001). As argued by Riazi (2016), critical theorists concern themselves with power relations and the social prejudice that results from those relations, and regard research as an avenue for changing social institutions and power relations on the basis of inequality. It is because of the aforementioned features of the critical theory paradigm that Smith

(2010) noted that “this paradigm is not really a theory .... but a view of the world that sees society in terms of conflict, inequity and power struggles” (p. 25). As such, from the critical paradigm, researchers need to think about what the implication of carrying out research in an unjust world is and thus help to empower groups that have been subordinated by demystifying policies and practices, and institutions that produce and sustain the subordination of some groups in the society (Lin, 2015).

According to (Mora et al., 2012), the assumptions relating to the ontology, epistemology, methodology, and axiology of the critical research paradigm are as follows. The critical research paradigm presupposes ontology of empirically researchable objects that can be sensed differently by instruments and observers in relation to their social status quo. The epistemology of the critical research paradigm comprises logic-argumentation or qualitative-based modes of coming up with reasonable and shared knowledge. The axiology of critical research is about acquiring knowledge and connections of interest on the issue being studied as an unprejudiced and truth-based human (Mora et al., 2012). The methodology is based on the qualitative and quantitative data unveiled.

3.2.4 Pragmatic paradigm

The pragmatic paradigm emerged from an understanding that different research methods can be mixed and can, in fact, be compatible (Creswell, 2009). In essence, pragmatism is a paradigm that permits the use of both deductive and inductive reasoning through a variety of combinations of quantitative and qualitative data (Creswell, 2009). Pragmatism can be described as a philosophical paradigm that considers reality as provisional instead of viewing it as absolute (Najmaei, 2016). One of the most notable aspects of the pragmatic paradigm is that instead of choosing between methods that have in the past been deemed to be paradigmatically

mismatched, it focuses on “what works” to provide an answer to the question being asked (Ary et al., 2010, p. 559). According to Creswell (2014), allowing the use of what is deemed to be workable, as envisaged in the pragmatic paradigm, makes it possible for researchers to utilise all approaches from a pluralistic viewpoint to comprehend the problem that is being investigated.

In pragmatic research, what is considered to be working is the truth about the subject that is being investigated at the time that the study is conducted. Given that pragmatism “places primary importance on the research question” (Shannon-Baker, 2016, p. 322), this means that the nature of the study and what is to be investigated determine when to use the pragmatic paradigm. More importantly, in the pragmatic paradigm, the truth is not premised on a strict interdependence between reality and the mind (Najmaei, 2016). Further, when pragmatism is used as a research paradigm, it “sidesteps the contentious issues of truth and reality, accepts, philosophically, that there are singular and multiple realities that are open to empirical inquiry and orients itself toward solving practical problems in the “real world”” (Feilzer, 2010, p. 8). This means that a pragmatic paradigm is not limited by the realities that may be attached to either qualitative or quantitative data collection methods when any of the methods are used singularly in a research.

The ontology, epistemology, methodology, and axiology of pragmatic research are as follows. With regard to ontology, pragmatism has external multiple views of reality (Saunders, Lewis & Thornhill, 2009). In addition, different views are used to best help in answering the research question (Saunders et al., 2009). Pragmatism’s view of epistemology is that either or both subjective meanings and observable phenomena can offer acceptable knowledge based on the research question (Saunders et al., 2009). In addition, pragmatism focuses on practical applied research and integrates different views to help in the interpretation of data (Saunders et

al., 2009). With regard to the methodology used in pragmatic research, researchers use mixed or multi-method designs that involve qualitative and quantitative methods of collecting data (Teddlie & Tashakkori, 2011). Finally, the axiology of pragmatic research is such that values play a major role in the interpretation of the results. During the process of analysing data, the researcher adopts both subjective and objective perspectives (Saunders et al., 2009).

Because of the relative "freedom" that the pragmatic paradigm confers on researchers, this paradigm can be applied in research studies that involve qualitative and quantitative research methods. This point is emphasised in the statement: "pragmatic investigations can use both quantitative and qualitative data to provide the best understanding of the research problem" (Najmaei, 2016, p. 25). As explained below, the present research utilised both quantitative and qualitative research methods, and therefore the pragmatic paradigm was selected as the most suitable paradigm.

3.2.5 Justification for applying the pragmatic research paradigm to this study

Given the possibility of using quantitative, qualitative, or mixed methods for this study, a number of factors were considered to ensure that the most appropriate research paradigm was selected. According to Creswell (2014), the factors that need to be considered when choosing a research paradigm include the research problem and personal experiences. Therefore, this study's research questions and my own personal interaction with the subjects of the study guided the selection of the research paradigm. The research questions have some elements that would be quantifiable and hence determined quantitatively, such as the number of technological tools that are used and how variables such as age and gender affect the educators' perceptions about the use of technology to support the learning of students with disabilities. At the same time, other aspects needed to be determined qualitatively, such as the educators' experiences in regard to

their interactions with students and the assistive technologies. There was also the need to see the value attached to the knowledge gained from the quantitative and qualitative data, which is made possible by the pragmatic research paradigm. Therefore, the pragmatic paradigm was selected as the most suitable paradigm for the current research.

3.3 Research Design

Research design can be defined as the overall strategy that a researcher chooses to integrate the different elements of a study in a logical and consistent manner, thereby ensuring that the research problem is effectively addressed (De Vaus, 2001). This includes the plan for collecting, measuring and analysing data, and is premised on the research problem (De Vaus, 2001).

According to Taylor, Kermode, and Roberts (2006), a research design offers a framework that can be used in a research project as the basis for answering a specified research question. The research design also offers guidance to the researcher in conducting the study and provides pointers to guide those involved in the study throughout the research project (Khan, 2008; Taylor et al., 2006). The research design that a researcher chooses to adopt can be a survey, a case study, a phenomenological study, ethnography, narrative inquiry, hermeneutics, or grounded theory (Kivunja, 2016). When choosing a research design, the researcher must ask whether and why the selected design is optimal for use in the particular research (Kivunja, 2016). The research design is important because it has a bearing on how the researcher approaches the research and conducts the study in a way that enables him or her to answer the stated research questions (Kivunja, 2016). Therefore, the research design outlines the specific details of how the research is carried out (Kivunja, 2016). The current research study, which applied a case study

methodology, involved a cross-sectional, exploratory case study. A cross-sectional case study design is a suitable methodology to collect data at a single point in time at a specific location (Lodico et al., 2012). This methodology is also suitable if the researcher would like to "examine current attitudes, beliefs, and opinions or practices about a specific group of people" (Creswell, 2012, p. 377). The justification for using the cross-sectional methodology in the current study was that the study was mainly focused on a specific group of educators who spend their time using technology to support and help students with different disabilities (i.e. hearing impairment, visual impairment and intellectual disability) in Saudi Arabian schools.

Basically, the research was designed as a case study, utilising mixed research methods involving qualitative and quantitative research methods. The aim of the exploratory study methodology was to "find out what is happening... to seek new insights... and to ask questions and assess phenomena in new light" (Saunders et al., 2009, p. 139) with respect to gaining an understanding of how technology is used to help students with hearing, visual and intellectual disabilities in schools in Saudi Arabia. The research design involved the collection and analysis of quantitative data followed by the qualitative data. The two sets of data were analysed separately and then brought together for the purpose of adding depth to the emerging outcomes. A summary of the process that was followed in the collection and analysis of data is shown in Figure 3.1.

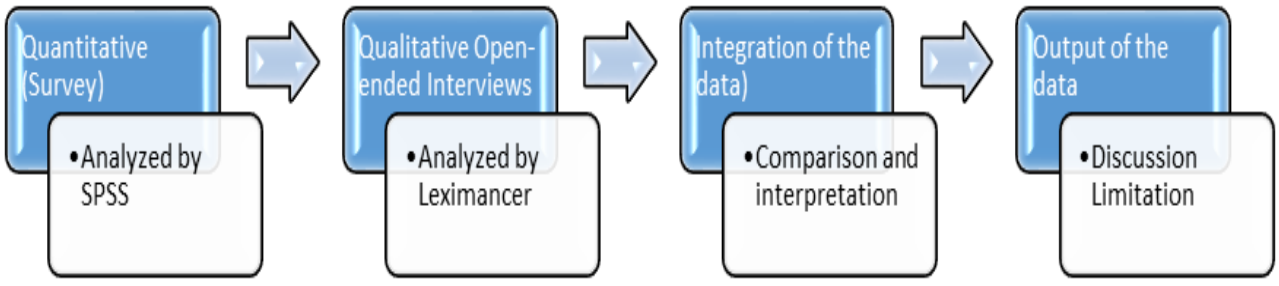

Figure 3.1: Illustration of the study's research design

In accordance with the location of the research in the pragmatic paradigm, both deductive and inductive approaches were used to test relationships between different concepts (deductive) and to gain "an understanding of the meanings humans attach to events" (Saunders et al., 2009, p. 127). Because of the importance of the research question in selecting the research design to be used, the current study relied on the research questions as stated in the introductory section of this chapter (section 3.1). Since the research questions have elements that require the use of both quantitative and qualitative research methods, as justified by the use of the pragmatic research paradigm, the sequential exploratory design was selected for this purpose while the mixed research methods were employed for data collection. Further details about the sequential exploratory design and the use of mixed methods in the research are provided in the following section.

3.3.1 Application of mixed research methods in a sequential, exploratory strategy

This study employed the sequential exploratory research design. It involved the use of both quantitative and qualitative research methods in what is referred to as mixed methods research, employing one method after another. According to Edinger (2008), "a sequential exploratory approach permits the collection and analysis of data based on both quantitative and qualitative research methods" (p. 57). Ordinarily, research designs that involve the collection of quantitative and qualitative data can employ parallel or sequential forms of data collection (Cameron, 2009). The parallel form, also known as the convergent strategy, involves the concurrent collection of data and analysis of two types of data (Cameron, 2009; Creswell, 2014), while the sequential form or the exploratory sequential strategy means that the two types of data are collected in sequence (i.e. one type of data offers a basis for collecting another type of data) (Cameron, 2009; Creswell, 2014).

According to Creswell (2014), the choice of the approach to be used (sequential or concurrent/parallel) is determined by whether the emphasis is placed on either the qualitative or quantitative data or on both types of data. Where the emphasis is placed on both types of data, the convergent approach is considered best. However, if the research emphasis is on either the quantitative component or the qualitative component of the study, then the sequential exploratory strategy is best used (Creswell, 2014). The sequential exploration strategy was adopted for the present research. This strategy allows the researcher to either commence the study with qualitative research, from where he/she obtains data, which is then used as a foundation for the quantitative research or to start with quantitative research followed by qualitative research (Creswell, 2014).

In the current study, I have started with quantitative research, followed by qualitative research. The rationale for adopting this strategy was to assist in generating an understanding of the study topic based on the quantitative study and using that understanding to create further awareness of any gaps that would be investigated through the qualitative study. In this study, I wanted to gain knowledge about educators' perceptions regarding the use of technology for students with hearing, visual and intellectual disabilities from quantitative data, so that the responses would be helpful during the process of designing questions for the second phase of the study, which involved a qualitative research approach.

3.4 Participants

The study participants were 266 educators of students with hearing, visual and intellectual disabilities in schools that use various technologies to help these students in their learning process. A total of 270 educators (from nine schools for students with hearing, visual

and intellectual disabilities, each school having 30 educators) were targeted for the research. However, of the total number of 270 educators, 266 educators provided their responses to the survey. Of the 266 educators, sixty were also interviewed as part of the research. These details are presented in Table 3.1.

Table 3.1: Participant details based on number of schools, targeted and actual responses in the survey, and the number of interviewed participants

Type of disability	No. of schools for each disability	No. of educators targeted per school	Total number of targeted educators
Hearing impairment	3	30	90
Visual impairment	3	30	90
Intellectual disability	3	30	90
Total number of educators targeted for the survey			**270**
Actual number of responses in the survey			**266**
Number of educators interviewed			**60**

The decision to study the perceptions of educators was informed by the understanding that educators spend most of their time at school with the students with special needs and are therefore likely to have a good understanding of each student's needs as well as where the use of technologies is most beneficial. The same educators have a role to help and guide students with special needs not only through their school and homework but also in assisting them to overcome obstacles they might otherwise not be in a position to. According to Miller, Fader, and Vincent (2001), the success of any services offered to young children rests with the professionals offering such services. In particular, Miller et al. (2001) indicate that teachers sometimes play a major curriculum development role for children with disabilities, and they assume the role of implementers of the special education curriculum.

3.4.1 Sampling of schools

Since the research aimed to investigate educators' perceptions and experiences of the use of technology to support the learning of students with hearing, visual and intellectual disabilities in selected schools in Saudi Arabia, purposive sampling was used to select the schools from which the participants for the study would be derived. Thus, the sampling strategy purposefully targeted schools that cater for students with the aforementioned disabilities.

Purposive sampling involves selecting a sample based on the understanding of a population (Babbie, 2008). It is also premised on the supposition that the researcher aims to discover, comprehend and gain insight and, for that reason, must choose a sample from which the most can be learned (Merriam, 2009). A purposive sample is thus one where individuals from a pre-specified grouping are purposively identified and sampled (Gerrish & Lacey, 2010). Such an approach is not so much concerned with random sampling since it aims for a sample of information-rich research participants (Struwig & Stead, 2001). Specifically, the sampling process was designed to only target those special schools that cater for students with the disabilities that have been discussed. For each of the three identified disability categories, three schools were selected. In total, therefore, nine schools were sampled for inclusion in the study. The selection criteria for each sampled school involved was a requirement to have only one specialisation in teaching students in each of the three disabilities on which the study was based (i.e. hearing impairment, visual impairment and intellectual disability). In total, therefore, three schools sampled for inclusion in this research specialised in teaching students with visual impairment, another three schools specialised in teaching students with hearing impairment, while the third category of schools were those that specialised in teaching students with intellectual disability. Details of the schools are shown in Table 3.2.

Table 3.2: The institutes and number of schools selected for the study

Institute	No. of schools per institute
Al Amal Institute (for learners with hearing impairment)	3
Al Noor Institute for the Blind (for learners with visual impairment)	3
Institute of Intellectual Disabilities (for learners with intellectual disability)	3
Total number of schools	**9**

The schools were identified by me based on information that is publicly available about these schools (i.e. the schools offer education to students with hearing, visual and intellectual disabilities). The nine schools targeted for the research were selected from three regions of Saudi Arabia (Riyadh, Jeddah, and Dammam) due to convenience and accessibility. The Kingdom of Saudi Arabia provides education to people with special needs (auditory disability, visual disability, and intellectual disability) through institutes supervised by the Ministry of Education in Saudi Arabia such as Al Amal Institute, Al Noor Institute and Institute of Intellectual Disabilities.

Al Amal Institute is one of the specialised institutes in auditory disability. Education in Al Amal Institute is based on taking educational directions in teaching. The educational system starts in the primary stage from the age of seven years, and the institution uses a curriculum similar to the one used in public education. The Al Noor Institute is the nucleus of private education in Saudi Arabia for visual disability. It provides educational, rehabilitative and cultural programs. Most Al Noor Institutes follow the boarding school system, which includes a residential section to stay in. In addition, the Ministry of Education in Saudi Arabia provides all institutes with a version of its educators' and students' textbooks customised and recorded by the Central Talking Library. The third type of targeted school in this the research is the Institute of

Intellectual Disabilities. Saudi Arabia established these institutes for intellectual disabilities. It starts with the qualifying stage, which lasts for two years and is followed by the primary stage, which is six years long. During this period, students, based on their abilities, get reading and writing lessons to improve their basic skills. There is an integrated approach for the students, and specially printed books are available for them. The students are subject to continuous evaluation throughout the year and, based on reports, the growth of the students' abilities and their collected grades are determined and thus transferred to the next stage (Afeafe, 2000).

3.4.2 Sampling of participants

Educators in all the selected schools were invited to participate in the study. The sampling frame for the survey fell within the purposive and convenience sampling techniques. Convenience sampling entails getting subjects wherever they can be found and usually wherever is convenient (Jackson, 2015). Jackson (2015) also adds that purposive sampling technique is based on the judgemental, subjective and selective study objectives as well as the related population. Further, participants are selected based on their accessibility as well as willingness to respond. Although convenience sampling is easy to use and less expensive, it has been criticised for being a weak form of sampling since the researcher does not make any attempt to know the population or to utilise a random process in selection (Gravetter & Forzano, 2012).

In addition, the researcher has little control over the authenticity of the sample and, as such, there is a high possibility of obtaining a biased sample (Gravetter & Forzano, 2012). However, these weaknesses were eliminated in this study by the fact that I employed purposive sampling to select the schools (special schools) in which the participants (educators) were to be studied. I have made it clear that only those educators who were involved in teaching students with the aforementioned disabilities should participate in the research. From each of the nine

selected schools, I targeted 30 educators. Details about the study and consent forms, together with questionnaires, were distributed to all participating schools. Educators who consented to participate were asked to complete the questionnaires.

3.4.3 Response rate

Each school has about 20–30 educators, which means that if all the educators had responded, the questionnaire survey would involve a maximum of 270 participants, (calculated as 30 educators × 9 schools = 270). As the researcher, I was expecting 270 educators to respond; however, only 266 educators responded to the questionnaire. The response rate per education institute is shown in Table 3.3 below.

Table 3.3: Response rate per each education institute

Schools/Institutes	Targeted number of educators	Actual number of educators who responded (actual sample size)	Actual number of responses as a percentage (%) of total sample size
Al Amal Institute	90	82	31
Al Noor Institute	90	78	29
Institute of Intellectual Disabilities	90	106	40
Total	**270**	**266**	**100.0**

As stated earlier, I also interviewed 60 of these educators as a way of administering the open-ended questions in the questionnaire. To abide with Saudi custom (where there is a separation of genders), my male research assistant went to the schools for male students and distributed the questionnaire and interviewed participants. Of the total of 270 (N) questionnaires distributed, 266 (n) were returned. The overall response rate was 98 percent. As illustrated in Table 3.4, 106 responses were from Institute of Intellectual Disabilities, 82 from Al Amal Institute and 78 from Al Noor Institute.

Table 3.4: Sampling response rate and percentage of participants per school

Schools	N	n	Response rate (%)	Participant (%) [n/266%]
Al Amal Institute	83	82	99	31
Al Noor Institute	79	78	99	29
Institute of Intellectual Disabilities	108	106	98	40
Total	**270**	**266**	**98**	**100**

3.5 Data Collection Instruments

The research used open-ended questions and interviews in order to collect qualitative data, while the survey questionnaire was used to collect quantitative data. The survey questionnaire focused on the educators' background information (such as gender, teaching experience) in Part A and their perceptions about the use of technology to support the learning of students with hearing, visual and intellectual disabilities in Saudi Arabian schools in Part B. The questionnaire contained 21 statements to be rated on a 1–5 point Likert-type classification from "Strongly disagree" to "Strongly agree" respectively. The survey questionnaire and open-ended questions were translated originally from English to Arabic to ensure the cultural adaptation of the survey for Arabic-speaking Saudi participants by Dr. Maisarah Kittaneh. (Lecturer of English at Imam University, Saudi Arabia) Examples of statements that were contained in the questionnaire are:

1. Learning can be improved considerably if educators support the use of assistive technologies for the students with disabilities (hearing impairment, visual impairment, and intellectual disability).
2. The use of technology helps students with disabilities (hearing impairment, visual impairment, and intellectual disability) improve their learning.

   (The full questionnaire is provided in the Appendix).

There were also open-ended questions at the end of the questionnaire that focused on the following themes:

- Type of technologies used in schools.
- Educators' experiences.
- How technology affects learning.
- The challenges involved and how these challenges can be overcome.

The following questions were also used to guide the interview discussions:

1. Does the school you teach in use assistive technology for students with hearing, visual and intellectual disabilities?
2. What types of technological tools are used in your school for students with hearing, visual and intellectual disabilities?
3. What is your experience as an educator using technology?
4. What difference do you think technology makes when it is used among students with hearing, visual and intellectual disabilities in your school?
5. Have you ever designed a program for students with hearing, visual and intellectual disabilities to improve their use of technology? What was it like?
6. How is the technology used towards enhancing learning for students with hearing, visual and intellectual disabilities in your school?
7. What is the role of technology and its influences on the learning of students with hearing, visual and intellectual disabilities in your school?
8. What are the challenges faced by your school in the implementation and/or use of technology for the learning of students with the aforementioned disabilities in your school?
9. How do you think the challenges can be overcome?

The use of open-ended questions in the interviews implies that the respondent is asked to provide his or her own answers to the questions (Rubin & Babbie, 2010). Qualitative questionnaires are often used when the researcher wants to know how the participants feel, think

about or experience a phenomenon, or when the researcher wants to know why the respondents think something happens (Johnson & Christensen, 2012). Since the participants are required to give their responses by writing their answers in their own words, the open-ended questions can offer rich information (Johnson & Christensen, 2012). I conducted 60 interviews with participants from all the nine schools involved in the study from three regions: Riyadh, Jeddah, and Dammam. The schools included Al Amal Institute, Al Noor Institute and Institute of Intellectual Disabilities. I obtained 20 responses from each of these three institutions. The interviews involved the use of open-ended questions as outlined above.

3.6 Data Collection

This section presents information about the various activities that were conducted as part of the data collection process. First is the process of seeking approval from the UNE Ethics Committee, which was done to ensure that the study was approved and to guarantee that ethical considerations would be adhered to during the research. The next part is a description of a pilot study that was conducted to check the feasibility of the data collection instruments (i.e. a survey questionnaire and interview questions). This is followed by a description of how the collection of data for the research was conducted.

3.6.1 Ethical procedures and informed consent

Prior to the process of collecting data, I sought the ethics approval from the University of New England (UNE) Ethics Committee. The need to seek ethics approval is related to the fact that researchers have documented various ethical dilemmas that can arise during the process of fieldwork and data collection, many of which are premised on issues of power and privilege, honesty and lying, as well as the overall quality of the association between the researcher and

what is being researched (Klenke, 2008). In addition, there are ethical issues relating to the construction of knowledge and matters of advocacy (Klenke, 2008).

This study observed the ethical issues of confidentiality, informed consent, and harm avoidance. First, the study was not anticipated to harm the participants. I had to seek consent prior to conducting the interviews. Second, informed consent was achieved by providing the participants with an information sheet prior to the interviews that provided background about the study and what it entailed. The voluntary nature of this study and the participants' right to withdraw from the study was reiterated in the information sheet, which the participants signed prior to the interviews. Finally, participants were reassured that the information would be stored safely and confidentiality would be protected at all times. Pseudonyms were used to report the findings. Participant's names were kept separate from the data until the research was completed.

Once approval was obtained, I sent a letter to the Ministry of Higher Education in Saudi Arabia detailing the purpose and relevance of the research. I also contacted the Ministry for the purpose of distributing a survey questionnaire to educators and conducting face-to-face interviews with them. The questionnaires were then distributed to the nine schools that were targeted from three regions: Riyadh, Jeddah, and Dammam. The schools included Al Amal Institute, Al Noor Institute and Institute of Intellectual Disabilities. I sought, and was given, permission to use the names of the schools.

Over a period of three months, I visited each school to seek the school principals' approval for the collection of data in their schools, and to ask for participants' consent. During each visit, I provided the school principal with copies of the information sheet for participants, consent forms, and questionnaires. Upon each school principal granting permission for the research to be conducted, I was given an appointment to meet with the targeted participants from

each school. All copies of the completed consent forms were stored in a safe cabinet to which only I had the key.

3.6.2 Pilot study

A pilot study was first conducted by asking educators in two schools to complete a draft questionnaire and allowing them an opportunity to participate in interviews. This was to help me validate/refine the questionnaire before it was used in the actual data collection process. The pilot test was conducted to determine whether the data collection tool (in this case, the questionnaires and interview guide) could yield accurate data (Cargan, 2007). More importantly, the pilot study was intended to provide answers in relation to whether there were enough directions for me to carry out the research and analyse the collected information; whether the necessary information was being made available; whether the questions being asked were appropriate for the people participating in the research; and whether the information gathered was consistent (i.e. whether the necessary items that could be evaluated for internal consistency were included) (Cargan, 2007).

During piloting of the research instruments, the following was performed to answer the related questions to the pilot study. First, I designed a survey and a questionnaire, which were then used to collect data for the feasibility study. This helped in understanding the study's research questions and problems. During the piloting stage, I was available and helped the research participants in regard to questions that were not clear. Secondly, to ensure that the sample that was being used for the pilot study represented the sample that was targeted for the research, I used respondents from two schools that were part of the schools targeted for the actual research. The importance of pretesting the survey instrument on people of a similar nature as those to be involved in the actual research has been emphasised by Walliman (2006); he stated

that, where possible, the researcher should "test a pilot study on people of a similar type to those in the intended sample to anticipate any problems with comprehension or other sources of confusion" (p. 90). In addition, I tested the content of the questionnaires by ensuring that all the main areas of the research had been covered in the questions. Thus, the questions that were used in the pilot study were the same as those used in the actual research. As part of the pilot study, I distributed 30 questionnaire samples to three schools, with each school having students with one of the three types of disabilities (i.e. hearing impairment, visual impairment and intellectual disability). I helped the participants in the pilot study to understand the questions by clarifying any areas in which the participants faced problems. This was followed by questions and answers participation during the feasibility study.

3.6.3 Data collection procedures

During subsequent meetings with the research participants after the pilot study, all the educators were invited to complete the survey and to answer the interview questions. I distributed questionnaires to each of the willing participants. Participants were required to answer the questions provided to them in the questionnaire relating to the use of technology in their schools.

3.7 Data Analysis

3.7.1 Qualitative data analysis

The data from the qualitative interviews comprising open-ended questions were analysed using the Leximancer software, which is explained below. This analysis related to research questions 1, 3, 4 and 5, which, as stated earlier (section 1.5), were:

1. What types of technological tools are used in schools for students with a disability (hearing impairment, visual impairment, and intellectual disability)?

3. What experiences do educators have about the use of technology to support the learning of students with disabilities?
4. What challenges do educators face while using different assistive technologies to teach students living with any of the three types of disabilities (hearing impairment, visual impairment, and intellectual disability)?
5. What can be done to improve the use of technology to support the education of students with these disabilities?

Leximancer is a semantic data analysis tool that was developed in 2001 at the University of Queensland, Brisbane, by Andrew Smith (Sotiriadou et al., 2014; Liverpool John Moores University, n.d.). The software is a useful analysis tool for researchers who need to explore a large amount of text-based data in cases where manual coding and analysis would take a long time. Thus, Leximancer was used to analyse the contents of collections of textual documents and to visually display the extracted information. The Leximancer software works through a process that is referred to as "unsupervised semantic mapping of natural language" or a kind of text mining (Liverpool John Moores University, n.d., p. 1). Leximancer uses two stages of extracting information – relational and semantic – by employing a unique algorithm for every stage (Smith & Humphreys, 2006; Liverpool John Moores University, n.d.). The software also calculates the occurrence of every word and then computes the distances between each of the words (a phenomenon known as co-occurrence). The results of calculations are shown in the form of network clouds, concept maps and concept thesauruses that can be looked at on the basis of individual concept levels and also by focusing on family connections that exist between various themes or concepts (Liverpool John Moores University, n.d.; Sotiriadou et al., 2014).

The display of the information being analysed is achieved via a conceptual map that offers a good view of the material, showing the key themes in the data, the main concepts that are captured within the text and the relationships that exist among the concepts. In addition to

offering a conceptual structure of the information being analysed, the concept map enables users to conduct a guided document search to explore occurrences of the concepts and the relationships between these concepts. In other words, Leximancer offers a way to quantify and display the conceptual detail of a set of documents and also provides a mechanism for using the information to explore important conceptual features (Leximancer, 2011).

During the process of analysing data, Leximancer automatically extracts the most important concepts that appear in the documents being analysed. The concepts are grouped into "higher-level themes" when the map is created (Leximancer, 2011, p. 14). Concepts that appear often in the same sets of text draw one another closely and therefore tend to appear close to one another in the map. Themes that emerge from the text are mapped using colours with different levels of "hotness" to suggest importance. The warm colours (i.e. red, orange and yellow) indicate the most important themes, with red indicating the most important theme followed by orange and so forth (Leximancer, 2011) while the cool colours (i.e. blue, green and purple) indicate the less important themes.

To analyse the interview data that were collected in the present research, the entire data set of the interview results (transcripts) was run through the Leximancer software. This was based on the topic "how technology is used to help students with hearing, visual and intellectual disabilities in the selected schools in Saudi Arabia". From the data, the following map (Figure 3.2) was extracted.

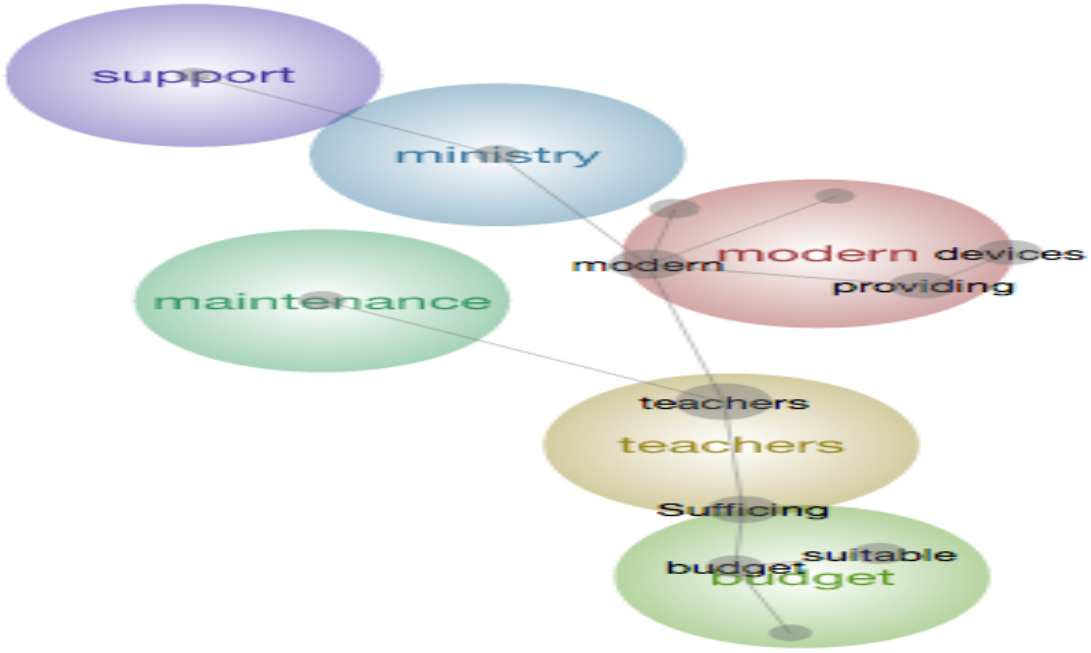

Figure 3.2: Leximancer mapping of concepts within themes in the study
Source: Data analysis by me.

It was previously noted that Leximancer automatically extracts the most important concepts discussed in the documents being analysed. In the analysis for this study, the focus was on educators' perceptions and experiences, with the main themes (shown in Figure 3.2 as the big circles), being "modern", "teachers", "budget'', "ministry", "support", and "maintenance". Inside each of these themes lie the concepts also illustrated in Figure 3.2. For example, the theme "modern" contains the concepts "modern", "devices" and "providing". The theme "teachers" consists of the concepts "teachers" and "sufficing". In the map, the importance of each concept's label is related to the concept's relative frequency in the text, and this varies in colour from red (highly frequent) to light grey (infrequent). The location and size of the concept point indicates its connectedness to the central theme. The colour of each concept indicates its thematic group. Each thematic group is also a cluster of concepts surrounded by a circle. After understanding the layout of the concept map as well as the concepts that were emerging from the data and how they

were connected, I then explored the various interrelationships that existed among the selected concepts. Themes were then explored as concept clusters that represented the most semantically linked groups of concepts. The theme name was derived from the most important concept in each cluster. Leximancer also produced a graphic that is called a relative frequency. As shown in Figure 3.3 below, the six most frequent concepts were “modern”, “teachers”, “maintenance”, “budget”, “ministry”, and “support”.

A detailed analysis using Leximancer revealed that “modern” (100 percent in 23 hits) was the most dominant concept. The word “teachers” was the second most mentioned tool at 50 percent in 21 hits. Other themes had generally low numbers of hits as follows: “maintenance” 30 percent in seven hits; “budget” 30 percent in seven hits; “ministry” 20 percent in six hits; and “support” 10 percent in five hits. Leximancer ranks the themes based on the frequency of the concepts that constitute each theme. The frequency is interpreted as reflecting the relative importance of the concepts and is portrayed in the Leximancer output, as illustrated in Figure 3.3 below.

Figure 3.3: Leximancer analysis of the relative frequency of each concept
Source: Data analysis by me.

3.7.1.1 Trustworthiness of the study

I conducted the qualitative aspect of the study while making an effort to ensure trustworthiness. Trustworthiness is a feature of research that demonstrates the research’s truth value, offers a basis for conducting the research, and makes it possible for external judgments to

be made in relation to the consistency of the procedures used in the research and the neutrality of the findings or decisions that are made in the research (Tappen, 2013). Trustworthiness has four aspects: "credibility, transferability, dependability, and confirmability" (Hepper, Kivlighan & Wampold, 2008, p. 294).

Credibility of research refers to whether the perceptions of the participants in a research or the events in the research correspond with the researcher's portrayal of the perceptions or events (Lodico, Spaulding & Voegtle, 2010). Transferability or generalizability refers to the ability of the results of a research to be applied to other contexts and scenarios beyond the latitude of the current research context (Given, 2008). In order to increase a research's transferability, the researcher needs to focus on two key areas: (1) how connected the participants should be to the phenomenon being investigated, and (2) the related boundaries of the findings of the research (Given, 2008). As regards the first consideration, the research participants are supposed to be members of the population that is related to the study. The second consideration pertains to providing a full understanding of the scenario being investigated and making sure that the research questions are answered in the appropriate way. Dependability on the other hand refers to the notion that the research can be relied upon over time (Hepper et al., 2008). That is to say that if the results of a research are dependable, they can be trusted over time. Lastly, confirmability implies that the researcher remains neutral and objective while analyzing and interpreting the data that have been collected in the research (Major & Savin-Baden, 2010).

To enhance the research's credibility, transferability, dependability, and confirmability, I acted in the following ways. As regards credibility, I adopted a systematic and consistent process in collecting and analyzing data. Also, all fieldwork and data analysis procedures were

conducted in such a way that they could be examined and confirmed by others. As regards transferability, I depended on a sample of individuals who were familiar with the research topic. And to ensure that the results were dependable, I made use of all interpretive cues from the participants including intonation and nonverbal communication to do make inferences regarding the responses from the participants. Finally, for confirmability, I remained objective during the entire process of collecting, analyzing and interpreting the results.

3.7.2 Quantitative data analysis

The quantitative data that were collected using questionnaires was analysed using SPSS software. SPSS provides tools to organise, transfer and analyse raw data. The software also enables me to identify frequencies, descriptions, crosstabs and correlations of data among other helpful analysis from the research.

3.7.2.1 Reliability of the tools

Tests were conducted to ascertain the psychometric properties (reliability) of the scale to ensure that the measurement was accurate and sound and that the constructs captured information required for the study (Hair, 2006; Creswell, 2014). To achieve this, reliability analysis (Cronbach's alpha test) was carried out for both the pilot and main study data. Reliability analysis was conducted for the questionnaire "Perceptions about the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disability)".

A pilot application of the tools was performed on 30 respondents, and the results subjected to reliability analysis. The reliability analysis results showed a Cronbach's Alpha of (0.737) for the whole questionnaire, as shown in Table 3.5 below. For the final data collection, the sample size was 266 respondents. The calculated Cronbach's alpha was (0.786) for the whole

questionnaire. These results indicate a good reliability for the questionnaire, with Cronbach's alpha ranges from r=0 to 1, with r=0.7 or greater considered as sufficiently reliable (Nunnally, 1978; Cooksey, 2007) (see Table 3. 5).

Table 3.5: Test-Retest Reliability: Cronbach's Alpha

	A pilot –test	**Main study**
Questionnaire	.737	.786

3.7.2.2 Factor analysis

I conducted a factor analysis of the scores for the scale. The factors analysis yielded seven factors, which accounted for 67.49 percent of the explained variance.

3.7.2.3 KMO and Bartlett's test

Table 3.6 displays the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and Bartlett's test of sphericity. The result of the KMO test was 0.758, indicating that the patterns of correlation were relatively compact and so factor analysis is reliable with a good degree of accuracy (Kaiser, 1974). In addition, the table presents the results of Bartlett's test with p-value < 0.05, indicating that the correlation matrix is not an identity matrix, so there was a relationship between the items, and in this case factor analysis is appropriate. Finally, all requirements above were met in this study, indicating that these factors could be distinct and reliable.

Table 3.6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.758
Bartlett's Test of Sphericity Approx. Chi-Square	1888.001
Df	210
Sig.	0.000

3.7.2.4 Factor extraction

Table 3.7 below shows 21 items with initial Eigenvalues related to each item as well as percentage of the variance. To determine the number of important and meaningful factors for interpretation, this study checked the total variance percentages. The results indicated that the cumulative variance was 67.49 percent for all factors. It is seen clearly that seven factors explain relatively 67.49 percent of the variance. In particular, factor 1 explains about 21.97 percent of the variance, factor 2 explains about 14.44 percent, and factor seven explains about 4.86 percent. Based on the Eigenvalues indicator in Table 3.7 and the scree plot, only seven factors had a value greater than 1.0.

Table 3.7: Total Variance Explained

Items	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
S1- The use of technology helps students with disabilities.	4.62	21.97	21.97	4.62	21.97	21.97	3.06	14.58	14.58
S2- Technology should be introduced in all schools that cater for students with disabilities.	3.03	14.44	36.41	3.03	14.44	36.41	2.24	10.67	25.25
S3- The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities.	1.67	7.95	44.36	1.67	7.95	44.36	2.23	10.60	35.85
S4- Improving the use of technology to help students with disabilities.	1.36	6.48	50.84	1.36	6.48	50.84	2.04	9.70	45.55
S5- My school principal expects me to use technology to support student learning.	1.31	6.25	57.09	1.31	6.25	57.09	1.77	8.41	53.97
S6- My school has an adequate/broad/wide range of assistive technologies.	1.17	5.55	62.63	1.17	5.55	62.63	1.43	6.81	60.77
S7- Parents of students have been of great assistance, giving in-kind assistive technology devices to the school.	1.02	4.86	67.49	1.02	4.86	67.49	1.41	6.72	67.49
S8- Learning can be improved considerably if educator supports the use of assistive technologies.	0.88	4.18	71.67						
S9- All stakeholders support the use of technology to support student learning.	0.71	3.40	75.07						

S10- The assistive technologies currently in use in my school are effective in helping students with disabilities.	0.67	3.20	78.27						
S11- My school has challenges acquiring assistive technologies for the students with disabilities.	0.61	2.89	81.17						
S12- Effectively use assistive technology to support learning.	0.58	2.78	83.95						
S13- Using assistive technologies when teaching the students with disabilities.	0.55	2.63	86.57						
S14- Students are more pleased to use assistive technologies.	0.51	2.44	89.01						
S15- Enhance the learning experience among students with disabilities.	0.47	2.25	91.26						
S16- Training to use of assistive technologies for the students with disabilities.	0.44	2.08	93.34						
S17- The use of technology in my school faces too many challenges.	0.36	1.69	95.03						
S18- As an educator, I already know what can be done to improve the efficiency of assistive technologies.	0.34	1.61	96.64						
S19- Identified the skills that students with disabilities need.	0.29	1.37	98.01						
S20- The lack of technology designed for Arab users is hindering technology use in my school.	0.22	1.05	99.06						
S21- Current assistive technologies need significant improvement.	0.20	0.94	100.00						

Extraction Method: Principal Component Analysis

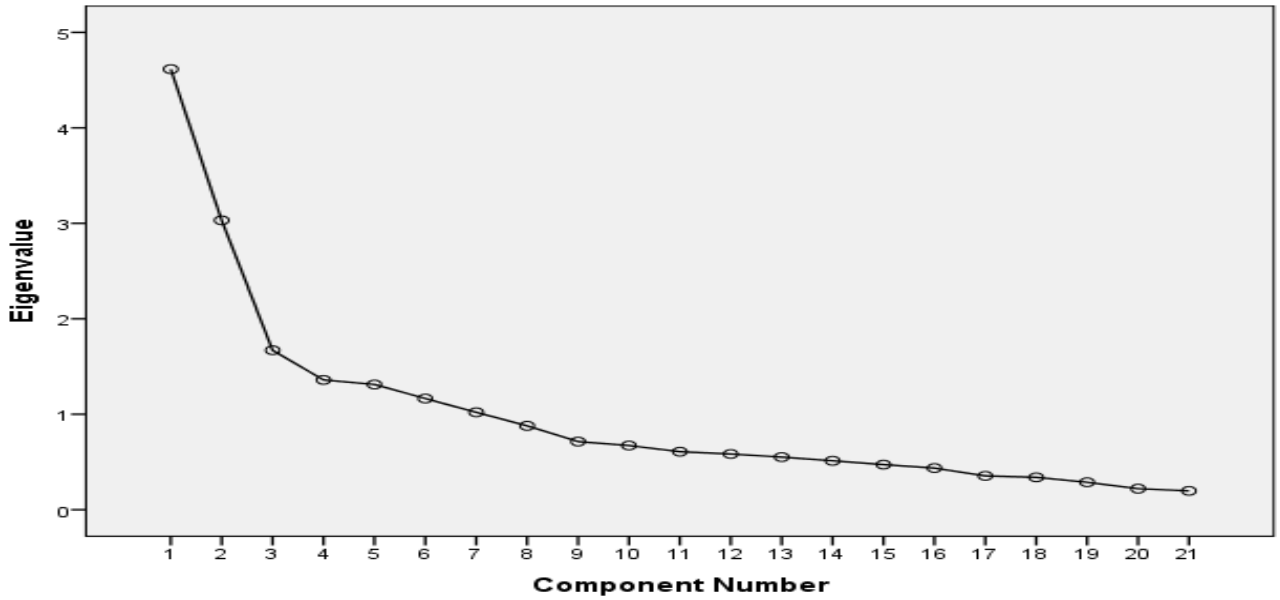

Figure 3.4 Scree Plot

3.7.2.5 Descriptive statistics of factors

This section presents descriptive statistics of the survey factors as outlined in Table 3.8

Table 3.8: Descriptive statistics for the seven factors

Factors	N	Mean	Std. Deviation
Factor 1: Resources and support	266	0.764844	0.207895
Factor 2: Benefits of technology	266	0.604454	0.00000
Factor 3: Educators' capacity	266	0.72254	0.12308
Factor 4: Aim of technology use	266	0.714135	0.31013
Factor 5: Students' disposition	266	0.855514	0.00000
Factor 6: Challenges	266	0.75576	0.331885
Factor 7: Future developments and improvement	266	0.788527	0.467745

Table 3.8 presents the descriptive statistics for the measured items of the factors. The mean value of Factor 1, resources and support, was (0.764844) with standard deviation of (0.207895); the mean value of Factor 2, benefits of technology, was (0.604454) – the smallest mean – with standard deviation (0.00000); the mean value of Factor 3, Educators' capacity, was (0.72254) with standard deviation (0.12308); the mean value of Factor 4, aim of technology use, was (0.714135) with standard deviation (0.31013); the mean value of Factor 5, students' disposition, was (0.855514) – the highest mean – with standard deviation (0.00000); the mean value of Factor 6, challenges, was (0.75576) with standard deviation (0.331885); and the mean value of Factor 7, future developments and improvement, was (0.788527) with standard deviation (0.467745).

The factors after promax rotation were as follows. There were five questions under Factor 1, the resource and support factor: **S3** – The Saudi Arabian education sector is doing enough to

provide assistive technology to students with disabilities; **S6** – My school has an adequate/broad/wide range of assistive technologies; **S7 –** Parents of students have been of great assistance, giving in-kind assistive technology devices to the school; **S9 –** All stakeholders support the use of technology to support student learning; and **S10 –** The assistive technologies currently in use in my school are effective in helping students with disabilities. The three items loaded into Factor 2, the benefits of technology factor, were: **S1** – The use of technology helps students with disabilities; **S2** – Technology should be introduced in all schools that cater for students with disabilities; and **S8 –** Learning can be improved considerably if educators support the use of assistive technologies. Factor 3, educators' capacity to use technology, had five questions: **S13** – Using assistive technologies when teaching the students with disabilities; **S15** – Enhance the learning experience among students with disabilities; **S16** –Training on the use of assistive technologies for the students with disabilities; **S18** – As an educator, I already know what can be done to improve the efficiency of assistive technologies; and **S19** –Identified the skills that students with disabilities need. Factor 4, which relates to the aim of technology use, had two questions: **S4** – Improving the use of technology to help students with disabilities; and **S5** – My school principal expects me to use technology to support student learning. Two questions were loaded for Factor 5, student disposition: **S12** – Effectively use assistive technology to support learning; and **S14** – Students are more pleased to use assistive technologies. Factor 6 was related to challenges and was loaded with two questions: **S11 –** My school has challenges acquiring assistive technologies for the students with disabilities; and **S17** – The use of technology in my school faces too many challenges. The final factor, Factor 7, was related to future developments and improvement. There were two questions under this factor:

S20 – The lack of technology designed for Arab users is hindering technology use in my school; and **S21** – Current assistive technologies need significant improvement (see Table 3.9).

Table: 3.9 PROMAX Pattern Matrix

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
S9- All stakeholders support the use of technology to support student learning.	.878						
S10- The assistive technologies currently in use in my school are effective in helping students with disabilities.	.764						
S7- Parents of students have been of great assistance, giving in-kind assistive technology devices to the school.	.737						
S6- My school has an adequate /broad wide range of assistive technologies.	.619						
S3- The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities.	.586						
S2- Technology should be introduced in all schools that cater for students with disabilities.		.874					
S1- The use of technology helps students with disabilities.		.814					
S8- Learning can be improved considerably if educators support the use of assistive technologies.		.658					
S18- As an educator, I already know what can be done to improve the efficiency of assistive technologies.			.843				
S19- Identified the skills that students with disabilities need.			.735				
S15- Enhance the learning experience among students with disabilities.			.711				
S13- Using assistive technologies when teaching the students with disabilities.			.534				
S16- Training to use of assistive technologies for the students with disabilities.			.309				
S4- Improving the use of technology to help students with disabilities.				.899			
S5- My school principal expects me to use technology to support student learning.				.875			
S14- Students are more pleased to use assistive technologies.					.766		
S12- Effectively use assistive technology to support learning.					.750		
S17- The use of technology in my school faces too many challenges.						.873	
S11- My school has challenges acquiring assistive technologies for the students with disabilities.						.793	

S20- The lack of technology designed for Arab users is hindering technology use in my school.							.870
S21- Current assistive technologies need significant improvement.							.751

Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.

The factors were subjected to reliability analysis and the results showed that Factor 1 had an alpha of 0.800, Factor 2 had an alpha of 0.760, Factor 3 had an alpha of 0.707, Factor 4 had an alpha of 0.844, Factor 5 had an alpha of 0.484, Factor 6 had an alpha of 0.555, and Factor 7 had an alpha of 0.526 Overall, it the alpha values were adequate for further analysis and therefore, the four factors were used as variables to determine how the participants' demographic characteristics such as gender and experience influenced their responses to the questionnaire about using technology. The results are presented in the quantitative results section.

Table 3.10: Measurement factors' coefficients and reliability measures

Factors	**Items**	**Cronbach's Alpha**
Resources and support	5	0.800
Benefits of technology	3	0.760
Educators' capacity	5	0.707
Aim of technology use	2	0.844
Students' disposition	2	0.484
Challenges	2	0.555
Future developments and improvement	2	0.526
Total	**21**	**0.668**

Data analysis for answering the research questions

In order to answer the key research questions, descriptive and inferential statistical procedures were used. For research question 2, "How do variables such as gender, training, and

educators' experience affect the educators' perceptions about the use of technology to support the learning of students with disabilities?", an independent samples T-test and an analysis of variance (ANOVA) were conducted with the entire scale and then with the seven factors to discover whether educators' perceptions about the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disability) were influenced by variables such as gender and occupation.

As reported above, the other research questions (1, 3, 4 and 5) were answered based on the outputs obtained using the Leximancer software. The purpose of answering these questions was to discover the types of technological tools and experiences that educators have, the challenges that educators face while using different assistive technologies, and how to improve the use of technology to support the education of students in Saudi Arabia with the aforementioned disabilities.

3.8 Summary

This chapter presented information about various aspects of the methodology that was used in the research to investigate how technology is used to help students with hearing, visual and intellectual disabilities in selected schools in Saudi Arabia. The research was located in the pragmatic paradigm, which is a philosophical paradigm that regards reality as provisional instead of viewing it as absolute. This paradigm was selected because it focuses on the research methods that can work to provide an answer to the research question. More importantly, the pragmatic paradigm was the perfect fit for this research because it used both quantitative and qualitative research methods. Specifically, this paradigm enables researchers to have multiple views of reality, to accept both subjective meanings and observable phenomena in the search for answers

to a research question, to use mixed research methods designs, and to acknowledge that the researcher's values play an important role in the interpretation of the results of a study.

Located within the pragmatic paradigm, the study employed a cross-sectional, case study methodology in which exploratory case study. Sequential mixed research methods were used to collect the data. The use of mixed methods was also justified because the use of both qualitative and quantitative data helped me to gain a better understanding of how the use of technology helps Saudi Arabian students with different types of disabilities. Specifically, the use of both qualitative and quantitative methods in a sequential way was important since it helped me to triangulate the data and validate the results and to address issues that might not have been clearly addressed using one method.

The population, sample size, and participants included nine schools in three cities in Saudi Arabia that offer education to students with hearing, visual and intellectual disabilities. Data collection was undertaken after ethics approval by the university and upon seeking consent from the Saudi Arabian Ministry of Education and the respective schools. Data collection instruments (the survey questionnaire and the open-ended/interview questions) were piloted before the actual data collection to ensure that the tools could be used to collect accurate data. Two hundred and seventy educators from the nine schools were targeted for data collection using a survey questionnaire. Of the targeted number 270, 266 educators responded to the survey questionnaire. In addition, 60 educators were also interviewed.

The qualitative data were analysed using the Leximancer software, while the quantitative data were analysed using SPSS. The findings from both the qualitative and quantitative analyses of data were integrated to provide a deeper understanding of the results by evaluating the extent

to which the data helped in providing answers to the research questions. Reliability testing and factor analysis were conducted as part of the analysis.

To make the research credible, transferable, dependable, and confirmable, I applied the following measures. I used a systematic and consistent procedure to collect and analyze data to enhance the credibility of the research. I also involved subjects who were familiar with the research topic and keenly analyzed their interpretive cues to make the results transferable and dependable. As regards confirmability, I was neutral during the course of collecting, analyzing and interpreting the results, the finding were then integrated.

According to Robinson, David, and Hill (2016), there are three techniques for integrating data in mixed methods studies: “triangulation, following a thread, and the mixed method matrix” (p. 277). Robinson et al. (2016) also note that triangulation is commonly applied in partially mixed methods designs given that it is done at the end of a study. Triangulation entails examining quantitative and qualitative results after both sets of data have been analysed for complementariness, contradictions, and convergence (Robinson et al., 2016). The mixed research methods matrix and following thread techniques are suitable for use in a fully mixed research methods design given that the integration of data is undertaken at the analysis stage (Robinson et al., 2016). Therefore, since the analysis of quantitative and qualitative data was completed separately in this study, triangulation was selected for integrating the results. This was done in two parts, as outlined in the next chapter (Results of Data Analysis).

Chapter 4: Results of the Data Analysis

4.1 Introduction

Chapter 2 reviewed the literature on hearing impairment, visual impairment, and intellectual disability and explored how technology is used to help children with any of these disabilities and Chapter 3 discussed the research methodology that was used to develop a survey and interviews to explore this topic with reference to how technology is used to help children with any of the aforementioned disabilities in Saudi Arabia. The current chapter (Chapter 4) presents the results that were obtained in the study. The chapter is divided into two parts, one dealing with results from the quantitative data analysis and the other dealing with results from the qualitative data. Accordingly, the first part of this chapter presents the results emerging from the data that were collected using the survey tool. The second part presents the results from the qualitative data that were collected from the interviews conducted with some of the study's participants.

4.2 Part 1: Quantitative Data Results

4.2.1 Introduction

The aim of this section is to present the findings that resulted from the quantitative data analyses. This part of the chapter starts by describing the respondents' background information, the basic sample descriptive statistics and the characteristics of the respondents. The part is organised as follows. The first section describes the demographic characteristics of the participants. The second section presents information about the perceptions of the respondents towards the use of technology for students with disabilities. The third section presents the results

of hypothesis testing, which was conducted using T-test and one-way ANOVA. A summary of the information obtained from the qualitative data results is also provided.

4.2.2 Demographic characteristics

Descriptive statistics were used to highlight basic information about the study participants. The information displayed frequency tables and percentages. The results are displayed and discussed below.

4.2.2.1 Gender

Table 4.1 below illustrates the gender distribution of the sample. It is evident that the sample had a higher proportion of females compared to males.

Table 4.1: Distribution of the sample according to gender

Gender	**Frequency**	**Percent**	**Cumulative**
Male	117	44	44
Female	149	56	100.00
Total	**266**	**100.00**	

4.2.2.2 Institution region

The research participants were asked to identify the region (Riyadh, Jeddah, or Dammam) in which their institution is located. This information is outlined in Table 4.2.

Table 4.2: Distribution according to the region in which each research participants' institution is located

Institution Region	**Frequency**	**Percent**	**Cumulative**
Riyadh	136	51	51
Jeddah	91	34	85
Dammam	39	15	100.0
Total	**266**	**100.00**	

Table 4.2 above presents the percentages of participants in each of the three regions as identified by the region in which each participant's institution is located. The data indicate that the highest percentage (51%) of the respondents were from Riyadh City. This is followed by Jeddah City (34%), while Dammam City had the least number of participants (15%).

4.2.2.3 Education degree

The educational level of the study sample varied between diploma, bachelor and master. The descriptive statistics for the participants' educational qualifications are presented in Table 4.3

Table 4.3: Distribution according to the participants' level of education

Education Degree	Frequency	Percent	Cumulative
Diploma	8	3	3
Bachelor	243	91	94
Master	15	6	100.0
Total	**266**	**100.00**	

Table 4.3 above presents the distribution of the research participants' educational qualifications. It is evident that the majority of the respondents had a bachelor's degree (91%). Six percent of the respondents had a master's degree while three percent of respondents reported having a diploma.

4.2.2.4 Occupation

Another demographic that was included in the questionnaire was the research participants' occupations. Table 4.4 below shows the frequency and percent of respondents' occupations.

Table 4.4: Distribution according to occupation

Occupation	Frequency	Percent	Cumulative
Teacher	259	97	97
Principal	7	3	100.00
Total	**266**	**100.00**	

Table 4.4 above illustrates the occupation distribution for the sample, indicating that teachers accounted for the highest percentage of participants (97%), while principals accounted for only three percent of the sample.

4.2.2.5 Name of school

For the purpose of the study, three of the schools that were selected specialise in teaching students with visual impairment. Another three schools specialise in teaching students with hearing impairment and the third category of schools comprised institutions specialising in teaching students with intellectual disability, as shown in Table 4.5.

Table 4.5: Distribution according to the name of the school

Name of School	Frequency	Percent	Cumulative
Al Amal Institute	82	31	31
Al Noor Institute	78	29	60
Institute of Intellectual Disabilities	106	40	100.0
Total	**266**	**100.00**	

Table 4.5 shows that the highest percentage of educators (40%) was from the Institute of Intellectual Disabilities. The second highest percentage (31%) of respondents was from the Al Amal Institute, while the remainder (29%) were from the Al Noor Institute.

4.2.2.6 Teaching experience

Teaching experience is an important demographic characteristic, as was established in the literature review. Table 4.6 below shows the frequency and percentages of the research participants' teaching experience.

Table 4.6: Distribution according to teaching experience

Teaching Experience	Frequency	Percent	Cumulative
Less than 6 years	59	22	22
From 6 to 10 years	58	22	44
From 11 to 15 years	50	19	63
More than 15 years	99	37	100.0
Total	**266**	**100.00**	

The data indicate that the proportion of educators who had more than 15 years' teaching experience was 37% percent. The proportion of respondents with both teaching experience of fewer than six years and between six and 10 years was 22 percent, while 19 percent of respondents had between 11 and 15 years' teaching experience.

4.2.2.7 Experience in using technology

Information regarding experience in the use of technology to assist students with hearing, visual and intellectual disabilities in learning is presented in Table 4.7.

Table 4.7: Distribution According to Experience in using Technology

Experience in using Technology	Frequency	Percent	Cumulative
Less than 6 years	135	51	51
From 6 to 10 years	91	34	85
From 11 to 15 years	15	5	90
More than 15 years	25	10	100.0
Total	**266**	**100.00**	

Table 4.7 shows that about half (51%) of the participants had experience using technology of between one year and six years. The percentage of educators who had between 6 and 10 years' experience using technology was 34 percent. Only about 15 percent of the educators had experience of more than 11 years in the use of technology.

4.2.2.8 Training in the use of assistive technology

Teaching experience and experience in using technology were not the only significant variables that related to e-learning; another important variable, as found in the literature review, was training in the use of assistive technology. The following table presents the distribution within the sample of participants based on the number of years that the participants were trained in the use of assistive technology. The information is grouped at three levels: less than four years, from 4–7 years, and more than eight years.

Table 4.8: Distribution of participants based on the number of years that the participants were trained in the use of assistive technology

Training in the use of Assistive Technology	**Frequency**	**Percent**	**Cumulative**
Less than 4 years	220	83	83
From 4 to 7 years	29	11	94
More than 8 years	17	6	100
Total	**266**	**100.00**	

It is clear from Table 4.8 above that the highest percentage of the educators who took part in the research (83%) had less than four years of training in the use of assistive technology. About 17% of the educators had four years or more of training in the use of assistive technology.

4.2.2.9 Scales Reliability

The output was checked for anomalies and to discover which items were not contributing to the strength of reliability of the scale. Table 4.9 below shows the item–total statistics of the reliability analysis. It shows that the corrected item–total correlations were strong (above .2) for all of the scale items except for ITEMS **S8** – Learning can be improved considerably if educators support the use of assistive technologies (.092), **S17** – The use of technology in my school faces too many challenges (.093), **S20 –** The lack of technology designed for Arab users is hindering technology use in my school (.161), and **S21 –** Current assistive technologies need significant improvement (.026).

The output also showed that if these items were deleted from the scale, the total alpha value for the scale would improve. However, the potential improvement in the overall alpha was not more than .008. Considering that the overall scale alpha coefficient was already above .070, which is considered acceptable for research (Nunnally, 1978; Cooksey, 2007), and the items were important in providing a more comprehensive understanding of the use of technology in Saudi Arabian schools, I decided not to delete the items.

Table 4.9: Item–Total Statistics

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
S1- The use of technology helps students with disabilities.	70.88	71.822	.252	.563	.783
S2- Technology should be introduced in all schools that cater for students with disabilities.	70.88	71.613	.254	.614	.782
S3- The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities.	72.97	64.954	.477	.472	.768
S4- Improving the use of technology to help students with disabilities.	71.39	66.270	.516	.620	.768
S5- My school principal expects me to use technology to support student learning.	71.25	67.659	.495	.605	.770
S6- My school has an adequate /broad wide range of assistive technologies.	72.80	63.743	.525	.647	.764

S7- Parents of students have been of great assistance, giving in-kind assistive technology devices to the school.	73.65	67.300	.368	.415	.776
S8- Learning can be improved considerably if educators support the use of assistive technologies.	71.02	72.875	.092	.432	.789
S9- All stakeholders support the use of technology to support student learning.	72.29	66.997	.365	.272	.776
S10- The assistive technologies currently in use in my school are effective in helping students with disabilities.	72.59	64.915	.502	.587	.767
S11- My school has challenges acquiring assistive technologies for the students with disabilities.	72.10	69.077	.231	.289	.785
S12- Effectively use assistive technology to support learning.	71.88	68.152	.298	.286	.781
S13- Using assistive technologies when teaching the students with disabilities.	72.13	68.205	.369	.294	.776
S14- Students are more pleased to use assistive technologies.	71.30	71.260	.213	.373	.784
S15- Enhance the learning experience among students with disabilities.	71.61	66.979	.473	.364	.770
S16- Training to use of assistive technologies for the students with disabilities.	72.96	63.538	.502	.375	.766
S17- The use of technology in my school faces too many challenges.	72.03	71.720	.093	.217	.794
S18- As an educator, I already know what can be done to improve the efficiency of assistive technologies.	71.97	65.512	.519	.452	.766
S19- Identified the skills that students with disabilities need.	72.04	67.025	.437	.387	.772
S20- The lack of technology designed for Arab users is hindering technology use in my school.	72.22	70.317	.161	.352	.790
S21- Current assistive technologies need significant improvement.	71.40	73.343	.026	.372	.794

4.2.3 Descriptive statistics: Perceptions about the use of technology for students with disabilities

The following descriptive statistics were calculated with respect to Section/Part (B) of the questionnaire: mean (M), standard deviation (SD) and rank for the mean scores of the respondents. This was done in relation to Research Question 1 (Perceptions about the use of technology for students with disabilities (hearing impairment, visual impairments, and intellectual disability). The results are shown in Table 4.10.

Table 4.10: Descriptive statistics: Mean scores of the respondents with regard to use of technology

Items	Mean	Std. Deviation
S1: The use of technology helps students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) improve their learning	4.69	0.545
S2: Technology should be introduced in all schools that cater for children with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	4.68	0.581
S8: Learning can be improved considerably if educators support the use of assistive technologies for the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	4.55	0.694
S5: My school principal expects me to use technology to support student learning.	4.32	0.762
S14: Students are more pleased to use assistive technologies when their parents/guardians support the use of such technologies.	4.27	0.7374
S4: My school principal is open to improving the use of technology to help students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	4.17	0.882
S21: Current assistive technologies need significant improvement (or redesign) if they are to help hearing impaired students.	4.17	0.853
S15: As an educator, I'm well-versed in the research on technology tools/aids that can enhance the learning experience among students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	3.96	0.868
S12: Students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my school are able to effectively use assistive technology to support their learning.	3.69	1.055
S18: As an educator, I already know what can be done to improve the efficiency of assistive technologies among the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my class.	3.6	0.955
S17: The use of technology in my school faces too many challenges.	3.54	1.043
S19: As an educator, I have identified the skills that students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) need in order to use assistive technologies more efficiently.	3.53	0.92
S11: My school has challenges acquiring assistive technologies for students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	3.47	1.089
S13: I am adept at using assistive technologies when teaching students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	3.44	0.893
S20: The lack of technology designed for Arab users is hindering technology use in my school.	3.35	1.092
S9: All stakeholders support the use of technology to support student learning.	3.28	1.06
S10: The assistive technologies currently in use in my school are effective in helping students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in their learning.	2.58	1.044
S6: My school has an adequate/broad/wide range of assistive technologies for use by the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	2.76	1.126
S16: My school has trained me adequately (and other teachers) in the use of assistive technologies for the students with disabilities (hearing impairment, visual impairment and intellectual disabilities).	2.61	1.187

S3: The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).	2.59	1.082
S7: Parents of students in my school have been of great assistance, giving in-kind assistive technology devices to the school.	1.92	1.013
Weighted Mean and Std. Deviation	**3.5985**	**0.41088**

Table 4.10 above shows the highest mean scores with respect to Section B of the questionnaire: "Perceptions about the use of technology for students with disabilities (hearing impairment, visual impairments, and intellectual disabilities)". This is in relation to the five statements below:

S1: The use of technology helps students with disabilities improve their learning (M=4.69, SD=0.545);

S2: Technology should be introduced in all schools that cater for children with disabilities (M=4.68, SD=0.581);

S8: Learning can be improved considerably if educators support the use of assistive technologies for the students with disabilities (M=4.55, SD=0.694);

S5: My school principal expects me to use technology to support student learning (M=4.32, SD=0.762);

S14: Students are more pleased to use assistive technologies when their parents/guardians support the use of such technologies (M=4.27, SD=0.737);

S4: My school principal is open to improving the use of technology to help students with disabilities (M=4.27, SD=0.737); and

S21: Current assistive technologies need significant improvement (or redesign) if they are to help the hearing impaired students (M=4.21, SD=0.853).

The mean scores for the previous items were within an interval of 4.2–5.00, an indication that the ranking was high (Strongly Agreed) based on the 5-point Likert scale. The items of the questionnaire that have moderate mean scores within the interval 3.41–4.20 are as described below:

S15: As an educator, I'm well-versed in the research on technology tools/aids that can enhance the learning experience among students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) (M=3.96, SD=0. 868);

S12: Students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my school are able to effectively use assistive technology to support their learning (M=3.69, SD=1.055);

S18: As an educator, I already know what can be done to improve the efficiency of assistive technologies among the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my class (M=3.6, SD=0.955);

S17: The use of technology in my school faces too many challenges (M=3.54, SD=1.043);

S19: As an educator, I have identified the skills that students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) need in order to use assistive technologies more efficiently (M=3.53, SD=0.92);

S11: My school has challenges acquiring assistive technologies for the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) (M=3.47, SD=1.089);

S13: I am adept at using assistive technologies when teaching the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) (M=3.44, SD=0.893);

S20: The lack of technology designed for Arab users is hindering technology use in my school (M=3.41, SD=1.092); and

S9: All stakeholders support the use of technology to support student learning (M=3.41, SD=1.06).

The items from the questionnaire that had low mean scores belong to the interval 1.81–2.60, which indicates 'Disagree' according to the 5-point Likert scale:

S10: The assistive technologies currently in use in my school are effective in helping students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in their learning (M=2.58, SD=1.044);

S6: My school has an adequate/broad/wide range of assistive technologies for use by the students with disabilities (hearing impairment, visual impairment and intellectual disabilities) (M=2.56, SD=1.126);

S16: My school has trained me adequately (and other educators) in the use of assistive technologies for the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) (M=2.60, SD=1.187);

S3: The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) (M=2.59, SD=1.082); and

S7: Parents of students in my school have been of great assistance, giving in-kind assistive technology devices to the school (M=1.92, SD=1.013).

The weighted average of all statements was 3.5985 with a standard deviation of 0.41088, which indicates 'Agree' as a general trend according to the 5-point Likert scale since it lies in the interval 3.41–4.20.

4.2.4 Type of technologies used by educators

The research question that was used to examine the types of technologies used by educators was: "What types of technological tools are used in schools for students with a disability (hearing impairment, visual impairment, and intellectual disability)?" This question was meant to give the informants an opportunity to indicate the types of technologies that are available in schools for students with a disability (hearing impairment, visual impairment, and intellectual disability). The educators were asked to name the kind of technology used in their schools as well as the kind of technology that they have used themselves. The educators' responses were regarded as an indicator of the equipment and technologies that are available for use by children with disabilities (hearing impairment, visual impairment, and intellectual disability) in the respective schools in Saudi Arabia. In turn, this provided an overview of the extent to which these technologies were being used to support the concerned children as well as their educators.

The results were as follows: 40 of the educators (90%) stated that their schools were using computers; twenty-eight educators (50%) indicated the use of projectors; 19 educators (20%) mentioned the use of iPad devices; and 18 educators (19%) mentioned the use of a smart board as a teaching aid. See Figure 4.1 for a list of all the technology types used by the participants in all the schools.

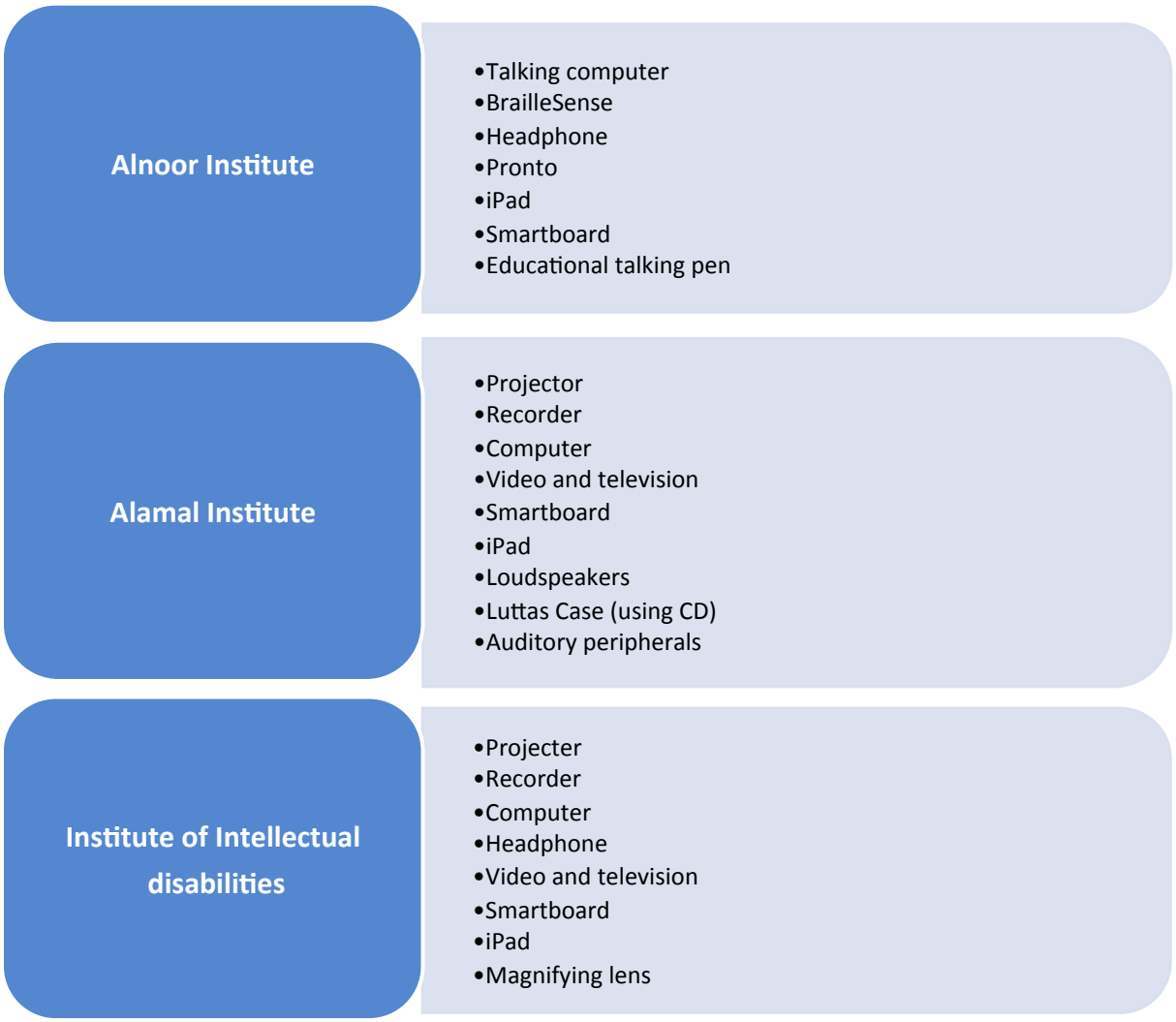

Figure 4.1: A list of all technology types used by the participants in all schools

How do variables such as gender and educators' experiences affect the educators' perceptions about the use of technology to support the learning of students with disabilities?

To answer this question, independent samples T-test and ANOVA were conducted to discover whether educators' perceptions about the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) were influenced by variables such as gender and occupation.

Before using the T-test, I ensured that variables were normally distributed from the p-p plot. Also, the homogeneity of variance was verified by Levene's test. The results of the T-test are shown in Table 4.11 below.

Table 4.11: Results of T-test

Perceptions about the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disabilities)		**N**	**Mean (S.D)**	**T**	**P-value**
Gender	Male	117	3.7123 (0.42446)	4.121	0.000
	Female	149	3.5091 (0.37788)		
Occupation	Teacher	259	3.6939 (0.39254)	0.622	0.535
	Principal	7	3.5091 (0.37788)		

It was found that there is a statistically significant difference in perceptions between males (M=3.712, SD=0.4244) and females (M=3,509, SD=0.3778) at the p=.05 confidence level, as shown in Table 4.11. This means that the gender of the participants influenced their perceptions of the use of technology for students with the different kinds of disabilities in favour of males, who had the highest mean score (3.7123). There is no statistically significant difference in attitudes between teachers and principals.

For the background variables (institution, education, teaching experience, technology experience, training on the technology, name of school) that have more than two categories, the one-way ANOVA procedure was used. This method is used when there is a categorical independent variable (with two or more categories) and a normally distributed interval dependent variable and I wish to test for differences in the means of the dependent variable. Table 4.12 below shows the results of the ANOVA test with six categorical groups (institution, education,

teaching experience, technology experience, training on the technology, name of school) in relation to perceptions about the use of technology for students with disabilities.

Table 4.12: Results of ANOVA test		**N**	**Mean (S.D)**	**P-value**
Institution	Riyadh	136	3.5578 (.41472)	0.169
	Jeddah	91	3.6625 (.40665)	
	Dammam	39	3.5910 (.40665)	
Education	Diploma	8	3.5238 (.40884)	0.814
	Bachelor	243	3.6032 (.41694)	
	Master	15	3.5619 (.31954)	
Teaching Experience	Less than 6 years	59	3.6610(.45245)	0.459
	From 7 to 10 years	58	3.5402(.38485)	
	From 11 to 15 years	50	3.6086(.40306)	
	More than 15 years	99	3.5902 (.40434)	
Technology Experience	Less than 6 years	135	3.5828 (.42464)	0.401
	From 7 to 10 years	91	3.5965 (.40340)	
	From 11 to 15 years	15	3.6317 (.35973)	
	More than 15 years	25	3.5985 (.38832)	
Training on the Technology	0–3	220	3.5706 (.41266)	0.049
	4–7	29	3.7143 (.35292)	
	8 and above	17	3.7619 (.42890)	
Name of School	Al Amal Institute	82	3.7009 (.39533)	0.007
	Al Noor Institute	78	3.4969(.37594)	
	Institute of Intellectual Disabilities	106	3.5939(.43127)	

Table 4.12 shows that there is no statistically significant difference in perceptions towards the use of technology to support the learning of students with disabilities in relation to

the aforesaid variables (institution, education, teaching experience, technology experience). Conversely, the independent variables (training on the technology, name of school) have a statistically significant effect on perceptions about the use of technology to support the learning of students with disabilities given that p-value = (0.049,0.007) < 0.05. Thus, it can be concluded that "training on the technology" and "name of school" affect the educators' perceptions about the use of technology to support the learning of students with disabilities. Consequently, the multiple comparisons tests were applied to determine which institution had a more pronounced effect on the educators' attitudes. The results of these tests are shown in Table 4.13 below.

Table 4.13: Multiple comparisons between school groups

Perceptions about the use of technology to support the learning of students with disabilities		**Mean Difference**	**Post Hoc P-value**	**Post Hoc 95% CI**
Name of School	Al Amal ---- Al Noor	0.20398	0.007	0.04, 0.36
	Al Amal ---- intellectual Education	0.10704	0.200	-0.04, 0.25
	Intellectual Education --- Al Noor	0.09694	0.277	-0.05, 0.24

*. The mean difference is significant at the 0.05 level.

Table 4.13 shows the multiple comparisons (Sheffe), which indicate that the difference between Al Amal and Al Noor Institute is significant in favour of Al Amal Institute – which has a higher mean difference (0.20398, P = 0.007). In addition, the multiple comparisons tests were applied to determine which training group had a more pronounced effect with regard to perceptions about the use of technology to support the learning of students with disabilities. The results of the tests are shown in Table 4.14 below.

Table 4.14: Multiple Comparisons between Training Groups

Perceptions about the use of technology to support the learning of students with disabilities		Mean Difference	Post Hoc P-value	Post Hoc 95% CI
Training on the Technology	From 4 to 7 years -- Less than 4 years	0.14372*	0.076	-0.014,0.302
	More than 8 years -- Less than 4 years	0.19134*	0.063	-0.010, 0.393
	More than 8 years -- From 4 to 7 years	0.04762	0.703	-0.197, 0.292

*. The mean difference is significant at the 0.10 level.

Table 4.14 shows that the multiple comparisons (Sheffe) from the differences between training groups and therefore favour a periodic timeframe of "More than 8 years". This period registered the highest mean of 3.762 as compared to 3.714 for the "4 to 7 years" group and 3.571 for the group of "Less than 4 years".

4.2.5 How do variables such as gender and educators' experiences affect the mean scores on each factor of the scale?

An independent sample T-test was used to analyse the effects of gender on the educators' perceptions about the use of technology to support the learning of students with disabilities. A one-way ANOVA was used to analyse the effects of teaching experience, training in use of technology, education degree, name of school, name of institution, region, and experience in using technology, on the educators' perceptions about the use of technology to support learning of students with disabilities. The two tests explored how technology is used for students with hearing impairment, visual impairment and intellectual disabilities in selected schools in Saudi Arabia. The independent sample T-test and Levene's test for homogeneity of variance in SPSS were utilised to test for the variance equality. If the p-value was significant (p-value <0.05), then the null hypothesis is rejected and the alternative hypothesis accepted (i.e. that the variances are unequal). If the p-value is insignificant (p-value > 0.05), the null hypotheses are accepted as there are no significant differences between the variances of the groups. The assumption here is

that the p-value = 0.05. The results that were analysed from the completed questionnaires are provided in the following section. These tests are presented in the next tables.

Table 4.15: Independent samples T-test group statistics to compare the educators' perceptions about the use of technology to support the learning of students with disabilities according to gender

Factors	Gender	N	Mean	Std. Deviation	Std. Error Mean	T-test	p-value
Resources and support	Male	117	.2811115	.92763341	.08575974	4.188	0.000
	Female	149	-.2207386	1.00228014	.08210999		
Benefits of technology	Male	117	.0308437	.93041790	.08601717	0.452	0.652
	Female	149	-.0242195	1.05389466	.08633841		
Educators' capacity	Male	117	.2234715	.92326124	.08535553	3.289	0.001
	Female	149	-.1754776	1.02564845	.08402439		
Aim of technology use	Male	117	.1642787	1.03674137	.09584677	2.395	0.017
	Female	149	-.1289974	.95394793	.07815046		
Students' disposition	Male	117	-.0895113	.79457705	.07345867	-1.350	0.178
	Female	149	.0702874	1.13330879	.09284427		
Challenges	Male	117	.1546602	.84652601	.07826136	2.321	0.021
	Female	149	-.1214446	1.09321460	.08955963		
Future developments and improvement	Male	117	-.0238010	1.03490750	.09567723	-0.343	0.732
	Female	149	.0186894	.97482426	.07986072		

The results of the independent samples T-test indicate that there is a significant statistical difference in the mean scores of the educators' perceptions about the use of technology to support learning of students with disabilities in the selected schools in some groups (resource and support, educators' capacity, aim of technology use, challenges) according to gender, while there are no significant differences in other factors. Therefore, the existence of significant statistical

differences at the p-value < 0.05 level indicates a positive factor for males, in both factor 1 (resources and support), factor 3 (educators' capacity), factor 4 (aim of technology use), factor 6 (challenges) and gender. Therefore, gender might have influenced the answers to these responses in these factors. The ANOVA test considers the impact of their experiences.

Table 4.16: Testing mean difference in factors according to the teaching experience variable using one-way ANOVA

Factors	**Teaching Experience**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	0.772	0.770	0.512	4.996	**0.002**
	Within groups	1.003				
Benefits of technology	Between groups	0.683	0.681	0.565	1.079	0.358
	Within groups	1.004				
Educators' capacity	Between groups	0.944	0.943	0.420	0.218	0.884
	Within groups	1.001				
Aim of technology use	Between groups	0.551	0.548	0.650	0.260	0.854
	Within groups	1.005				
Students' disposition	Between groups	3.915	4.050	**0.008**	1.731	0.161
	Within groups	0.967				
Challenges	Between groups	2.413	2.453	0.064	0.139	0.936
	Within groups	0.984				
Future developments and improvement	Between groups	0.844	0.843	0.472	1.720	0.163
	Within groups	1.002				

A one-way ANOVA was employed to indicate whether there are significant differences in the mean scores for the educators' perceptions about the use of technology to support the learning of students with disabilities across the four teaching experience groups. The table above

shows the test of homogeneity of variance was determined by a Levene's test to detect differences between the variances, where the null hypothesis assumes no difference between a group's variances. As shown in the results above (Table 4.16), the F-value for the Levene's test was between 0.139 and 4.996, with p-values in the range between 0.161 and 0.936. Given that the p-value is greater than 0.05, the implication is that the null hypothesis is accepted, and a conclusion made that there is no significant difference between the four groups except factor 1 (resources and support).

The results presented in Table 4.16 show that there are no statistically significant differences in the mean scores between factors according to teaching experience, except for factor 5 (students' disposition) where the results show there is a significant difference between teaching experience groups at significant level (F-test value is 4.050 with p-value = 0.008) in favour of the 11 to 15 years group.

Table 4.17: Testing mean difference in factors according to the institution variable using one-way ANOVA

Factors	**Institution**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	0.996	0.496	0.610	1.855	0.158
	Within groups	264.004				
Benefits of technology	Between groups	0.064	0.032	0.969	1.472	0.231
	Within groups	264.936				
Educator s' capacity	Between groups	2.683	1.345	0.262	0.707	0.494
	Within groups	262.317				
Aim of technology use	Between groups	9.396	4.834	**0.009**	0.317	0.728
	Within groups	255.604				
Students' disposition	Between groups	8.789	4.511	**0.012**	3.844	**0.023**
	Within groups	256.000				

Challenges	Between groups	8.789	2.391	0.093	0.482	0.618
	Within groups	256.211				
Future developments and improvement	Between groups	4.733	1.803	0.167	0.332	0.718
	Within groups	260.267				

For the institution variable, the results show an F-value for all factors between 0.032 and 4.834 with a p-value greater than 0.05 in five factors. This means that there are no significant differences in mean scores between the institution groupings on any of the factors of the "Perceptions about use of technology for students with disabilities" in the selected schools. In other words, institution had no influence. Moreover, the results of Levene's test show that there is no difference between group variances as the p-value is greater than 0.05 for six factors; therefore, the null hypothesis that there is no difference between groups is accepted and we conclude that the population variances for each group are approximately equal. That is, the assumption of homogeneity of variance is met, which confirmed that there was homogeneity of variance in a sample size of five factors, except for factor 5 (students' disposition). In addition, the results show that there is a significant difference in factors aim of technology use and students' disposition) between institution groups at a significant level (F-test value is 4.834, 4.511 with p-value = 0.009 and.012) in favour of the Jeddah group.

Table 4.18: Testing mean difference in factors according to the school variable using one-way ANOVA

Factors	**Name of School**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	11.115	5.757	**0.004**	0.696	0.499
	Within groups	253.885				
Benefits of technology	Between groups	3.734	1.880	0.969	7.555	**0.001**

	Within groups	261.266				
Educators' capacity	Between groups	24.420	13.348	**0.000**	0.741	0.478
	Within groups	240.580				
Aim of technology use	Between groups	4.994	2.526	0.082	2.776	0.064
	Within groups	260.006				
Students' disposition	Between groups	20.101	10.793	**0.000**	8.390	**0.000**
	Within groups	244.899				
Challenges	Between groups	4.515	2.279	0.104	1.744	0.177
	Within groups	260.485				
Future developments and improvement	Between groups	1.092	0.544	0.581	0.730	0.483
	Within groups	263.908				

For the school variable, the results present an F-value for all factors between 0.544 and 13.348 with p-value greater than 0.05 in four factors. This means that there are no significant differences in mean scores between the school groupings on any of the factors of the "Perceptions about use of technology for students with disabilities" in the Saudi schools studied. In other words, school type had no influence. Moreover, the results of Levene's test show that there is no difference between group variances due to the fact that the p-value is greater than 0.05 for five factors. We therefore accept the null hypothesis that there is no difference between groups and conclude that the population variances for each group are approximately equal. That is, the assumption of homogeneity of variance is met, which confirmed that there was homogeneity of variance in a sample size of five factors, except for factors 2 (benefits of technology) and 5 (students' disposition). In addition, the results show that there is a significant difference in the resources and support and educators' capacity factors between school groups at a significant level (F-test value is 5.757and 13.348 with a p-value = 0.004 and 0.000) in favour

of the Al Amal Institute group. Furthermore, there is a significant difference in students' disposition between school groups at a significant level (F-test value is 10.793 with p-value = 0.000) in favour of the Al Noor Institute group.

Table 4.19: Testing mean difference in factors according to experience in using technology variable using one-way ANOVA

Factors	**Experience in using Technology**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	0.772	0.241	0.868	3.367	**0.019**
	Within groups	1.003				
Benefits of technology	Between groups	0.683	1.224	0.302	2.809	**0.040**
	Within groups	1.004				
Educators' capacity	Between groups	0.944	2.405	0.068	1.592	0.192
	Within groups	1.001				
Aim of technology use	Between groups	0.551	0.615	0.606	1.063	0.365
	Within groups	1.005				
Students' disposition	Between groups	3.915	0.654	0.581	0.736	0.531
	Within groups	0.967				
Challenges	Between groups	2.413	0.790	0.500	0.359	0.783
	Within groups	0.984				
Future developments and improvement	Between groups	0.844	0.155	0.927	0.269	0.848
	Within groups	1.002				

For the experience in using technology variable, the results of Levene's test show that there is no difference between the group variances as the p-value is greater than 0.05 for five factors. We therefore accept the null hypothesis that there is no difference between groups and conclude that the population variances for each group are approximately equal. That is, the assumption of homogeneity of variance is met, which confirmed that there was homogeneity of

variance in a sample size of five factors, except factors 1 and 2. Moreover, the results present F-values for all factors between 0.241 and 2.405 with a p-value greater than 0.05. This means that there are no significant differences in mean scores between the experience in using technology groupings on any of the factors of the "Perceptions about use of technology for students with disabilities" at the level of significance (0.05). In other words, experience in using technology had no influence. The next test is ANOVA according to the education degree variable.

Table 4.20: Testing mean difference in factors according to the education degree variable using one-way ANOVA

Factors	**Education Degree**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	5.863	2.975	0.053	0.151	0.860
	Within groups	259.137				
Benefits of technology	Between groups	.520	0.259	0.772	0.684	0.505
	Within groups	264.480				
Educators' capacity	Between groups	4.816	2.434	0.090	0.618	0.540
	Within groups	260.184				
Aim of technology use	Between groups	.834	0.415	0.661	2.199	0.113
	Within groups	264.166				
Students' disposition	Between groups	5.005	2.532	0.081	0.288	0.750
	Within groups	259.995				
Challenges	Between groups	.798	0.397	0.673	1.898	0.152
	Within groups	264.202				
Future developments and improvement	Between groups	1.501	0.749	0.474	1.196	0.304
	Within groups	263.499				

For the education variable, the F-value for all factors was between 0.259 and 2.975 with a p-value greater than 0.05. This means that there are no significant differences in mean scores for

the education degree on any of the factors of the "Perceptions about use of technology for students with disabilities" at the level of significance (0.05). In other words, education degree had no influence. Moreover, the results of Levene's test show that there is no difference between group variances, since the p-value is greater than 0.05 for all factors. We therefore accept the null hypothesis that there is no difference between groups and conclude that the population variances for each group are approximately equal. That is, the assumption of homogeneity of variance was met, and this confirmed that there was homogeneity of variance in a sample size for all factors.

For the training variable, the results of Levene's test, as presented in Table 4.21 below, show that there is no difference between group variances as the p-value is greater than 0.05 for six factors.

Table 4.21: Testing mean difference in factors according to the training variable using one-way ANOVA

Factors	**Training**	**Mean Square**	**F-Test**	**P-value**	**Levene Statistic**	**P-value**
Resources and support	Between groups	4.251	2.144	0.119	3.068	**0.048**
	Within groups	260.749				
Benefits of technology	Between groups	.859	0.428	0.652	1.843	0.160
	Within groups	264.141				
Educators' capacity	Between groups	5.221	2.643	0.073	0.001	0.999
	Within groups	259.779				
Aim of technology use	Between groups	3.161	1.587	0.206	0.015	0.985
	Within groups	261.839				
Students' disposition	Between groups	1.358	0.677	0.509	1.968	0.142
	Within groups	263.642				
Challenges	Between groups	2.040	1.020	0.362	2.079	0.127

	Within groups	262.960				
Future developments and improvement	Between groups	2.040	0.623	0.537	0.942	0.391
	Within groups	262.960				

Given that the p-value was greater than 0.05 for the six factors, as shown in Table 4.20, the null hypothesis that there is no difference between groups was accepted. Also, it was concluded that the population variances for each group are nearly equal. That is, the assumption of homogeneity of variance is met, which confirmed that there was homogeneity of variance in a sample size of six factors, except for factor 1. Moreover, the results present F-values for all factors between 0.428 and 2.643 with a p-value greater than 0.05. This means that there are no significant differences in mean scores between the training groupings on any of the factors of the "Perceptions about use of technology for students with disabilities" at the level of significance (0.05). In other words, training had no influence. However, at the level of significance of 0.10, there is a significant difference in means between the educators' perceptions about educators' capacity according to training, since the F-value = 2.643 with a p-value (0.073) less than 0.10.

The multiple comparisons tests were applied to determine which training group had a more pronounced effect with regard to perceptions about educators' capacity. The results of the tests are presented in Table 4.22 below.

Table 4.22: Multiple comparisons of educators' capacity according to training groups

Perceptions about educators' capacity according to Training groups		**Mean Difference**	**Post Hoc P-value**	**Post Hoc 95% CI**
Training on the Technology	From 4 to 7 years --- Less than 4 years	0.35804*	0.069	-0.028,0.7446
	More than 8 years -- Less than 4 years	0.39053	0.120	-0.102, 0.883
	More than 8 years -- From 4 to 7 years	0.32491	0.915	-0.565, 0.630

*. The mean difference is significant at the 0.10 level.

Table 4.22 shows that the multiple comparisons (Sheffe) indicate that the differences between training groups “From 4 to 7 years” and “Less than 4 years” in favour of “From 4 to 7 years”, which had mean differences (0.35804) and p-value (0.069) significant at (0.10).

4.2.6 Summary

1. For the total sample size, females accounted for a higher proportion of the research participants, representing 56 percent of the total sample. The highest percentage of respondents were from Riyadh City (51%). In total, 91 percent of the research participants had a bachelor’s degree and teachers accounted for 97 percent of the participants. The higher percent (40%) of educators’ perceptions were in the Institute of Intellectual disabilities. Approximately 50 percent of the research participants had teaching experience of between one year and five years, while 37 percent of the participants had more than 15 years of teaching experience. About 83 percent of educators’ had less than four years in training on how to use technology.
2. The respondents agreed with the statements about perceptions about the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disabilities), with a weighted mean of 3.5985 and a standard deviation of 0.41088.
3. Gender affects the educators’ perceptions about the use of technology to support the learning of students with disabilities in the selected schools. The male participants were the best at using technology to support the learning of students with disabilities by the highest value mean of 3.7089.

4. There is no statistically significant difference between the attitudes of teachers and principals towards the use of technology for students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).
5. There is no statistically significant difference in the research participants' perceptions about the use of technology to support the learning of students with disabilities, according to the independent variables of institution, education, teaching experience, and technology experience.
6. Al Amal Institute had the highest mean value (3.701) for the use of technology to support the learning of students with disabilities in selected Saudi schools.
7. The number of years that the educators have been trained in regard to the use of technology has a statistically significant effect on their perceptions about the use of technology to support the learning of students with disabilities. Specifically, the group of educators who had been trained for eight years or more had the highest mean (3.762).
8. A one-way ANOVA was conducted by relying on seven factors to explore how technology is used to assist students with hearing, visual and intellectual disabilities in selected schools in Saudi Arabia. The finding from the ANOVA indicates that the technology, the ability of educators to use the technology, the aim of technology use, future developments and improvement, challenges faced, and students' disposition towards using technology should be considered for the future of the students with disabilities in Saudi Arabian schools.

4.3 Part 2: Results of Qualitative Data Analysis

4.3.1 Introduction

This part of the results chapter presents an analysis of the qualitative data that were collected from the interviews conducted with the research participants. The results are based on nine questions that were presented to the educators who took part in the research as part of my attempt to answer some of the research questions. The nine questions were structured to collect the research participants' views regarding different issues. The first question assessed whether the educators' schools use technology. The second question focused on the types of technological tools that are used in the sampled schools. The third question addressed the educators' experience with regard to the use of technology and he fourth question was about the difference that educators think technology makes when it is used to help students with disabilities in their learning activities. The fifth question sought to determine whether the educators have designed any programs to help students with disabilities. The sixth question queried how technology is used to enhance learning for students with disabilities. The seventh question was about how technology influences the learning of students with disabilities and the eighth question looked at the challenges that schools face in the implementation of technology. Finally, the ninth question was focused on how these challenges can be addressed. The data that were collected and analysed for each question are presented in the following sections.

4.3.2 Q1. Does the school you teach at use assistive technology for students with hearing, visual and intellectual disabilities?

The purpose of this question was to determine whether the schools from which the sample of the participants in the study was obtained use assistive technologies to help learners with disabilities, particularly the three disabilities that were the focus of this study. Of the 66

educators who responded to this question, 47 answered “yes”, indicating that their institutions were using assistive technology. Fifteen of the participants said “no”, meaning that their schools were not using assistive technology. The remaining four participants responded by saying “somewhat” and also indicated that there was a lack of adequate equipment, such as computers, in their schools, and for this reason they were not able to use assistive technologies effectively. Thus, it can be seen that most (47 of 66, or 71 percent) of the educators were of the view that their schools have deployed assistive technologies to be used to help students with disabilities due to their special learning needs. Fifteen of 66 (slightly over 22%) of the respondents were of the view that their schools were not using assistive technologies to help students with special learning needs. About six percent of the respondents (four of 66) indicated that their schools were using assistive technologies as available, as a result of the lack of adequate equipment to support effective use of assistive technology to help students with disabilities in their learning activities.

4.3.3 Q2. What types of technological tools are used in your school for students with any of these disabilities: hearing, visual and intellectual disabilities?

This question was meant to give the educators an opportunity to indicate the types of technologies that are available in their schools for students with any of the aforementioned disabilities. The educators were asked to name the kind of technology or technologies used in their schools as well as the kind of technology that they have used themselves. The educators’ responses were used as an indicator of the equipment and technologies that are available for use by students with the disabilities that were the focus of the study in the respective schools in Saudi Arabia. This, in turn, gave me an overview of the extent to which these technologies were being used to support the students with disabilities as well as their educators.

The data for this question were analysed with the assistance of Leximancer qualitative data software. The first step of the analysis was to identify the themes in the data. To identify the themes, I entered all the transcribed interview data this question into the Leximancer software. The initial list of concepts that was obtained contained several items including a computer, board, projector, iPad, Braille, programs, recorder, television, video, CDs, data, devices, easily, educational, games, information, and pictures. I then deleted items that were deemed to be unrelated to the question. The items that were deleted included data, devices, easily, educational, games, information, and pictures. Thereafter, the remaining concepts were merged to produce the final concept map. The themes that were identified in the Leximancer product were: computer, board, iPad, projector, Braille, programs, and recorder.

For thematic analysis, Leximancer was used to mine the data and identify the keywords that provided the foundation for each theme. Using the keywords, Leximancer configured the concepts that constituted each theme and was then used to display the relationships between keywords in the different concepts and themes. Detailed analyses using Leximancer revealed that "computer" (100% in 31 hits) was the most dominant concept. The word "board" was the second most mentioned tool at 55 percent in 17 hits. The third most dominant tool was "iPad" with 48 percent occurrence in 15 hits. Leximancer ranked the themes based on the frequency of the concepts that constituted each theme. The frequency is interpreted as reflecting the relative importance of the concepts and is portrayed in the Leximancer output as illustrated in Figure 4.2 below.

Figure 4.2: Leximancer analysis of themes and hits in the data

As shown in Figure 4.2, the aforementioned concepts (computer, board, and iPad) constituted the main themes that represented the types of tools that were used to help students with hearing, visual and intellectual disabilities in Saudi Arabia.

The number of hits of each theme gives an overview of the kind of technology that was mentioned most by the educators who took part in the research. This is in line with the fact that Question 2 sought to determine the types of technological tools that the research participants' school had put in place to help students with any of the three disabilities that were the focus of this study. Therefore, based on the results of the analysis, it can be seen that the computer is the technology that most of the research participants mentioned as a technology that their respective school uses to help students with disabilities in their learning activities.

What the above findings mean is that many of the research participants were of the view that their schools were using computers in various ways to help meet the learning needs of students with disabilities. Looking at the answers that were provided by the research participants on the types of technologies that their schools use, the word "computer" is mentioned several times either alone or alongside other technologies. For example, one participant indicated "auditory peripherals, computer, and projector", another mentioned "computer, projector and smart board", and a third more mentioned "talking computer, Braille sense, pronto, and smart view for visually weak students". Other responses in which the word computer was mentioned include "resource room, smart board, educational games, iPad and computer"; "smart board,

computer, iPad, TV and DVD"; "computers and smart board"; and "sensational, visual tools like computer, educational objects and smart board". The implication of having the word "computer" mentioned by the research participants several times is that computers and other computer-related technologies were arguably the most common types of technologies that were being used across the schools whose educators took part in the study.

As noted above, "board" was the second most mentioned theme, with 17 hits, as shown by the Leximancer analysis results in Figure 4.2. Indeed, the word "board" was mentioned several times by the research participants in reference to "smart board". This can be seen in the number of the research participants' responses such as "smart board and projector"; "computer, projector and smart board"; "smart board and computer"; and "resource room, smart board, educational games, iPad and computer". Other responses in which the words "smart board" were mentioned include "smart board, computer, iPad, TV and DVD"; "computers and smart board"; and "sensational and visual tools like computer and educational objects and smart board". The phrase "smart board" was also mentioned in the following responses: "computer laboratories, data show and smart board"; "computer, projector and smart board"; and "smart board, computer, iPad, projector, and magnifying lens". It is important to note that a smart board is an interactive whiteboard that enables smart applications such as touch and scrolling interactions that make it possible for users to use devices such as computers without the need to have conventional devices such as a keyboard or mouse. Therefore, since smart boards and computers go hand-in-hand, it can be said that some of the schools that have invested in computers (apparently the most widespread technology) have also invested in smart boards to help learners with any of the disabilities that were the focal point of this study.

The discussion about computers and smart boards above can also be applied to “iPads” and “projectors”, which are the other themes that have a relatively high number of hits, with “iPad” having 15 hits and “projector” having 14 hits in the Leximancer analysis results. What this means is that iPads and projectors are other technologies that most of the schools that were sampled in this study had invested in to help meet the learning needs of students with disabilities. Notably, iPads can be used as computer devices while projectors are used alongside computers to project the learning content on a computer screen onto a larger screen. Therefore, it can be argued that, on the basis of the Leximancer analysis findings, the themes “computer”, “(smart) board”, “iPad”, and “projector” are closely related. Also, in regard to the research question, it can be understood that the four technologies that have been mentioned above are the ones that most of the schools in the study have in place to help students with disabilities meet their learning needs. The four technologies are followed by others such as Braille, relevant computer programs and recorders.

When the concept map opened, the concepts that were visible were “computer”, “programs”, “board”, “iPad”, “projector”, “Braille” and “recorder”. Based on guiding information from Leximancer Pty Ltd (2017), these concepts are the ones that appeared most frequently in the interview text that was being analysed, and are also those that were most connected to other concepts on the concept map. The brightness of each concept’s label indicates the frequency of that concept in the text that is being analysed (Leximancer Pty Ltd, 2017). The brighter the concept label of a given concept, the more frequent the concepts must have been coded in the text that is being analysed (Leximancer Pty Ltd, 2017). As stated earlier, the concept map that was obtained from the analysis is illustrated in Figure 4.3.

Figure 4.3: Leximancer analysis: Concept map for Question 2 – types of technology

Like the ranking graphic illustrated in Figure 4.2, the concept map also shows the seven themes that Leximancer found in the data. As shown in Figure 4.3, the seven themes were computer, board, iPad, projector, Braille, programs, and recorder. This means that these seven themes were considered to be the most dominant tools used as technology in the selected schools in Saudi Arabia for the students with the aforesaid disabilities.

Leximancer uses the "hotness" of colours to infer the importance of the different themes. As illustrated in Figure 4.3, the computer was regarded as the most important theme in relation to the types of technologies that are available in schools for students with the different types of disabilities being highlighted in this study. This result is consistent with the interview data, which demonstrated that all the educators agreed that a computer is an effective tool since it helps them in clarifying information faster and helps draw students' attention through the use of

applications such as Microsoft Office. For example, one participant said: “Computer and projector. It uses projectors (photo show), practical lessons and lessons to where the students can determine their needs, and daily lessons and activities.”

The second most important theme as found through Leximancer analysis is the board. As explained earlier, the board was used here to mean smart board. The educators said that the smart board is useful for students with different disabilities because it enables the educators to display lesson content easily through the use of a wide screen that facilitates enhanced vision for the students. This was typified by various responses of the research participants in which they mentioned the phrase “smart board”. Such statements included the following: “computers and smart board sensational and visual tools like the computer and educational objects and smart board”; “talking computer, Braille sense, pronto, and Smartboard view for visually weak students”; “smart board and projector”; “computer, projector and smart board”; “resource room, smart board, educational games, iPad and computer”; “smart board, computer, iPad, TV and DVD”; “computers and smart board”; “sensational and visual tools like computer and educational objects and smart board”; “computer and smart board”; “computer laboratories, data show and smart board”; “computer, projector and smart board”; and “smart board, data show devices and resources room”.

The finding that the smart board is the second most mentioned technology suggests that most of the schools that were sampled have invested in the smart board as one of the technologies that they use to help meet the learning requirements of students with disabilities. Given that smart boards are used to display content that is generated by computers, a connection can be seen in that schools that have invested in computers are also likely to have invested in

smart boards. This explains why the concepts “computer” and “board” appeared close together on the concept map, with “computer” having the brightest colour label followed by “board”.

As can be seen in the concept map, Leximancer identified the iPad as the third most important theme among the tools used in the sampled schools. This result emerged from the data gathered from the educators who participated in the research. In particular, some of the educators’ response indications were “iPad and laptop” and stated that the educators’ schools had “educational audio programs downloaded on iPads by a company that supports this program mechanism”. Other responses that were provided by the research participants in which the word “iPad” was mentioned include the following: “smart board, computer, iPad, TV and DVD”; “iPad and projector”; “iPads and smartphones”; “Luttas Case is a program for communication using CDs; iPads have programs for communication, speech viewer programs for vocalising words by computer and voice amplifying devices and vocalisation training device”; “computer, Braille sense, and iPad”; “iPads and computer supported by talking programs”; “iPad”; “iPads and mobiles”; “smart board, iPads, and PowerPoint”; “projector, laptop, iPad”; “smart board, computer, iPad, projector, and magnifying lens”; and “computer, projector, and iPad”. The responses provided by various educators suggest that the educators’ schools had in place devices such as iPads, smartphones and other related devices that they used alongside other technologies like computers, smart boards, and voice amplifying devices. It can be argued that iPads and other related devices such as smartphones and tablets may be preferred by schools that have students with special needs because of the portability of such devices. iPads are also small gadgets and can be used to provide the interactivity that students with disabilities require in their process of engaging in different learning activities.

The educators also mentioned projectors, Braille, programs, and recorders as the other types of technological tools that are used for students with disabilities in the schools involved in the research. The fact that these concepts (projectors, Braille, programs, and recorders) appear in dull colour labels on the concept map indicates that they were not mentioned as frequently as the other three concepts (computers, smart boards, and iPads). However, it is important to mention that the fact that projectors, Braille, programs, and recorders appeared on the concept map means that these devices or systems are some of the important technologies that schools that teach students with disabilities use after computers, smart boards, and iPads. In particular, projectors are used together with other technologies such as computers and smart boards. It is therefore not surprising to find that the concept of "projector" closely followed that of "iPad" on the concept map. The same can be said for "Braille" and "programs". Notably, Braille can be used to refer to various equipment and software that help people with visual impairments to read. Programs refer to different software that can be used together with computers and other devices such as iPads to help people with different types of disabilities to learn (e.g. voice recognition software or Braille software).

The fact that "Braille" and "programs" were commonly mentioned by the research participants together with the technologies such as computers shows the interrelationship between these technologies. Examples of the statements that included "Braille" or "programs" and words like "computer" include "computer, Braille sense, and iPad"; "talking computer, Braille sense, pronto, and Smart view for visually weak students"; "computer and Braille sense"; "talking computer and Braille sense"; "speaking computer, iPad, Braille sense, vision program, iPhone programs, devices for people having good vision and changed to be using Braille, cell phone" and "iPads and computer supported by talking programs".

Similarly, recorders can be regarded as special software or devices that help users to record different kinds of sounds. On the concept map illustrated in Figure 4.20, it can be seen that the concepts Braille, recorder, computer, and programs appear close to each other, thus indicating the high correlation between these concepts.

4.3.4 Q3: What is your experience as an educator using technology?

The purpose of this question was to help me understand the educators' experiences with regard to their use of assistive technologies in helping learners with special needs. The educators were asked to share their experiences that they have had (if any) with assistive technologies.

The responses that were provided by the research participants (i.e. the educators) during the interviews conducted with them were transcribed for the purpose of analysing the same. Leximancer software was used to conduct a thematic analysis of the transcribed data. To identify themes in the data, all transcribed interview data pertaining to Question 3 were entered into the Leximancer software. The initial list of themes that were identified had 11 items: "computer", "information", "technology", "easily", "programs", "communicating", "time", "available", "useful", "pictures" and "applications". I then deleted some items that were deemed not to be relevant to this question; as a result, eight themes remained. The eight themes were "computer", "technology", "iPad", "information", "communicating", "pictures", "useful" and "available".

Among the eight themes, "computer" was the most dominant with 16 hits. Indeed, looking at the responses given for this question, there are many mentions of the word "computer". For instance, "Using computer and laptop helps and facilitates communicating concepts very much, and helps in varying the means of presentation"; "Good experience using assisting devices, computers, and projectors"; and "Using computer and its educational programs and videos to show educational programs". This was followed by "technology", "iPad" and

"information", all of which had nine hits. Again, the words "technology", "iPad" and "information" can be seen in various statements made by the educators (and in some cases two of these words appear in the same statement), for instance: "Technology is useful in education and saves the educator's effort"; "Technology supports education and facilitates communicating information to students"; "Using iPads and laptops"; "Technology contributed in communicating information to the impaired students fast and easily and keeping this information in the student's memory for the longest possible period of time"; and "It saves time and conveys information correctly". The theme "communicating" followed with five hits. This was followed by "pictures", "useful" and "available", which had four hits each. The eight themes and the hits for each theme as produced by Leximancer are shown in Figure 4.4, below.

Figure 4.4: Leximancer analysis of themes and hits in the data for question 3

Leximancer was also used to produce a concept map based on the concepts identified in the interview data for question 3. When the concept map opened, the themes that were visible were "computer", "technology", "iPad", "information", "communicating", "pictures", "useful" and "available". These concepts are shown in Figure 4.5 below.

Figure 4.5: Concept Map for question 3 – the experience of the educator as regards the use of technology

Looking at Figure 4.5, it can be seen that the labels for "computer" and "iPad" intersect. The same applies to the labels for "available" and "technology" as well as "information" and "communicating". Given that the theme "computer" had the highest number of hits, the intersection of the labels for "computer" and "iPad" is an indication that most of the educators' talk about iPad was related to the participants' experience in relation to using computers. For instance, in one statement a participant noted: "Using computer programs, iPad applications and projectors to show videos which support the lesson". The same applies to the relationship between the words "available" and "technology" and "information" and "communicating". For instance, one participant noted that technology is "Completely wonderful, special and comfortable. You can communicate information quickly and easily".

4.3.5 Q4: What difference do you think technology makes when it is used among students with hearing, visual and intellectual disabilities?

The purpose of this question was to help me understand how technology makes a difference with regard to learning when it is used by learners with disabilities. That is, the question sought help understand if educators think that the use of assistive technology when dealing with students with disabilities makes a difference compared to when such learners are taught without any supporting assistive technology. The responses to this question are meant to show the perceived differences in regard to students' learning outcomes that arise from using assistive technology, from the perspective of educators. From the responses, one can tell the benefits, if any, of using assistive technology to help learners who have any of the three disabilities that are the subject of this study.

As with the other interview questions, the information that was obtained based on the interviews that were conducted with participants was transcribed in readiness for analysis. Also, thematic analysis was conducted using Leximancer to identify the main themes in the data and the hits associated with these themes and to generate a concept map that could show the relative importance of the concepts in the data as well as the relationships that exist between these concepts.

In the analysis, six themes were identified: "information", "attention", "help", "time", "facilitates", and "develops". Of these, "information" had the highest number of hits, with 16. "Information" appeared to have the highest number of hits because of the idea that when educators use technology, they are able to pass information to students more easily or more clearly. This is seen in statements such as "It communicates information easily"; "It saves time

and effort and communicates information easily"; and "It communicates information in a faster and clearer way".

"Information" was followed by "attention" with 14 hits and "helps", which had 10 hits. This occurrence can be related to statements that suggested that technology helps to draw learners' attention or that technology helps by making learning more interesting for students with disabilities. This is apparent in statements like: "Highly attracting the students' attention and provoking their interactive abilities"; "It helps to communicate information easily"; and "It helps to research more and enjoy learning and reading". The other themes that were identified were "time", "facilitates" and "develops" with seven, four and three hits respectively. These themes are also indicative of how technology helps or facilitates the process of learning for learners with disabilities. The details of themes and hits pertaining to Question 4 are illustrated in Figure 4.6.

Figure 4.6: Leximancer analysis of themes and hits in the data for Question 4 – the difference that educators think technology makes when it is used to help students with disabilities

The interview data for Question 4 were also entered into Leximancer to identify the key concepts in the text. The concepts that emerged are shown in Figure 4.7.

Figure 4.7: Concept Map for question 4 – the difference that educators believe technology makes when it is used in helping children with disabilities

From Figure 4.7, it can be seen that most of the participants' discussion about technology was centred on "attention". More importantly, concepts such as "information", "develop" and "helps" are closely linked together, as shown by the intersection of the concept labels. This suggests that, in addition to mentioning how technology helps by drawing the attention of learners, the educators also talked about how technology helps them to pass information to learners or helps develop the learners' abilities.

4.3.6 Q5: Have you ever designed a program for students with hearing impairment, visual impairment or intellectual disabilities to improve their use of technology? What was it like?

This question was meant to help me understand whether the educators who participated in the study had designed any program to help learners with disabilities improve their use of

technology. The question was aimed at understanding the experience of those educators who have designed or used an assistive program.

Of the 66 educators who responded to the question of if they have ever designed a program for a student with any of the three disabilities to help such students use technology in their learning activities, 61 of the participants responded with "no" and the remaining five responded in the affirmative. This implies that the majority of the educators had not designed any programs to help students with disabilities in terms of how they are able to use the assistive technologies that are in place in their schools.

The five educators who said "yes", meaning that they had designed some sort of program, also indicated the types of program that they have designed. These programs varied among the five educators and can also be seen to have been designed based on the kind of need that each educator was faced with.

Specifically, one of the five educators responded as follows:

> "I got the Jeddah Prize in 2015. I prepared a vocalisation course and I am working on it to make the textbook visual"

From the participant's response, it can be noted that the educator came up with a vocalisation course and was still working on the course to make a textbook based on the visualisation concept, and for designing the program, the educator had received the Jeddah Prize in 2015.

Another educator responded to the same question as follows:

> "Yes – sign language, there was progress in which students participated"

This participant's response suggests that the educator had designed a program that would help learners with regard to sign language. Such a program could be targeted to help students who

have hearing impairments or any other disabilities that could have negatively affected their hearing ability.

The third research participant noted that she had designed an Arabic version of the Braille board:

> "Yes, an Arabic version of the Braille board. Also, I received a patent for the invention with teamwork, it was applied to blind teachers with success, but there was no sponsor"

The response given by educator indicated that this educator's program was aimed at helping students with visual impairments to read using an Arabic version of the Braille board. The response also goes further to show that the program was patented and was also used by blind educators successfully, even though there was no sponsor to support the program.

Another educator indicated that they had used an augmented reality program, which was an incredible experience and produced motivating results for both educators and students. The educator participant's response was as follows:

> "Yes, Using an augmented reality program was a fantastic experience with motivating results for the teacher and the students"

However, the participant's response, does not indicate whether the educator actually designed the "reality program" that was mentioned in the statement.

Finally, the fifth educator participant, while agreeing that she had designed a program to help students with disabilities in their learning process, also noted that she used a visual-based program that was aimed at helping children who rely on vision not only in learning but also in testing the learners. The response was as follows:

> "Yes, We supervised teamwork of teachers for communication using a program in the student's pads who are mentally paralysed (visual). It is a visual-based

> program by which students can be tested by relying on vision only and the device articulates the answer. Also, we used a touch-based program with the mute students, which is helpful in choosing food, colours, etc. As a principal, it is great. I noticed that the student can communicate her idea and feel through it"

The response given by the educator did not indicate whether the educator had designed the program personally or was just using the program.

4.3.7 Q6: How is the technology used towards enhancing learning for students with hearing, visual and intellectual disabilities?

Question 6 was meant to provide an understanding of how technology is used by educators to enhance learning for students with disabilities. In other words, using this research question, I sought to understand how educators in Saudi Arabia use technology as a way of enhancing the learning process of students with hearing impairments, students with visual impairments, and those with intellectual disabilities.

As was done for the other interview questions, the interview data that were obtained for question 6 was transcribed in order to have it in a format that could be analysed. The data was then entered into Leximancer for the purpose of analysing it thematically and generating concepts relating to the data. From the thematic analysis, the following themes were noted: "programs", "practice", "information", "devices", "reinforcement", and "explanation". Among these themes, "programs" was the most dominant, with 19 hits. It was followed by "practice" with nine hits. "Information" and "devices" were the next themes with six hits each. The last two themes were "reinforcement" with four hits and "explanation" with two hits. These details are illustrated in Figure 4.8.

Theme	Hits
programs	19
practice	9
information	6
devices	6
reinforcement	4
explanation	2

Figure 4.8: Leximancer analysis of themes and hits in the data for Question 6 – How technology is used to enhance learning for students with disabilities

The high number of hits for the theme "programs" suggests that the educators who took part in the research frequently mentioned programs as one of the tools that they use to help students with disabilities. On the concept map (Figure 4.9), the "programs" label has the hottest colour and lies close to the "practice" label, which had the second highest number of hits. The "programs" label is also intersected by other labels including those for "information" and "reinforcement". This means that the two concepts ("information" and "reinforcement") were mentioned alongside or in relation to "programs".

Figure 4.9: Concept Map for question 6 – How technology is used to enhance learning for students with disabilities.

Looking at that interview data, it is true that the word “programs” was mentioned alongside some of these concepts by various interview participants. Some examples include the following: “Through reinforcement programs that exist in social media”; “By providing the students with exciting and suitable scientific programs”; “Through connecting classroom curriculum with effective programs to communicate information in the easiest ways and also activating non-curricular activities to discover the students' potentials”; and “Through reinforcement programs that exist in social media”. These statements show that educators use various programs to pass information to learners with disabilities and to promote positive reinforcement among students. The fact that “practice” was also mentioned frequently, as shown by the hotness of the colour of this concept in the concept map, also indicates that educators use technology to promote practicing various concepts for the learners with disabilities. This is reflected in various statements including “By involving students in the lesson design and making them practice it during the lesson” and “Empirical practice is better than the theoretical one because it elevates enthusiasm and attracts attention”.

4.3.8 Q7: What are the roles of technology and its influences on the learning of a student with hearing, visual and intellectual disabilities?

The purpose of Question 7 was to determine the role of technology and how technology influences the learning of students with any of the three kinds of disabilities that are highlighted in this study. In other words, this question was meant to help me understand what role technology plays when it is used to help students with disabilities in their learning activities. The question was also meant to determine the ways in which technology influences the learning of students who have any of the three disabilities.

The data obtained through interviews with the participants was transcribed in readiness for analysis and then fed into Leximancer for thematic analysis and for the purpose of generating a concept map to identify the concepts in the data. For the thematic analysis, the following themes with their respective hits were identified: “information” (30 hits); “positive” (12 hits); “helps” (seven hits); “facilitates” (five hits); “level” (four hits); “abilities”, “different”, “attention” (three hits each); and “knowledge (two hits). These themes and their hits are illustrated in Figure 4.10.

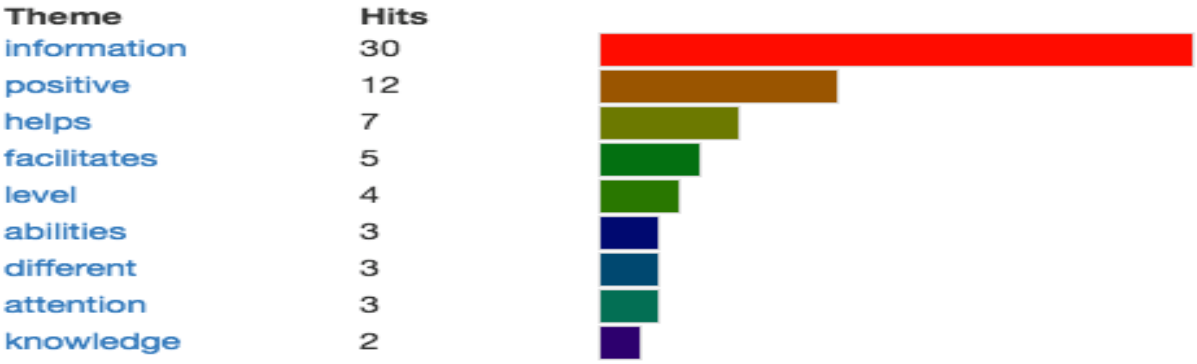

Figure 4.10: Leximancer analysis of themes and hits in the data for Question 6 – the role of technology and its influences on the learning of students with disabilities.

Based on the information in Figure 4.10, it can be seen that the theme that was mentioned most by the educators who took part in the research was “information”, followed by “positive” and “helps”. From the interview responses, it can be seen that the word “information” was mentioned severally, suggesting that technology helps in the dissemination of information to students and also influences the way the students learn. This can be seen from the following examples of responses: “Overcoming many difficulties, saving time and effort, and communicating the information easily” and “Its role is very important since it saves time and effort and makes information easy to be communicated”. In addition, several educators mentioned that technology influences learners with disabilities as well as their educators in a

"positive" way as shown by responses such as: "It plays a positive and effective role"; "It has a positive role on students in that it enriches their information and makes them deal with technology in a better way"; and "It is useful and has a positive effect on the student and the teacher alike". These findings are corroborated in the concept map derived from the same data (Figure 4.11).

Figure 4.11: Concept Map for Question 6 – the role of technology and its impact on the learning of students with disabilities.

From Figure 4.11, it can be seen that the "information" concept was the most dominant, given that the label for this concept has the hottest colour. Also, the "information" label is closely intersected by the label for the "positive" concept, which is the second concept in regard to the hotness of the colour. This means that most of the talk by the educators was centred on how technology changes the learning process as well as the learners with respect to how information is passed.

4.3.9 Q8: What are the challenges faced by your school in the implementation and/or use of technology for the learning of students with the aforementioned disabilities?

The aim of this research question was to find out from the educators the challenges that their schools face in the process of implementing or using technology to help students with any of the three kinds of disabilities (i.e. hearing impairments, visual impairments and intellectual disabilities). That is, through this question, I sought to determine the challenges that schools in Saudi Arabia face in their efforts to use technology to help meet the needs of students with disabilities from the perspective of the educators who were interviewed.

After transcribing the interview data it was entered into Leximancer for thematic analysis and to identify the main concepts in the data. For the thematic analysis, the following themes were identified: "training", "devices", "available", "financial", "use", "budget", "tools", "maintenance", and "capabilities". These themes, together with hits for each theme, are shown in Figure 4.12. "Training" is the theme with the highest number of hits (17), followed by "devices" with 14 hits and "available" and "financial" with 12 hits each. The theme "use" follows with 11 hits.

Figure 4.12: Leximancer analysis of themes and hits in the data for Question 8 – the challenges faced by schools in the implementation and/or use of technology for the learning of students with disabilities.

Looking at the interview information, lack of training or adequate training, high cost of devices, devices/technologies not being available and financial constraints are some of the issues

that were identified by the educators as the challenges that schools face in their efforts to implement the use of technology to support the learning of children with disabilities. This is apparent in statements such as: “I think that the most important point is the insufficient monetary liquidity, constant training on this technology by teachers”; “Internet unavailability; lack of programs, applications, educational games and smart boards, and applications-driven curricula”; and “Insufficient technology and lack of training”. Similarly, in the concept map for the Question 8 data (Figure 4.13), the most dominant concepts are “financial” and “training”, meaning that the research participants mentioned lack of adequate training and limited financial resources as some of the challenges that their schools face in their attempts to implement the use of technology to help students with disabilities.

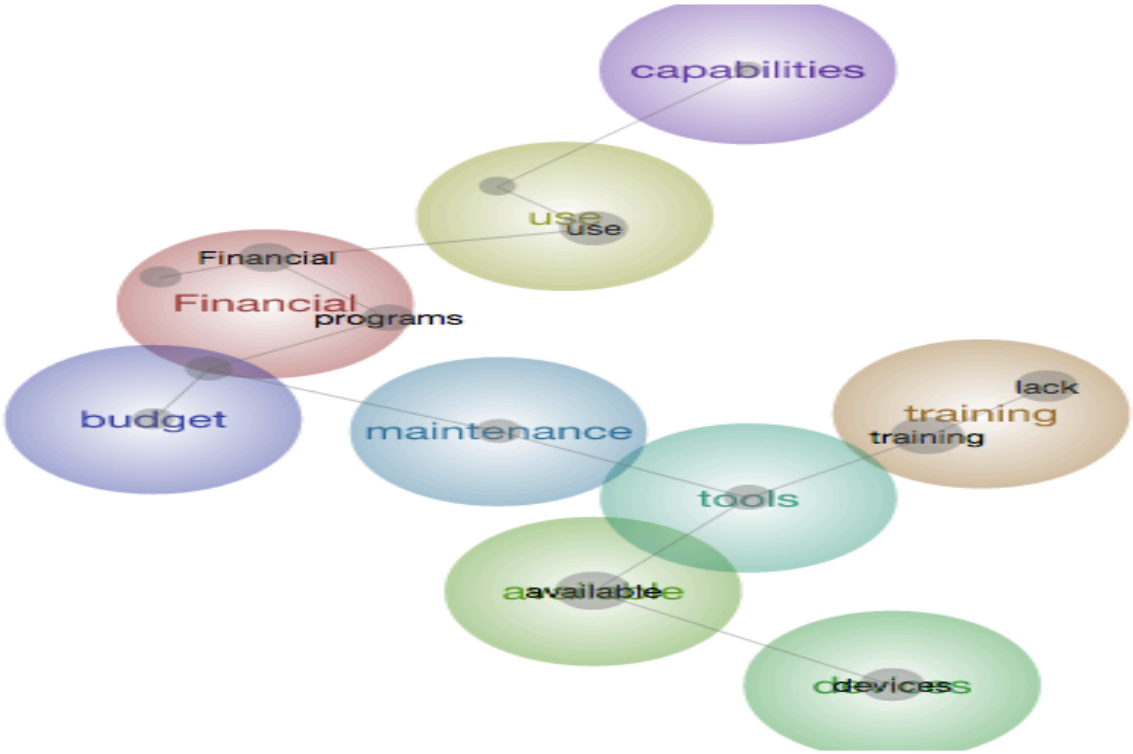

Figure 4.13: Concept Map for Question 8 – challenges that schools face in the implementation and/or use of technology for the learning of students with disabilities.

4.3.10 Q9: How do you think the challenges can be overcome?

This question was meant to gauge how the educators who participated in the study believed the problems that their schools face in their efforts to provide and use technology to support the learning needs of students with disabilities can be addressed. In other words, through this question I sought to understand what the educators think are the solutions to the challenges that their schools face in their effort to implement the use of technology in helping students with disabilities.

The interview data for Question 9 were transcribed and analysed using Leximancer to identify the themes and concepts. With regard to the thematic analysis that was conducted, the following themes were identified: "modern", "teachers", "maintenance", "budget", "ministry", and "support". Among these themes, "modern" had the highest number of hits (23), followed by "teachers" (21). Other themes had generally low numbers of hits as follows: "maintenance" – seven hits; "budget" – seven hits; "ministry" – six hits; and "support" – five hits. These themes and their respective hits are shown in Figure 4.14.

Figure 4.14: Leximancer analysis of themes and hits in the data for Question 9 – educators' views on how the challenges that schools face with regard to how the use of technology to support children with disabilities can be addressed.

The fact that the themes that had the highest number of hits were "modern" and "teachers" shows that the educators who were interviewed mostly talked about these two themes. This observation is supported by various statements from the interview data. For instance, some

of the statements that included the word "modern" are: "Boosting the institute with modern technology and monetary liquidity"; "Equipping classrooms with modern technology"; and "Developing school programs and providing schools with modern technology". Some of the statements that included the word "teachers" are as follows: "By making use of the experiences of the other countries, training teachers on modern technology and sufficing them to the students and training students on how to use them"; "Sufficing a special budget, preparing a suitable place, and training teachers to use them"; and "The ministry should put forward plans and programs, training teachers and supply technological devices". These results suggest that much of the talk by the interviewed educators was focused on issues such as providing modern technology and training teachers so that they are able to use these technologies to support children with disabilities in their learning activities. These findings are also confirmed in the concept map for the same data (Figure 4.15), which shows the concept of "modern" with the hottest colour label followed by "teachers".

Figure 4.15: Concept Map for Question 9 – teachers' perceptions of how the challenges that schools face with regard to the use of technology to support children with disabilities can be overcome.

From Figure 4.15, it can be noted that the concepts “modern” and “teachers” are also closely linked with others such as “providing”, “devices” and “budget”, which indicates that the interviewees talked about providing things like devices and budgets to help address the challenges that schools face with regard to dealing with the needs of children with disabilities.

4.4 How the qualitative data supports/confirms the quantitative data

The qualitative results of research support the quantitative results in various ways. For example, while responding to the questions in the survey questionnaire, the participants agreed with the statement that their schools have a wide range of assistive technologies for use by the students with disabilities. This point was confirmed through the interview, whereby the participants in the interview mentioned that their schools have a wide range of devices including computers, iPads and others that are used to support learning for students who have disabilities. Also, another common view that is expressed through the responses to the survey questionnaire and the interview that was conducted is that there are challenges such as unavailability of certain types of assistive technologies and limited or lack of training for teachers. As such, there is a general feeling, as expressed through the questionnaire and the interview, that teachers are not adequately prepared to use the assistive technologies that are available. This in turn hinders the effective use of assistive technologies even when such technologies are available in schools.

Another observation relates to the perceptions that teachers have towards the use of assistive technologies. Based on the survey questionnaire, most of the participants agreed with statements pertaining to whether they have positive attitudes towards the use of assistive technologies in their schools. These statements include the benefits of assistive technologies to students and the effectiveness of using assistive technologies in teaching students with disabilities. The point that the participants have positive attitudes towards technology use was

confirmed in the interviews, where the participants highlighted the benefits of using assistive technologies to help students.

4.5 Summary

In regard to the qualitative data results, it is noted that I answered research questions relating to the educators' views on the following issues. The first issue was whether the educators' schools use technology and the second issue was the types of technological tools in use in the sampled schools. Another matter is the educators' experience with regard to the use of technology as well as how the educators think technology makes a difference when it is used to help students with disabilities. Another issue that was the focus of the qualitative analysis is whether the educators who were interviewed have created any programs to help students with disabilities. In addition, the issues of how educators and schools use technology to enhance learning for students with disabilities and how technology impacts the learning of students with disabilities were also analysed. The last two issues that were addressed in the research questions relate to the challenges that schools in Saudi Arabia face in their efforts to implement the use of technology to help learners with disabilities, and how these challenges can be addressed.

It was noted that most of the educators said that their schools use assistive technologies and that the most commonly used tools are computers, smart boards, and iPads. With regard to educators' experience in the use of technology, most of the educators' experience was related to the use of computers. It was also noted that the educators are of the view that assistive technologies help them to communicate information to students more easily. On the question of whether the educators have designed a program to help students with disabilities, only a few educators were found to have designed such a program. It was also mentioned that educators use different programs to help students with disabilities in their learning activities. More importantly,

the research participants noted that different technologies help them to pass information to learners with disabilities more easily. The challenges in the use of technology, as noted by the educators, mainly include lack of adequate training for teachers, limited devices/technologies, and unavailability of resources such as finance to support technology programs. The educators also noted that these challenges can be addressed by providing modern technologies, training teachers and providing other kinds of support or maintenance that are necessary. The qualitative results of research confirm the quantitative results in various ways. Similarities between the two sets of findings were found in terms of the positive attitudes of the participants towards the use of assistive technologies, the types of assistive technologies that are available in schools, and the challenges that schools face, such as limited or lack of training for teachers in relation to the use of assistive technologies.

Chapter 5: Discussion

5.1 Introduction

This chapter discusses and critically analyses the findings of the study as presented in Chapter 4. The aim of the discussion chapter is to determine whether the objectives of the present study were achieved and whether the study's research questions, as outlined in Chapter 1 of the thesis, were answered. Another aim of the discussion and analysis of the findings is to determine how the findings of the present study compared with results of other studies relating to the use of technology to assist students with different disabilities in their school learning activities. The discussion highlights how the findings deviate from or support existing knowledge with regard to the aforementioned area of study in the Saudi Arabian schools that were selected. Given that the literature review in Chapter 2 was not restricted to the use of technology in Saudi Arabia, the findings of this study (as presented in Chapter 4) will be compared with the situation in other countries across the world, as discussed in existing sources of literature.

Since the discussion chapter is based on the findings chapter, the discussion and analysis are presented in the same format as Chapter 4. Thus, the outline of Chapter 5 is as follows. The chapter is divided into two main parts. The first part is the discussion of the quantitative data results as obtained using the survey questionnaire. This includes the demographic aspects of the research participants; educators' perceptions about the use of technology for students with disabilities; the types of technologies used by educators; and how variables such as gender and educators' experiences affect educators' perceptions of the use of assistive technology. The second part of the this chapter is discussion of the qualitative data results. This section is focused on critically analysing the responses that the research participants gave to the interview

questions. Thus, the discussion relates to the findings regarding the nine interview questions that the research participants were asked. The final part of Chapter 5 is a summary of the information presented in the entire chapter.

5.2 Part 1: Discussion of Quantitative Data Results

5.2.1 Introduction

As noted above, this section discusses the quantitative data results that were obtained based on the use of the survey questionnaire. The information that was collected using the survey questionnaire is as follows. The first section is perceptions of the research participants regarding the use of technology to assist students with disabilities. This is followed by details about the types of technologies that are used by the educators who participated in the research. Then there is a section about how variables such as gender and educators' training experience affect their perceptions of the use of technology to assist students with any of the three disabilities that are the focus of this study: hearing impairment, visual impairment, and intellectual disability. In all these sections, the findings are discussed and critically analysed and compared with current knowledge on the use of technology to assist learners with disabilities in selected schools in Saudi Arabia and other countries across the world.

5.2.2 Teachers' perceptions of the use of technology for students with disabilities

The results in section 4.3 (Chapter 4) – Perceptions of the use of technology for students with disabilities – show that the educators who took part in the survey had different perceptions regarding the use of technology for students with disabilities. The implication of these findings is that the educators who took part in the study largely agreed that the use of assistive technologies is beneficial to learners with disabilities. The same finding is supported by the fact that the

benefits of technology factor had a p-value greater than 0.05, suggesting that this factor is statistically significant in relation to how educators view the benefits of using assistive technology to help students with disabilities.

The educators also supported the idea that technology should be introduced in all schools that cater for students with disabilities. In addition, it can be noted that the research participants largely agreed that the learning of students with disabilities can be improved greatly if educators support the use of assistive technologies. More importantly, the research participants agreed that their school principals expected them to use assistive technologies to support the learning of their students and that the principals were open to improving the use of technology. Also, the research participants agreed with the statement that students are more enthusiastic about using assistive technologies when their parents or guardians support the use of such technologies. Lastly, the participants also strongly agreed with the statement that the existing assistive technologies need to be improved or redesigned in order to help students with disabilities in the schools that were sampled. Therefore, overall, it can be argued that the educators who took part in the research had positive attitudes towards the use of assistive technology due to the benefits that they believe are associated with using such technologies. Furthermore, it can be noted that the research participants' schools are receptive towards the use of assistive technologies since the schools' principals were said, based on the participants' answers, to be promoting the use of these technologies.

Having positive attitudes towards technology and technology use has been identified in various studies (for instance, Al-Zaidiyeen, Mei & Fook, 2010; Almekhlafi & Almeqdadi, 2010) as a crucial factor that determines teachers' use of educational technology in general. The results of the present study are also consistent with those of a study that was conducted in Jordan to

determine teachers' attitudes towards the use of technology in the classroom (Al-Zaidiyeen et al., 2010). In particular, Al-Zaidiyeen et al. (2010) found that teachers in Jordan had a low level of information communication technology skills for use in teaching but, at the same time, they had positive attitudes towards the utilisation of information communication technology. Although the study by Al-Zaidiyeen et al. (2010) was about educational technology in general, and particularly about information communication technologies, the results can be likened to the results of the present study since assistive technologies also include information communication technologies such as computers and other related devices. In the present study, as was noted earlier, most of the educators who took part in the research had a few years of experience with regard to the use of assistive technologies and, as seen above, most of the educators have positive attitudes towards the use of assistive technology.

There were also statements for which the research participants gave a moderate positive score (i.e. agree) on the Likert scale. These statements include the following:

- **S15**: As an educator, I'm well-versed in the research on technology tools/aids that can enhance the learning experience among students with disabilities (hearing impairment, visual impairments, and intellectual disabilities).
- **S12**: Students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my school are able to effectively use assistive technology to support their learning.
- **S18**: As an educator, I already know what can be done to improve the efficiency of assistive technologies among the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in my class.
- **S17**: The use of technology in my school faces too many challenges.

- **S19**: As an educator, I have identified the skills that students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) need in order to use assistive technologies more efficiently.
- **S11**: My school has challenges acquiring assistive technologies for the students with disabilities (hearing impairment, visual impairment, and intellectual disabilities).
- **S13:** I am adept at using assistive technologies when teaching the students with disabilities (hearing impairment, visual impairment and intellectual disabilities).
- **S20**: The lack of technology designed for Arab users is hindering technology use in my school.
- **S9:** All stakeholders support the use of technology to support student learning.

The implications of the responses given by the research participants with regard to the statements above can be summarised as follows. Firstly, the educators can be said to have some knowledge and skills with regard to the types of assistive technologies that they can use to enhance the learning of the students in their schools. It can also be argued that the students that the research participants teach are somewhat able to use assistive technologies. More importantly, from the perspective of the educators, there are challenges such as difficulties in acquiring assistive technologies as well as a lack of technologies that have been designed specifically for Arab users.

Despite these challenges, the research participants also noted that all stakeholders in their schools are supportive of the use of assistive technologies. These findings either differ with or agree with the findings of various other studies that have been conducted in regard to educators' awareness about the use of technology, the challenges that exist in relation to technology adoption, and the attitudes of different stakeholders towards the use of technology. For instance,

a study conducted by Yusuf and Fakomogbon (2008) in one state in Nigeria to determine the availability of assistive information communication technologies (ICTs), teachers' attitude towards ICTs in special education schools, and teachers' awareness about ICTs, found that most of the teachers were not aware of the potential of using ICTs in helping students with disabilities. Nonetheless, most of the teachers who took part in the research had positive attitudes towards the use of technology (Yusuf & Fakomogbon, 2008). Alkahtani (2013) also found that educators' awareness about the capabilities of and working with assistive technologies varied. Hence, it can be argued that teachers' understanding regarding the various types of assistive technologies, their capabilities and uses vary not only in Saudi Arabia but also in other countries across the world.

The research participants also disagreed with the following statements:

- **S10:** The assistive technologies currently in use in my school are effective in helping students with disabilities (hearing impairment, visual impairment, and intellectual disabilities) in their learning.
- **S6:** My school has an adequate/broad/wide range of assistive technologies for use by the students with disabilities (hearing impairment, visual impairment and intellectual disabilities)
- **S16:** My school has trained me (and other educators) adequately in the use of assistive technologies for the students with disabilities (hearing impairment, visual impairment and intellectual disabilities).
- **S3**: The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities (hearing impairment, visual impairment and intellectual disabilities).

- **S7**: Parents of students in my school have been of great assistance, giving in-kind assistive technology devices to the school.

The implications of the responses made by the research participants to the above statements are as follows. First, the assistive technologies currently in use in the sampled schools are not as effective as the educators think they should be (as implied by the responses to **S10**). Secondly, the schools that were sampled seem to have inadequate assistive technologies (as implied by the responses to **S6)**. Thirdly, the responses to statement **S16** imply that the research participants' schools have not provided adequate training in the use of assistive technologies. There is also some indication that the educators who took part in the research think that the education sector in Saudi Arabia (probably both government and private institutions in the country) is not doing enough to provide the assistive technologies that learners with disabilities need, as implied by the responses to statement **S3**. Finally, based on the responses to statement **S7**, parents of students with disabilities play an important role in helping students as well as the educators of those students.

The findings relating to statements **S10**, **S6**, **S16**, and **S3** generally imply that there are challenges with regard to the educational technologies that are available to help students with disabilities. The point is emphasised by the finding in the ANOVA analysis that the challenges factor is statistically significant with regard to the perceptions that educators have towards the use assistive technologies and the barriers to the use of such technologies.

The sentiments noted in relation to statements **S10**, **S6**, **S16**, and **S3** are also common in many countries around the world, as indicated by various research studies. In many countries, especially developing countries such as Saudi Arabia, Kenya, Tanzania and Bangladesh, training on assistive technology has been found to be lacking, and this is coupled with limited investment

by the respective governments in efforts to improve the provision of assistive technologies to students with disabilities (Alfaraj & Kuyini, 2014; Grönlund et al., 2010; Nyagah et al., 2017)

5.2.3 Types of technologies used by educators

As noted in section 4.4 – Types of technologies used by educators (Chapter 4), 90 percent of the educators indicated that their schools were using computers or computer-related devices. Another 50 percent of the total number of educators said that they were using projectors, while 20 percent of them mentioned the use of iPad devices. Another 19 percent of the educators pointed out that their schools were using smart boards. It should be noted that the total of these percentages exceeds 100 percent, which means that educators who participated in the research, or their schools, could be using more than one type of assistive technology. For instance, one school could be using computers or other computing devices and other technologies such as smart boards or projectors at the same time. It is for this reason that, while 90 percent of the educators pointed out that they were using computers, many others still pointed out that they were using devices such as projectors.

The results regarding the types of assistive technologies used in schools are consistent with some findings in the literature. For instance, according to Indiana University (2015), the most common types of assistive technologies are video captioning and remote transcription devices that are used with computers. It should be noted that the statement by Indiana University (2015) is based on the situation in developed countries such as the United States. Advanced countries also tend to adopt the use of devices such as iPads (Alfaraj & Kuyini, 2014). Conversely, many developing countries tend to have basic assistive technologies with very limited use of ICTs or no assistive technologies at all. Such basic technologies are also referred

to as low-tech technologies (Granschow, Philips & Schneider, 2001) as was noted in section 2.5 of this thesis.

According to Grönlund et al. (2010), many developing countries use basic assistive devices such as stylus and paper that are used in manual writing, slate, wheelchairs, white canes and other related devices. For instance, in Tanzania, it was found that devices that are based on ICT are used only in some privately-owned schools and government schools have none (Grönlund et al., 2010). Further, some special education schools in Tanzania lack even basic aids for special education such as glasses and Braillers. However, Grönlund, et al. (2010) also note that there are a number of schools in Kenya and Tanzania that have successfully adopted the use of ICTs as assistive devices.

5.2.4 How variables such as gender and level of experience affect educators' perceptions about the use of technology

It was apparent in the results section (section 4.5 – How variables such as gender and educators' experiences affect the mean scores on each factor of the scale) that gender has an impact on the research participants' perceptions regarding the use of assistive technology to help learners with learning disabilities. In this regard, it was noted that male educators who took part in the research were using technology more compared to their female counterparts. It was also found that the period over which educators have been trained in the use of technology has a significant impact on the educators' perceptions regarding the use of technology to help learners with disabilities.

The first finding regarding male educators using technology more compared to female educators is supported by various results in past studies. For instance, Mahdi and Al-Dera (2013) found that female teachers reported less use of ICTs such as computers in the classroom

compared to male teachers. Similarly, Zhou and Xu (2007) found that female educators had less computer expertise as compared to males in relation to the use of about 30 percent of computer tools. This finding implies that female educators were likely to use computers and other related technologies to a lesser extent compared to their male counterparts. Also, in many studies on gender and the use of technology in teaching, female teachers have been cited as having limited access to technology, which in turn results into low computer use (Buabeng-Andoh, 2012). This assertion can be used to explain the finding in the present study that male educators were using technology more in comparison to female educators in the schools that were sampled. Interestingly, it was also noted that the study involved more female participants than males. This means that, even though there are more female educators as compared to male educators in the schools that were sampled, many of the females were less likely to use assistive technology.

With regard to the second issue about how educators' level of experience affects their perceptions about the use of assistive technology, as was noted above, it was found that the period of training on technology use has an impact on how educators perceive the use of assistive technology. Specifically, the category of tutors who had been trained for at least eight years was found to have more positive attitudes towards the use of assistive technology. What this means is that the more a person is trained in technology use, the more the person becomes confident and positive about the use of such technologies. This finding is supported in studies by authors such as Young and MacCormack (2014) who concluded that the more trained teachers are, the more likely they are to use technology. It was noted that training in assistive technology use is necessary to make it possible to implement the use of the technology in the classroom (Bruinsma, 2011).

5.3 Part 2: Discussion of Qualitative Data Results

5.3.1 Introduction

As was pointed out in section 5.1, part 2 of this chapter discusses the qualitative findings. This section critically analyses the responses that the research participants gave to the nine interview questions. The interview questions looked at the following issues. First, whether the schools where the research participants teach use assistive technology and second, the type of assistive technologies used in the schools from which the sample of participants was drawn. The third issue is the educators' experience with regard to the use of assistive technology and the fourth point is the difference that educators think technology brings about when it is used to assist students with disabilities. The fifth issue is whether the educators who participated in the research had designed any programs to help learners with disabilities and if so, what the experience was like. The sixth question was about how technology is used to enhance learning for students with disabilities. The seventh question was concerned with the role of technology and technology's impacts on the learning of students with disabilities. The eighth question looked at the challenges that schools face in the adoption and use of technology for the learning of students with disabilities. The last issue (question 9) was concerned with how the research participants think that the challenges that schools face in the adoption and use of technology can be overcome.

5.3.2 Whether the schools where the research participants teach use assistive technology for students with disabilities

The responses given to the question of whether the research participants' schools were using assistive technology were mixed. As was noted in the results section, a considerable number of the participants (47 of 66, or 71 percent of the total number) said that their schools

had adopted the use of assistive technology. Others (15 of 66 or 22 percent of the total number) indicated that their schools were not using assistive technologies. Additionally, there were a few participants (four of 66) who noted that their schools were "somewhat" using assistive technologies, meaning that these schools had only a low level of use of the assistive technologies required to support the learning needs of students with disabilities.

There are various implications of the findings regarding the use of assistive technology in the schools that were sampled. One of the implications is that the level of use of technology in the schools varies depending on a number of factors. For example, there are schools that have a significant level of use of assistive technology, but there are also schools that are only using assistive technology at a basic level; then there are schools that are not using any technology at all, as reported by the research participants. These findings can be said to reflect the situation in Saudi Arabia and other countries in the world as similar findings have been reported in the existing literature.

The Saudi Arabian government has been making efforts to provide for the learning needs of children with disabilities (Nounou et al., 2012). These efforts seem to have focused more on the urban areas than the rural areas of the country, such that schools that cater for the needs of children with disabilities in urban areas have better facilities than those in rural areas (Nounou et al., 2012). In addition, in section 2.6 of the literature review it was noted that the government has been slow to provide the infrastructure and facilities that are required to help learners with disabilities (Alfaraj & Kuyini, 2014). Similarly, studies such as that conducted by Fakrudeen, Miraz, and Excell (2017) have revealed that although Saudi Arabia has made efforts to improve the infrastructure and facilities that are required by students with disabilities, the infrastructure varies from one school to another. For instance, according to Fakrudeen et al. (2017), some

schools may have separate laboratories that have been set aside for special needs students while other schools may have common laboratories that are used for inclusive education. The implication of having computers or other technologies that are shared is that such facilities may have some limitations with regard to their ability to cater for the different needs of students with disabilities and also limited access to the facilities.

Furthermore, as noted above, countries such as Tanzania, Kenya and Bangladesh have varying levels of adoption of technology in schools that cater for children with special needs (Grönlund et al., 2010). The findings of the present study conform with previous studies (e.g. Alfaraj & Kuyini, 2014; Grönlund et al., 2010) that suggest that assistive technology has positive impacts on students with disabilities. Overall, it can be noted that many schools have adopted the use of assistive technologies. Additionally, where the use of assistive technology has been embraced, the level of technology use varies from one school to another.

5.3.3 Types of technological tools that are used in the sampled schools to help students with disabilities

As was noted in the results chapter, an analysis of the research participants' responses with regard to the types of assistive technologies that are used in their schools showed that the computer was the most mentioned device. Computers were followed by (smart) boards, iPads, projectors and Braille respectively. Other technologies that were mentioned to a lesser extent include "programs" and "recorder" (see Figure 4.2). The implication of this finding is that in schools where assistive technologies are being used, computers are the devices that are most commonly used, followed by smart boards, iPad devices, and projectors. It is important to note that devices such as smart boards and projectors are used along with computers. More

importantly, even iPads are computing devices given that they are an example of tablet computers.

Therefore, it can be argued that, in the schools that were sampled, where there has been an adoption of assistive technology, the most commonly used types of technology are computer-related devices. This finding is consistent with the findings of studies conducted in developed countries such as the United States, where it was noted computer-related devices are the most common types of assistive technologies (Alfaraj & Kuyini, 2014; Indiana University, 2015). However, the results of this study contradict the findings of studies that have suggested that many developing countries such as Saudi Arabia usually have basic assistive technologies or none at all in schools that cater for the needs of children with disabilities (Alfaraj & Kuyini, 2014; Borg et al., 2011; Grönlund et al., 2010).

It is also important to note that some educators in the present study pointed out that their schools had a low level of adoption of technology or were not using any assistive technology. This means that even though some schools in Saudi Arabia are using computer-related technologies as assistive devices, some schools only have basic assistive technologies while others have none – which is reflective of the situation in many developing countries. Even though the schools in this study do not fully represent all Saudi schools, the findings suggest that use of technology will differ in different schools.

5.3.4 Educators' experience with regard to using technology to help students with disabilities

The results relating to educators' experience with regard to using technology to help students with disabilities basically show the perceptions or attitudes that educators have towards assistive technologies. The results show what the educators who took part in the research think

about different assistive technologies. For instance, the Leximancer results analysis showed that words such as “computer”, “technology”, and “iPad” were mentioned alongside words such as “useful”, “communicating”, “information”, and “pictures”. This implies the various uses or level of usefulness of assistive technology from the perspective of the research participants in the study. For example, computers and other related technologies are used to improve communication between educators and students and can also be used to relay pictures for students. Computers are also useful in that they enable learners to share information among themselves and with their educators. Therefore, the educators’ experiences that were being examined are the ways in which teachers use technology and the thoughts of teachers with regard to the usefulness or uses of assistive technology.

Several studies have also examined what educators think about the uses of assistive technology or educational technology in general. There are five distinct benefits of assistive technology. Assistive technologies help students with disabilities to reach their potential, the technology gives them self-confidence, helps them be more independent, makes the curriculum easy to understand and boosts engagement among students (Alkahtani, 2013). Normally, assistive software makes all the difference (except for cases like Braille) because, without them, the hardware would be just a normal computer, which would, in most cases, be fit for use by people who do not have any disabilities. Thus, the findings of the present study show that the research participants have positive attitudes towards the use of assistive technology based on their views about the different ways in which the technologies help them or the ways in which the educators are able to use the technology. This is an important point given that when educators have positive attitudes towards the use of assistive technologies, they are likely to help students with disabilities to use these technologies more effectively.

5.3.5 The difference teachers think technology makes when it is used to assist students with disabilities

The responses that were given by the educators who were involved in the research with regard to Question 4 further serve to emphasise the educators' views in relation to the uses and usefulness of assistive technology. Question 4 specifically sought to determine the difference that the participants thought technology makes when it is used to help students with disabilities. The analysis of the Leximancer results for this question revealed that the research participants mentioned words such as "information", "attention" and "help", with these words receiving the highest numbers of hits. Other words that had a considerable number of hits include "time", "facilitates" and "develops". All these words that were mentioned by the research participants suggest the improvements that assistive technologies bring about when they are used to help students with disabilities with their classroom activities. Examples are evident from Section B, which consists of questionnaire responses. These statements emphasise the ways in which technology is used to bring about some assistance or a difference in the manner in which educators of students with disabilities deliver instruction to students and interact with their students.

Various studies have highlighted the difference that assistive technology brings about when it is used to help learners with disabilities. For example, assistive technologies for learners with hearing impairments help such learners to hear sounds that they would not be able to hear without such technology (Heckendorf, 2009). Similarly, assistive technologies for students with visual impairments help students in a variety of ways, including making it possible for the students to use spreadsheets, send and read emails, and read the text in the form of synthesised speech (Indiana University, 2015). Some assistive technologies also help students by magnifying

computer screens to make it possible for learners with visual impairments to read computer text (Indiana University, 2015).

Returning to the findings of the present study, it is important to note that the points provided by the research participants regarding the difference that is brought about by the use of assistive technology are general and not specific to a particular kind of disability. Therefore, there is some difference between the findings of the present study and what has been written in the literature. The difference is that while sources of literature such as Heckendorf (2009) and Indiana University (2015) have mentioned the specific area or way in which assistive technologies bring about a difference, the findings of the present study relate to the general ways in which assistive technologies improve learning for students with disabilities. In other words, the interview results did not contain a specific way in which a given type of technology brings about a difference in relation to a particular kind of disability. As noted by the Schwab Foundation for Learning (2000), assistive technologies are different, and "a technology that is appropriate for one purpose in a particular setting may be of little value in another situation" (p. 6). Hence, based on the findings of the present research, it is not clear how a given assistive technology brings about a specific difference to a student with a particular kind of disability.

5.3.6 Whether educators have ever designed a program for students with disabilities to improve their use of technology and what the experience was like

The significance of the results relating to Question 5 of the interview questions is that the responses that were given by the research participants highlight the role that educators can play in designing assistive technologies. As was pointed out in section 5.2.3 with regard to educators' perceptions about the use of technology for students with disabilities, the participants strongly agreed with statement **S21** in the survey questionnaire, which stated that "Current assistive

technologies need significant improvement (or redesign) if they are to help the hearing impaired students". This demonstrates that many of the educators who took part in the study are of the view that the assistive technologies that are currently being used in Saudi Arabia (or the educators' schools in particular) need to be improved or redesigned to make them more appropriate for use in their schools. This emphasises the role that an educator can play when it comes to designing or making a contribution to the design of assistive technologies.

In the results relating to Q5, it was indicated that only five of the 66 research participants had designed or been involved in designing a program or device to help students with disabilities. However, on analysing the participants' responses, it is not clear whether the educators had designed any program or had just been involved in adapting some aspects of a given assistive technology. For instance, one educator reported having prepared a "vocalisation course". It is not clear what the course entails and how it functions. Also, it is not clear whether the course was based on a particular assistive technology that is already in the market. Another educator reported having designed a sign language. In this case also, it is not clear whether the "sign language" was a new kind of assistive technology. Another educator reported having designed an Arabic version of the Braille board. This can be said to be a process of adapting the existing version of the Braille board so that the device can be used by students who speak or learn in Arabic.

In the obtainable literature, not much has been written about teachers being involved in designing new kinds of assistive technologies. However, it has been suggested that educators can use their knowledge about their students to create learning materials that are custom-made to suit the learning needs of these students (Lin, 2012). Also, educators can be involved in areas such as making the design of school ICT laboratories or special computer rooms that are used by

students with learning disabilities (Jones et al., 2018). Therefore, the findings of the present study and the existing literature agree with regard to the view that teachers can be involved in the design or adaptation of some assistive technologies in accordance with the needs of their students.

5.3.7 How technology is used to enhance learning for students with disabilities

With regard to how the teachers who took part in the study use technology to enhance the learning of students with disabilities, the research participants mentioned various concepts that show how technology is used. The results of the Leximancer analysis of the themes relating to this question showed that the educators who were interviewed mentioned themes such as programs, practice, information, devices, reinforcement, and explanation. Looking at the statements made by the research participants in response to Question 6, it can also be noted that some statements contained some of the aforementioned themes. For instance, while responding to the questions about how technology is used, one research participant replied as follows: “By providing the students with exciting and suitable scientific programs.” Another participant said: “Through connecting classroom curriculum with effective programs to communicate information in the easiest ways and also activating non-curricular activities to discover the students' potentials”. Another participant indicated that assistive technology is used “through reinforcement programs that exist in social media”. It can be seen that the statements suggest the ways in which the educators use assistive technology to help their students. However, as with the responses that were made by the research participants in relation to Question 5, the answers are general in context and do not point out how a particular technology is used to enhance the learning of a student with a specific type of disability.

As was noted in the literature review, there are various ways in which assistive technologies help to enhance the learning of students with disabilities. For instance, hearing technologies help amplify sounds to make it possible for students with hearing impairments to hear content that is being delivered by the teacher (Northern & Downs, 2002). Similarly, assistive technologies for students with visual impairments help students to read by enlarging text or converting the text into speech (Indiana University, 2015). Since the research participants did not point out specific cases in which an assistive technology was used to enhance the learning of a student with a particular kind of disability, it is not easy to specify the particular ways in which an assistive technology has been used to enhance learning for students with disabilities in the present study. However, it can be said that overall, some of the general ways in which assistive technologies enhance learning, as identified by the participants in this study, include improving communication, encouraging positive reinforcement for students, and encouraging students to engage in non-curricular activities. This is in line with the notion that assistive technologies have the potential to improve the lives of students with learning disabilities (Adebisi, Liman & Longpoe, 2015).

The participants' responses to Q7 give an overview of the effects of technology on the learning of students with disabilities. Based on the results of the Leximancer analysis that was conducted in regard to this question, it was noted that the research participants frequently mentioned themes such as "information", "positive", "help" and "facilitates". These themes are evident in statements that were made by the participants, such as assistive technology helps in "overcoming many difficulties, saving time and effort, and communicating the information easily"; "Its [assistive technology's] role is very important since it saves time and effort and makes information easy to be communicated"; and "It [assistive technology] plays a positive role

for students as it enriches their information and makes them deal with technology in a better way".

The aforementioned responses show that assistive technology plays roles such as helping overcome the difficulties that students with disabilities would ordinarily face when they do not get any technological aid for their learning. Such problems include difficulties in communication, and difficulties in accessing information. In other words, according to the research participants, assistive technology positively influences the learning of students with disabilities by facilitating or helping such students in aspects such as communication and access to information. In the literature, related studies (e.g. Bruinsma, 2011) have also found that assistive technology can be utilised in classrooms to help students become successful in areas where they would otherwise have difficulties. As pointed out in relation to the responses of the participants in the present study, the areas in which students with disabilities face difficulty include communication and retrieving information from others.

5.3.8 Challenges that schools face in the implementation and/or use of technology for the learning of students with disabilities

The responses that were given to the educators who took part in the research in relation to Question 8 give an account of the challenges that the schools that were sampled face in the use of assistive technology. Looking at the results of the Leximancer analysis for this question, the main themes identified by the research participants include "training", "devices", "available", "financial", "use", "budget", "tools", "maintenance", and "capabilities". These themes highlight some of the challenges that the participants indicated were hindering the adoption and use of assistive technology in their schools. The themes point to issues such as lack of training, financial and budget limitations, and shortage or lack of assistive devices. Turning to the

statements that the participants made in regard to Question 8, some examples of are as follows: “I think that the most important point is the insufficient monetary liquidity, constant training on this technology by educators”; “Internet unavailability; lack of programs, applications, educational games and smart boards, and applications-driven curricula”; and there is “insufficient technology and lack of training”.

It is easy to see that the prominent issues in these statements include lack of training for educators, lack of infrastructure and the devices/technologies that are necessary for a successful adoption of assistive technology, and financial constraints. To a large extent, these findings agree with the findings made in part of the results of the present study (particularly sections 5.2.2 and 5.2.3) as well as many studies that have been completed on the adoption of technology, and assistive technology in particular, by schools. For instance, as was noted in section 2.4 of the literature review, Alkahtani (2013) identified lack of knowledge by teachers as a key barrier to the use of assistive technology in the classroom to help students with special educational needs. In particular, Alkahtani (2013) suggested that 72.4 percent of the teachers who took part in the research had limited knowledge or no knowledge at all with regard to the use of assistive technologies. Similarly, Buabeng-Andoh (2012) noted that “On the school level, factors such as support, funding, training, and facilities influence teachers’ adoption and integration of technologies into their classrooms” (p. 147). Grönlund et al. (2010) also report the existence of challenges such as lack of assistive technologies, limited support in terms of funding and lack of training in countries like Bangladesh, Kenya, and Tanzania. Lack of resources such as necessary technologies has also been identified as one of the challenges that schools face (Almekhlafi, 2010).

It is, however, important to note that the aforementioned challenges are mostly felt in developing countries. In developed countries such as Norway, Grönlund et al. (2010) found that more teachers receive training on the use of assistive technology and that these teachers are knowledgeable in the field of learning difficulties. Further, according to Grönlund et al. (2010), there is a lot of support offered to students with disabilities and their teachers in Norway. Nonetheless, Grönlund et al. (2010) also note that successful implementation of assistive technology programs in Norway is hindered by factors such as rigid school culture and resistance from the people who are supposed to manage such programs.

The implication of the findings of the present study and the other findings that have been mentioned is that the challenges schools face in the implementation of assistive technology varies from one country to another.

5.3.9 How educators think the challenges that schools face in the implementation and/or use of technology can be overcome

The research participants provided various suggestions that they think can be used as solutions to the challenges that schools face in their efforts to implement the use of assistive technologies. The responses can be summarised as provision of training for teachers in the use of assistive technology, provision of more facilities such as relevant classrooms and the required assistive devices and technologies, increasing funding to support the needs of schools in relation to the necessary technologies, and developing programs that the schools can use to effectively implement the use of assistive technology.

The points suggested by the participants in the present study as the remedy to the challenges that schools face as they use assistive technologies to help students with disabilities have also been suggested in other studies that have been conducted in the past in the field of

educational technology. Various studies have suggested similar or related steps as remedies for the challenges that schools face when it comes to adopting the use of educational technology in general and assistive technology in particular. For instance, it has been argued that proper training and professional development of teachers in relation to assistive technology use is important for proper implementation of the technology (Bruinsma, 2011). Alkahtani (2013) also suggested that professional development practices that are premised on best practice and research are critical for the successful execution of assistive technology for learners with special needs. In addition, educators who participated in a study by Alfaraj and Kuyini (2014) about the use of technology to support learning for children with Down syndrome called for more training to prepare them to serve better through technology and inclusion. Funding and the cost of assistive technology is also an issue that has been addressed as requiring attention since schools can have the necessary assistive technologies and other supporting resources only if they have the funds that are required to purchase the necessary equipment, provide training, and implement the assistive technology programs (Bruinsma, 2011).

5.4 Summary of the Discussion Chapter

This chapter has analysed the findings of the study in two parts: the quantitative data results and the qualitative data results. The analysis of the quantitative data results looked at four key areas: the demographic aspects of the research participants; educators' perceptions about use of technology for students with disabilities; the types of assistive technologies that are used in schools; and the impact of teachers' gender and level of experience on educators' perceptions about the use of technology. As discussed in the first part , male educators tend to use technology more compared to female educators. Interestingly, there are more female educators than male

educators in the schools that were sampled. Also, educators tend to use assistive technology more when they have a higher level of education, training and professional development, and experience in the use of assistive technology. It has also been noted that many educators have positive attitudes towards the use of assistive technology even though there are limitations such as lack of training and lack of commitment by schools/the government to support the use of assistive technologies to help students with disabilities. Computers have been identified as the most commonly used assistive technology. Even then, the situation in many developing countries is that there are mostly low-tech assistive technologies. Finally, with regard to part 1 of this chapter, teachers' gender and experience impact their attitudes towards assistive technologies.

With regard to part 2 of this chapter, the analysis looked at the interview results that constituted the qualitative data. Along this line, it was noted that the use of assistive technology varies among schools; while some schools have assistive technologies, others do not. More importantly, the assistive technologies used in schools vary, not only between schools, but among countries. Similarly, teachers use assistive technologies differently and have different views regarding the role of assistive technologies in enhancing the learning of students with disabilities. The challenges that schools face in the adoption of assistive technologies also vary but the most notable challenges are lack of training and professional development for educators with regard to the use of assistive technology, limited investment in the necessary technologies, and lack of support for assistive technology programs. As discussed, these challenges can be addressed by enhancing training for educators, providing funding for the necessary assistive technologies, and enhancing the level of support for assistive technology programs among other approaches.

Chapter 6: Conclusions and Recommendations

6.1 Introduction

This chapter presents a critical summary of the key findings of the research in relation to whether the study answered the research questions outlined in Chapter 1 of the thesis. In addition, this chapter presents recommendations for future research and limitations. The learning from the research and the contribution was provided.

Chapters 1–5 of the thesis have presented details of the study that was conducted to examine how technology is used in various schools in Saudi Arabia to help students with any of the following disabilities: hearing impairment, visual impairment, and intellectual disability. As noted in Chapter 1, the main objective of the study was to investigate how technology is used as part of efforts to enhance learning for students with the aforementioned disabilities in selected schools in Saudi Arabia. The study also aimed to examine the challenges that schools face in the implementation and use of technologies that are used to support the learning of students with any of the three disabilities. Furthermore, the study was focused on examining the perceptions that educators in Saudi Arabia, specifically those from the schools that were sampled for the study, have with regard to the use of technology to support the learning of students with disabilities. In addition to stating the objectives of the study, Chapter 1 introduced the topic of study and offered some background information regarding the three disabilities and their definition It was also stated that the three disabilities (i.e. hearing impairment, visual impairment and intellectual disability) were selected for the study given that they are the most recognised learning-related disabilities in Saudi Arabia. Additionally, the Ministry of Education in Saudi Arabia has provided more resources to schools that offer services to students with the said disabilities compared to schools that cater for students with other types of disabilities.

Chapter 2 of the study presented a review of the literature about the three disabilities selected for the study and gave an account of how technology is utilised to help children with these disabilities. Chapter 3 detailed the research methodology that was employed to establish the instruments that were used to carry out the study (i.e. survey questionnaire and interview questions) and explained how the study was carried out. Chapter 4 of the study presented the findings and Chapter 5 discussed and critically analysed the findings.

The purpose of Chapter 6 is to summarise the main findings of the research and make recommendations regarding the findings. Thus, the chapter is divided into various sections as follows. The next section (6.2), presents the main conclusions that can be drawn from the findings of the research. This is then followed by the recommendations (section 6.3) that can be made in relation to the findings of the study. That is then followed by a discussion of the limitations of the study (section 6.4), in (section 6.5) the research learning's have been addressed. Finally, section 6.6 involves the contributions provided.

6.2 Conclusions

The study sought answers to five main research questions and to achieve three objectives. The first question sought to determine the types of technological tools that are in use at schools that cater for the needs of students with hearing impairment, visual impairment and intellectual disability in Saudi Arabia. The second question sought to find how variables such as gender, training, and teachers' experience influence the perceptions of educators towards the use of technology to support the learning of students with disabilities. The third research question was aimed at determining the experiences of educators in relation to the use of technology to support the learning of students with disabilities. Through the fourth research question, I sought to

determine the challenges that educators in schools in Saudi Arabia face as they use technology in the education of students with any of the three disabilities. Finally, the fifth research question looked at what can be done to improve the use of technology to support the education of students with the abovementioned disabilities in schools in Saudi Arabia.

Based on the research questions, the main conclusions that can be made from the study are as follows. With regard to the first research question, the study found that the technological tools that were being used in most schools were computers, followed by other devices such as projectors, iPads, and smart boards. Other devices that were mentioned by the educators who took part in the study included loudspeakers, headphones, Braille devices, recorders, video systems and television sets, educational talking pens, magnifying glasses and auditory peripherals. It is important to note that the technologies that were mentioned by the educators vary from one institution to another since each of the three institutions that were sampled for the study (Al Amal Institute, Al Noor Institute and Institute of Intellectual Disabilities) offers learning services for students with a specific type of disability. Another point worth mentioning is that the schools that were studied were using more than one type of technology since most of the technological devices that are used to assist learners with disabilities are complementary. For instance, computers can be used alongside other technologies such as headphones, smart boards, and projectors. Thus, it can be concluded that the types of assistive technologies vary from one school to another, and the schools also have different levels of adoption of assistive technologies.

Referring to other studies that have been conducted on related areas, the current study noted that computers are the most commonly used assistive device in developed countries such as the United States. Conversely, developing countries such as Kenya and Vietnam tend to use

mostly low-cost or basic assistive devices such as spectacles, slate and stylus devices, and Braillers to help students with disabilities (Oira, 2014; Palmer et al., 2015).

With regard to the second research question on how variables such as gender, training, and educators' experience affect educators' perceptions towards the use of technology to support the learning of students with disabilities, the conclusions that can be made are as follows. Firstly, it was found that gender affects the perceptions of educators towards the use of technology to assist students with disabilities. In particular, male educators have more positive attitudes towards the use of technology compared to their female counterparts. However, no statistically significant difference (p-value = 0.535 > 0.05) was found between the attitudes of educators and school principals towards the use of technology to help students with disabilities. This implies that the attitudes of the individuals who took part in the research towards assistive technology did not necessarily vary on the basis of one's rank as either an educator or a school principal.

Another conclusion that can be made is in regard to the educators' level of training in technology and their teaching experience. Notably, educators who had been trained for a longer period on the use of assistive technology had more positive attitudes towards using it than those who had been trained for a shorter period or received no training at all. Also, teachers with a longer period of teaching experience and a higher level of experience in the use of assistive technology reported a more positive attitude towards its use to help students with disabilities. In other words, it can be noted that the more training an educator has received in relation to the use of technology, the more confidence and positive attitude the educator will have towards using assistive technologies to help students with disabilities. Also, having teaching experience means that an educator would have most likely been exposed to additional training or hands-on

experience in the use of assistive technologies. Hence, educators with more teaching experience are likely to be more confident in the use of assistive technologies, as was found in this research.

The third research question sought to determine the experiences that educators have with regard to the use of technology to support the learning of students with disabilities. The conclusion that can be made in relation to the findings for this question is that the educators have positive attitudes (p-value = (0.049, 0.007) < 0.05) towards assistive technologies based on their experiences with, or the ways in which they are able to use these technologies. In other words, the different ways in which educators are able to use assistive technology to assist students with disabilities, such as by communicating and delivering content, affect the perceptions that educators have towards using these technologies.

The fourth research question investigated the challenges that educators face in their efforts to use different assistive technologies to support the teaching of students living with any of the three types of disabilities. The most notable issues that were identified in the research as barriers to the successful implementation of assistive technology by schools in general, and teachers in particular, can be summarised, in no particular order, as follows. The first point is the issue of lack of training for educators on the use of assistive technology. The second issue is the lack of infrastructure and the technologies, as well as devices that are needed for the successful implementation of assistive technology. The third issue is the lack of finance and other resources that are required to adequately run assistive technology programs in schools that provide learning services for children with special needs. Such challenges have also been identified in other countries, particularly developing countries such as Kenya, Bangladesh, and Tanzania (Grönlund et al., 2010; Nyagah et al., 2017). It is also important to point out that these challenges vary among different schools even within the same country, which is the case in Saudi Arabia and

other developing countries such as Tanzania and Kenya (Alfaraj & Kuyini, 2014; Grönlund et al., 2010; Nyagah et al., 2017). For instance, while one school in a given region could have all the required resources, such as trained teachers and the necessary technologies, another school in another region could have very few or none of these resources.

The fifth research question sought to determine what needs to be done to improve the use of technology to support the education of students with these disabilities in Saudi Arabia. The conclusions that can be made in relation to the findings pertaining to this research question are outlined next. Firstly, the educators suggested that training teachers adequately in the use of assistive technologies would better prepare them to use these technologies in teaching students with disabilities. The issue of the importance of training has also been reported widely in the literature that was cited in this thesis. In particular, it was noted in the discussion chapter (Chapter 5) that effective training and professional development of educators with regard to the use of assistive technology is critical for proper implementation of the technology in schools (Alkahtani, 2013; Bruinsma, 2011). Therefore, training needs to be provided to educators at two levels. The first level is the training of educators in colleges or other institutions of higher learning and the second level is training practising educators as part of their professional development programs.

Another very important point is that there is a need to provide facilities such as appropriate classrooms and the requisite assistive devices and technologies to improve the uptake and use of assistive technologies in the classroom. As was noted in chapters 4 and 5, providing modern assistive technologies to schools can encourage more teachers to use these technologies in the teaching of children with disabilities. Undoubtedly, the provision of modern technologies has to be done alongside the provision of other necessary facilities such as special classrooms or

computer laboratories to support the use of these technologies. More importantly, it can be argued that the provision of assistive technologies needs to be concomitant with the training of educators to use these technologies. This is because educators can use the technologies that have been made available in schools only if they have been adequately trained in their use.

Another suggestion that educators made regarding what needs to be done to improve the use of assistive technology in schools is that schools need to have adequate financing. It is important for schools to have the resources that are necessary for the implementation of assistive technology programs as this will enable them to provide the necessary support for assistive technology use, identify the appropriate assistive technologies that are required for their students' unique needs, and motivate educators and students to use these technologies. As was noted in the research, different schools have varying levels of adoption of assistive technologies. Additionally, even the types of assistive technologies that are used in different schools vary. Therefore, providing sufficient funds to schools will help ensure that schools that cater for the needs of students with disabilities are able to determine the gaps that exist in their implementation of assistive technology and adequately address these gaps. Also, given that most of the assistive technologies are costly, having adequate funds to purchase them is one of the ways in which schools that provide learning services for students with disabilities can generally be supported to acquire the technologies.

Another conclusion that can be made from the research findings, though not directly related to the research questions, is the issue of the gender of the educators who took part in the current research. As has been noted above, the study established that gender affects the attitudes of educators towards the use of assistive technology to help students with disabilities. Specifically, the highlight of the issue to do with gender is that the study revealed that male

educators had more positive attitudes towards the use of assistive technology in comparison to female educators. This finding has also been corroborated by findings from other research studies that have been conducted in the past (Kashkary, 2014). Based on these previous findings, it can be argued that there is a likelihood that more male educators will use assistive technologies compared to female educators. Ironically, the study also revealed that the schools that were sampled had more female educators than males. This is an interesting finding given that while the schools have more female educators compared to males, it is the male educators who have more positive attitudes towards the use of assistive technology. This implies that many of the female educators are not likely to use the assistive technologies effectively due to their lack of positivity or less positive attitudes towards the use of the technologies. The next section presents the recommendations that have been suggested based on the findings of the research discussed in this thesis.

6.3 Recommendations

6.3.1 Training of educators

With respect to the finding that educators' experiences regarding the use of assistive technology are based on the various ways in which they view the technology as beneficial, it is important to emphasise the need for training. In particular, educators' training needs to focus on the types of needs students have as well as different types of assistive technologies to be used to satisfy these needs. As it was noted in section 1.2 of Chapter 1, "teacher training must include a strong component of the most current information internationally, including on technology and assistive devices for the success of education" (UNESCO, 2009, p. 97). This emphasises the fact that training of educators should focus on ensuring that the teachers gain adequate knowledge regarding the needs of students with disabilities as well as how the different technologies that are

meant to benefit these students are used to achieve the goals of assistive technology use. The training of educators needs to be conducted both at the college or university level and as part of educators' professional development, as explained below under the recommendations on policy formulation and implementation.

6.3.2 Policy formulation and implementation

With regard to training on the use of assistive technology and how educators' experience affects educators' perceptions towards technology, suggested policy measures that need to be taken to ensure that educators have positive attitudes towards technology are as follows. Firstly, there is a need to have a government policy that incorporates training on the use of assistive technologies in the syllabus of educators' training colleges or universities. This way, educators graduating from higher learning institutions will be equipped with the skills that are required to use different kinds of assistive technologies.

Secondly, government policy needs to include professional development programs for educators who are already in service. This is because the need for professional development that incorporates training on the use of assistive technologies was widely mentioned by the individuals who took part in this study. The importance of training was also emphasised in numerous studies that have been cited in this thesis, notably in chapters 2 and 5 (e.g. Alfaraj & Kuyini, 2014; Alkahtani, 2013; Bruinsma, 2011; Buabeng-Andoh, 2012; Grönlund et al., 2010; UNESCO, 2009). The professional development programs should incorporate training on the use of educational technologies such as computers and other assistive technologies in general. More importantly, such programs should reflect the changing trends in technology by ensuring that educators have the skills that are required in the use of emerging educational technologies and

technologies for students with disabilities in particular, as has been pointed out by UNESCO (2009).

Thirdly, there is a need to have a government policy that promotes the utilisation of educators' levels of teaching experience and the resources that are available in ways that are beneficial to students. One approach that can be part of such a policy is the implementation of common planning time in schools that provide learning for students with disabilities. Common planning time can be defined as a regularly arranged period in the course of a school day when educators who teach the same learners convene for joint planning, preparation of materials, parent conference, and student assessment (Mertens et al., 2010). During common planning time sessions, teachers can share the knowledge and experiences that they have, discuss students' needs – especially with respect to the assistive technologies that are required, and plan on how to best use the resources that are available in their school.

6.3.3 Resources/financial support for assistive technology programs

With regard to the finding that there is a shortage of the necessary technologies and supporting infrastructure as well as limited financing for assistive technology programs, the suggested actions are as follows. Firstly, the government of Saudi Arabia should ensure that schools that cater for the needs of students with disabilities have all the facilities that the students need in order to learn effectively. Such facilities include different kinds of assistive technologies such as computers, smart boards, projectors, and hearing aids. These technologies should be provided after considering the individual needs of each school, given that schools in different regions cater for the needs of students with different types of disabilities, and thus, each school has unique needs.

In addition, there should be supporting facilities and infrastructure to ensure that the assistive technologies that are available are used effectively. For instance, where computers and other related devices like projectors and iPads are available, there should be amenities such as electricity and an Internet connection as well as infrastructure such computer laboratories or secure classrooms where the different assistive devices can be kept safely.

More importantly, adequate financing is required to ensure that different kinds of assistive technology programs in schools run effectively. Finances are required in areas such as the provision of information technology support services, replacing damaged or faulty devices, and carrying out maintenance operations to ensure that the assistive technologies that are available are operational all the time. Furthermore, adequate financing is required in areas such as providing training for the educators who are involved in the use of assistive technology to teach students with disabilities. The need for adequate financing in order to provide for the learning needs of children with disabilities was highlighted in Chapter 1. In particular, it was argued that governments need to allocate sufficient funds that can be used to purchase and maintain the various technologies and assistive devices that are used by students with different types of disabilities (UNESCO, 2009) (see section 1.2 – Background to the Study). Thus, schools that cater for the learning needs of students with disabilities should be supported to ensure that they have the necessary technologies and supporting infrastructure. Remarkably, in order for the necessary assistive technologies to be available in schools and remain fully functional all the time, the schools need to be provided with adequate funds to run the assistive technology programs.

With regard to purchasing the various assistive devices and the supporting equipment that students with disabilities need, the devices should be relevant to the needs of the students for

which the technology is targeted. In Chapter 2 it was noted that there is a need to design assistive technologies that can be used effectively by people who speak Arabic (Alquraini, 2011) in the context of the use of such technologies in Saudi Arabia. It was also indicated that as long as the necessary assistive technologies are not accessible to the people who need them, they will not be of use to these groups (notably educators and students) (Alquraini, 2011). In addition, in the results chapter it was noted that one educator had designed an Arabic version of the Braille board. Such an effort and others such as buying assistive technologies that are easy to use in relation to the language in which they have been programmed or are based on can help to make educators' experiences with the technologies more positive. Thus, assistive technologies that are purchased by the government or schools should be relevant to the specific needs of each school that caters for the needs of students with disabilities. This is because if educators find that assistive technologies are relevant, useful and easy to use, they are likely to be more motivated to use the technologies in their teaching activities.

6.3.4 Future research

In relation to the finding that some schools were using devices such as computers while other schools were not using assistive technology or were only using the technology at a lower level, future research should focus upon why these differences exist. Future studies need to look at the types of technologies that are available in the schools that cater for the needs of students with different types of disabilities in Saudi Arabia. This will help determine the types of assistive technologies that each school has and the devices that each school is lacking. Such studies can also help to establish how devices such as computers are used, whether and how they are used alongside other devices, and the impacts of using these devices on the learning outcomes of students with disabilities. Studies in the suggested areas can also help reveal why some schools

have many varieties of assistive technologies while others have none of the different types of assistive technologies.

With regard to the observation that variables such as educators' gender, training, and experience affect their perceptions about the use of assistive technologies, future studies should look at ways of capitalising on these aspects to increase the uptake of assistive technology in schools. For instance, there is a need to conduct a study to determine why female educators generally report low usage of technology, as was discussed in Chapter 5. Some of the reasons that are attributed to this include female educators having less computer expertise compared to males, female educators being less comfortable with the different types of educational technologies, and female educators having less experience with regard to using the various types of educational technologies (Buabeng-Andoh, 2012; Mahdi and Al-Dera, 2013; Zhou & Xu, 2007). Going forward, there is a need to discover why female educators tend to have less technological expertise compared to male educators. The same applies to the reasons female educators tend to have less experience in the use of educational technology, including assistive technologies, and why female educators are likely to be less comfortable using educational technology in their teaching activities.

Regarding the finding that the schools that were sampled had more female educators as compared to male educators and that male educators tend to use technology more than females, future studies should determine why female educators have lower positive attitudes towards the use of assistive technology to help students with disabilities. This is because, given that the number of female educators is higher than that of male educators, the use or adoption of assistive technologies would be much higher assuming that such technologies are available in schools. Since studies such as Kashkary (2014) have suggested that male educators are more positively

inclined towards using technology compared to female educators, future studies should investigate why this is so.

Based on the limitations of the current research, given that the focus was only on three schools that offer learning services for children with hearing, visual and intellectual disabilities, future comparative studies should focus on the situation in mainstream schools. As was noted in section 2.4 of Chapter 2, Saudi Arabia has several mainstream schools that provide learning services for children with different types of special needs (Alnahdi, 2013). Thus, future studies should investigate whether and how assistive technologies and other types of learning-related technologies are used in mainstream schools. The studies should also investigate whether there are any challenges in relation to the use of assistive technology and learning-related technologies in general in mainstream schools in the country.

It is also important that future studies on the use of assistive technology in schools focus on a wider region within Saudi Arabia. This will help to discover results about a larger number of schools, and such results will provide a wider picture about the use of assistive technologies in schools in different parts of Saudi Arabia (both urban and rural areas of the country).

6.4 Limitations of the Study

The notable limitations of this study are related to the sampling method that was used as well as the nature of the sample. In particular, the use of the purposive sampling method as explained in Chapter 3 (section 3.4.1) of the thesis implies that the group of participants who took part in the study comprised individuals with a particular experience to share. In this case, the experience to be shared was the information that the educators and school principals had in relation to the use of assistive technology to help students with a disability. Since the sample was

selected only from schools that offer learning to students with any of the three types of disabilities that were the focus of this study, it can be noted that the study left out mainstream schools that cater for both students with disabilities and those without disabilities. Therefore, it can be argued that leaving out other schools would have resulted in the collection of a broader range of data if other sampling methods were used.

Another limitation of the study is related to the argument that in purposive sampling, "the researcher's judgment in identifying the population members and selecting the sample can be flawed or biased" (Blankenship, 2010, p. 87). What this statement means in relation to the current study is that I could have made errors of judgment while selecting the schools that were considered for the study and in deciding on the sample size. In other words, the schools that were selected may not be sufficiently representative of the state of schools that provide learning services to students with disabilities in the wider region of Saudi Arabia.

Finally, the use of the purposive sampling method implies that the results that were obtained based on the sample population cannot be generalised across Saudi Arabia.

6.5 Learning from the research

This research has enabled me to understand the extent to which assistive technologies are used to help students with disabilities to achieve their educational objectives as well as the perceptions that teachers have towards the use of different types of assistive technologies. The research has also enabled me to understand the problems that teachers and schools in general face with regard to the use of assistive technologies. Based on the findings of the research, I have learned that while teachers have positive attitudes towards the use of assistive technologies, many schools do not have adequate assistive technologies. As well, I have learned that lack of proper training of teachers on the use of assistive technologies limits the effective use of these

technologies. Based on my understanding of how the three types of disabilities that have been discussed in this research affect students, I believe that more needs to be done to ensure that schools in Saudi Arabia adequately cater to the learning needs of students with disabilities. My thinking and future actions are therefore focused on how well the limited resources that are available can be used to effectively support the students with disabilities. In particular, I believe that with proper training of teachers, the assistive technologies that are currently in use can be used in a much better way.

6.6 Research contribution

The research makes a contribution to the existing knowledge by providing findings about the extent to which assistive technology is used in Saudi Arabia, the perceptions that educatoers have towards the use of the technology, and the challenges that schools face in regard to the use of assistive technologies. By using mixed methods to collect data and by reviewing a wide variety of sources, the research has various methodological and theoretical implications. The methodological implication is that the use of mixed methods provides offers a good way of collecting and analysis qualitative and qualitative data in a single research. The theoretical implication is that the findings of this research have added knowledge about the use of assistive technologies by students with any of the three types of disabilities that have been the focus of this research.

6.7 Concluding Summary

This chapter has discussed the main conclusions that can be made based on the findings of the study and also provided recommendations on the basis of these conclusions. The chapter has also stated and explained the limitations of the study. With regard to the objectives of the

study, it has been noted that the three objectives were met. Notably, the research probed how technology is used to help students with disabilities, examined the challenges that schools face in the implementation and use of assistive technologies, and examined the perceptions that teachers have towards the use of assistive technology in the education of students with disabilities.

In regard to the research questions of the study, the main conclusions that have been made in relation to the findings of these questions are as follows. First, the research identified computers, projectors, iPads and smart boards as the leading assistive technologies that are used in the schools that were sampled. Other assistive technologies include loudspeakers, headphones, Braille devices, recorders, television sets, video systems, educational talking pens, magnifying glasses and auditory peripherals. The second conclusion is that educators' gender and level of training affect their perceptions of the use of assistive technologies. The third conclusion is that educators have positive attitudes towards assistive technologies based on the experiences that they have with these technologies. The main challenges that schools face in regard to the implementation of assistive technology are: lack of training for educators on the utilisation of assistive technology, limited availability of the necessary assistive technologies and supporting infrastructure, and lack of finance and other resources that are needed to adequately operate assistive technology programs. To solve this problem, it was noted that there is need to train educators in the use of assistive technologies, provide the necessary assistive devices and supporting infrastructure, and provide adequate finance to facilitate the running of assistive technology programs in schools.

Recommendations have been made with a focus on the need to discover why some schools have better assistive technologies than others and why female educators report low use of technology. Also, it has been suggested that training of educators on the use of assistive

technologies should be done both as part of the training programs in colleges and other higher learning institutions and as part of educators' professional development programs. More importantly, it has been recommended that there is need to make educators see the benefits of using assistive technologies by focusing on the usefulness of these technologies. To address the challenge of lack of assistive technologies, it has been recommended that the necessary devices, along with supporting infrastructure and finances, be provided.

The study's limitations have also been discussed. These limitations are linked to the fact that purposive sampling was used to select the sample for the study. Thus, the sample is limited in scope with regard to the information that it generated, and the findings of the study cannot be generalised. Based on the limitations of the study, further recommendations about future research have been provided.

The learning from the research is that the research provides an understanding of the problems that educators and schools in general face in regard to the use of assistive technologies. The research also makes a contribution to knowledge by presenting findings about the degree to which assistive technology is used in Saudi Arabia, educators' perceptions towards the use of the technology, and the challenges that schools face as regards the use of assistive technologies.

References

AbilityNet. (2009). *Using assistive technology with pre-school children*. Retrieved from https://www.abilitynet.org.uk/playni/documents/UsingAssistiveTechnologywithPre-schoolChildren.pdf

AbilityNet. (2017). *We are AbilityNet. Adapting technology. Changing lives*. Retrieved from https://www.abilitynet.org.uk/

Abuzinadah, N. E., Malibari, A. A., & Krause, P. (2017). Towards empowering hearing impaired students' skills in computing and technology. *(IJACSA) International Journal of Advanced Computer Science and Applications*, *8*(1), 107-118.

Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using assistive technology in teaching children with learning disabilities in the 21st century. *Journal of Education and Practice*, *6*(24), 14-20. Retrieved from https://files.eric.ed.gov/fulltext/EJ1078825.pdf

Afeafe, M. Y. (2000). *Special education in Saudi Arabia*. Retrieved from http://www.khayma.com/education-technology/PrvEducation3.htm

Ageranioti-Bélanger, S., Brunet, S., D'Anjou, G., Tellier, G., Boivin, J., & Gauthier, M. (2012). Behaviour disorders in children with an intellectual disability. *Paediatrics & Child Health*, *17*(2), 84-88.

Ahmad, F. K. (2015). Use of assistive technology in inclusive education: making room for diverse learning needs. *Transcience*, *6*(2), 62-77.

Albar, L., & Hurst, A. (2012). *Cross-cultural differences in assistive technology use for deaf individuals.* Retrieved from https://lulaalbar.files.wordpress.com/2014/04/cross-cultural-differences-in-at-use-for-deaf3.pdf

Aldabas, R. A. (2015). Special education in Saudi Arabia: History and areas for reform. *Creative Education*, *6*, 1158-1167.

Al-Dali, W., Fnais, M., & Neubould, I. (2013). Private higher education in the Kingdom of Saudi Arabia: Reality, challenges, and aspirations. In L. Smith & A. Abouammoh (Eds.), *Higher education in Saudi Arabia: Achievements, challenges and opportunities* (pp. 127-136). Dordrecht, Netherlands: Springer.

Alfaraj, A., & Kuyini, A. B. (2014). The use of technology to support the learning of children with Down syndrome in Saudi Arabia. *World Journal of Education*, *4*(6), 42-53.

Al-hano, I. A. (2006). *Representations of learning disabilities in Saudi Arabian elementary schools: A ground theory study* (PhD thesis). University of Wisconsin-Madison, Madison.

Alkahtani, K. D. F. (2013). Teachers' knowledge and use of assistive technology for students with special educational needs. *Journal of Studies in Education*, *3*(2), 65-86. Retrieved from http://www.macrothink.org/journal/index.php/jse/article/viewFile/3424/2906

Almekhlafi, A. G., & Almeqdadi, F. A. (2010). Teachers' perceptions of technology integration in the United Arab Emirates school classrooms. *Journal of Educational Technology & Society*, *13*(1).

Almethen, M. A. (2017). *Saudi special education teachers' knowledge, skills, and professional development needs of assistive technology in the classroom* (Unpublished master's thesis). California State University, San Bernardino. Retrieved from http://scholarworks.lib.csusb.edu/cgi/viewcontent.cgi?article=1506&context=etd

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: The Arab Bureau of Education for the Gulf States.

Alnahdi, G. (2013). Inclusion of students with intellectual disabilities in Saudi Arabia. *Proceedings of the 13th Biennial Conference of the International Association of Special Education,* 119-121.

Alnahdi, G. H. (2014). Special education programs for students with intellectual disability in Saudi Arabia: Issues and recommendations. *The Journal of the International Association of Special Education*, *15*(1), 83-91.

Alnaim, F. (2015). Learning disabilities concept and identification: Primary teachers' perspectives in Saudi Arabia. *International Journal of Social Science and Humanity*, *5*(12), 1040-1044.

Alothman, A. (2014). *Inclusive education for deaf students in Saudi Arabia: Perceptions of schools principals, teachers and parents* (unpublished Doctor of Philosophy thesis, University of Lincoln, Lincoln).

Alquraini, T. (2011). Special education in Saudi Arabia: Challenges, perspectives, future possibilities. *International Journal of Special Education,* 26(2), 149-159.

Al-Rowaily, M. A., AlFayez, A. I., AlJomiey, M. S., AlBadr, A. M., & Abolfotouh, M. A. (2012). Hearing impairments among Saudi preschool children. *International journal of pediatric otorhinolaryngology*, *76*(11), 1674-1677.

AlShahrani, M. M. (2014). *Saudi Educators' attitudes towards deaf and hard of hearing inclusive education in Jeddah, Saudi Arabia* (unpublished Doctor of Philosophy thesis, University of Exeter, Exeter). Retrieved from

https://ore.exeter.ac.uk/repository/bitstream/handle/10871/15846/AlshahraniM.pdf?sequence=3

Altamimi, A.A., Lee, L. W. Sayed-Ahmed, A. A., & Kassem, M. M. (2015). Special education in Saudi Arabia: A synthesis of literature written in English. *International Journal of Special Education*, *30*(3), 98-117.

Al-Zaidiyeen, N. J., Mei, L. L., & Fook, F.S. (2010). Teachers' attitudes and levels of technology use in classrooms: The case of Jordan schools. *International Education Studies*, *3*(2), 211-218. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.895.7215&rep=rep1&type=pdf

Ary, D., Jacobs, L. C., Sorensen, C., & Razavieh, A. (2010). *Introduction to research in education* (8th ed.). Belmont, CA: Wadsworth.

Ashman, A. (1998). Students with intellectual disabilities. In A, Ashman & J. Elkins (Eds.), *Educating children with special needs* (3rd ed.) (pp. 417-461). Sydney: Prentice Hall Australia Pty Ltd.

Australian Hearing. (2014). *What is an early intervention in hearing loss?* Retrieved from https://www.hearing.com.au/milestone/what-is-early-intervention/

Babbie, E. (2008). *The basics of social research* (4th ed.). Belmont, CA: Thomson Higher Education.

Barclay, L. A., & Staples, S. (2012). The importance of listening instruction. In L. A. Barclay (Ed.), *Learning to listen/listening to learn: teaching listening skills to students with visual impairments* (pp. 3-23). New York: AFB Press.

Barry, A. K. (2002). *Linguistic perspectives on language and education*. Westport, CT: Greenwood Publishing Group, Inc.

Biddle, C., & Schafft, K. A. (2015). Axiology and anomaly in the practice of mixed methods work: pragmatism, valuation, and the transformative paradigm. *Journal of Mixed Methods Research*, *9*(4) 320–334.

Bin Battal, Z. M. (2016). Special education in Saudi Arabia. *International Journal of Technology and Inclusive Education* (IJTIE), *5*(2), 880-886.

Blankenship, D. C. (2010). *Applied research and evaluation methods in recreation*. Champaign, IL: Human Kinetics.

Borg, J., Larsson, S., & Lindström, A. (2011). Assistive technology in developing countries: A review from the perspective of the convention on the rights of persons with disabilities. *Prosthetics and Orthotics International*, *35*, 20-29.

Brue, A. W., & Wilmshurst, L. (2016). *Essentials of intellectual disability assessment and identification*. Hoboken, NJ: John Wiley & Sons, Inc.

Bruinsma, A. M. (2011). *Implementation of assistive technology in the classroom* (Unpublished master's thesis, St. John Fisher College, New York). Retrieved from https://fisherpub.sjfc.edu/education_ETD_masters/65/

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 8*(1), 136-155. Retrieved from https://files.eric.ed.gov/fulltext/EJ1084227.pdf

Cameron, R. (2009). A sequential mixed model research design: design, analytical and display issues. *International Journal of Multiple Research Approaches*, *3*, 140–152.

Cargan, L. (2007). *Doing social research*. Lanham, Maryland: Rowman & Littlefied Publishers, Inc.

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment* (Vol. 17). Sage publications.

Centres for Disease Control and Prevention (CDC). (2015). *Official MADDSP and MADDS surveillance case definitions*. Retrieved from http://www.cdc.gov/ncbddd/developmentaldisabilities/casedefinitions.html

Cheung, N. (2013). Defining intellectual disability and establishing a standard of proof: Suggestions for a national model standard. *Health Matrix*, 23, 317. Retrieved from https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1066&context=healthmatrix

Chilisa, B., & Preece, J. (2005). *Research methods for adult educators in Africa*. Cape Town: UNESCO Institute for Education and Pearson Education South Africa.

Cook, A., & Hussey, S. (2002). *Assistive technologies: Principles and practices* (2nd ed.). Philadelphia, PA: Elsevier Health Sciences.

Cooksey, R. W. (2007). *Illustrating statistical procedures: For business, behavioural and social science research*. Tilde University Press.

Cope, C., & Ward, P. (2002). Integrating learning technology into classrooms: The importance of teachers' perceptions. *Educational Technology & Society*, *5*, 67-74.

Creswell, J. W. (2009). Mapping the field of mixed methods research. *Journal of Mixed Methods Research*, *3*(2), 95-108.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.).Upper saddle River, NJ: Pearson.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed). Thousand Oaks, California: SAGE publications.

Croser, R. (2015). Inclusive technology. In A. Ashman (Ed.), *Education for inclusion and diversity* (5th ed.) (pp. 162-195). Melbourne: Pearson Australia.

Cryer, P. (2006). *The research student's guide to success*. Berkshire: The Open University Press.

Dandashi, A., Karkar, A. G., Saad, S., Barhoumi, Z., Al-Jaam, J., & El Saddik, A. (2015). Enhancing the cognitive and learning skills of children with intellectual disability through physical activity and edutainment games. *International Journal of Distributed Sensor Networks*, *11*(6), 165165. Retrieved from http://journals.sagepub.com/doi/pdf/10.1155/2015/165165

Dash, N. (2006). *Inclusive education for children with special needs*. New Delhi: Atlantic Publishers & Distributors.

Dash, N., & Dash, M. (2005). *Essentials of exceptionality and special education*. New Delhi: Atlantic Publishers & Distributors.

De Vaus, D. A. (2001). *Research design in social research*. London: SAGE,

Deaf Children Australia. (2012). *Language development and deaf children*. Retrieved from https://deafchildrenaustralia.org.au/wp-content/uploads/2014/11/Language-Development-and-Deaf-Children-2012-v2-1.pdf

Decker, K. B., & Vallotton, C. D. (2016). Early intervention for children with hearing loss. *Journal of Early Intervention, 38*(3). Retrieved from http://journals.sagepub.com/doi/abs/10.1177/1053815116653448

Deiner, P. L. (2010). *Inclusive early childhood education: Development, resources, and practice* (5th ed.). Belmont, CA: Wadsworth.

Denicolo, P., Long, T., & Bradley-Cole, K. (2016). *Constructivist approaches and research methods: A practical guide to exploring personal meanings*. London: SAGE Publications Ltd.

Econtext (2011). *Early intervention programs to assist children with hearing loss develop spoken language: A social cost-benefit analysis*. Report prepared for First Voice. Retrieved from http://www.firstvoice.org.au/wp-content/uploads/2016/09/02-Social-cost-benefit-analysis-summary-report-2.pdf

Edinger, M. J. (2008). *An exploratory study of creativity-fostering teacher behaviours in secondary classrooms*, The College of William and Mary.

Edirisingha, P. (2012). Interpretivism and positivism (ontological and epistemological perspectives). Retrieved from https://prabash78.wordpress.com/2012/03/14/interpretivism-and-postivism-ontological-and-epistemological-perspectives/

Edwards, L, & Crocker, S. (2008). *Psychological processes in deaf children with complex needs: An Evidence-based practical guide*. London & Philadelphia: Jessica Kingsley Publishers.

Erin, J. N., & Koenig, A. J. (1997). The student with a visual disability and a learning disability. *Journal of Learning Disabilities*, *30*, 309-320.

Eunice, L. K., Nyangia. E. O., & Orodho, J. A. (2015). Challenges facing implementation of inclusive education in public secondary schools in Rongo Sub- County, Migori County, Kenya. *IOSR Journal of Humanities and Social Science (IOSR-JHSS), 20*(4), 39-50.

Eynon, R., Hjorth, I, Yasseri, T., & Gillani, N. (2016). Understanding communication patterns in MOOCs: Combining data mining and qualitative methods. In S. Elatia, D. Ipperciel &

O.R. Zaïane (Eds), *Data mining and learning analytics: Applications in educational research* (pp. 207-217). Hoboken, New Jersey: John Wiley & Sons, Inc.

Fakrudeen, M., Miraz, M. H., & Excell, P. (2017). Success criteria for implementing technology in special education: A case study. *Paper presented at the Fifth International Conference on Internet Technologies and Applications (ITA 13), At Creative and Applied Research for the Digital Society (CARDS), Glyndŵr University in Wrexham, North East Wales, UK*. Retrieved from https://arxiv.org/ftp/arxiv/papers/1708/1708.09404.pdf

Feilzer, M. Y. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, *4*(1), 6–16.

Frederickson, N., & Cline, T. (2009). *Special educational needs, inclusion and diversity* (2nd ed.). Berkshire: Open University Press.

Ganschow, H., Philips, L., & Schneider, D. (2001). Closing the gap: Accommodating students with language learning disabilities in college. *LWW Journals, 21*(2), 17-37.

Gargiulo, R. M. (2015). *Special education in contemporary society* (5th ed.). Thousand Oaks, California: SAGE Publications, Inc.

Gerrish, K. & Lacey, A. (2010). *The research process in nursing* (6th ed.). Chichester, England: Blackwell Publishing Limited.

Given, L. M. (Ed.) (2008). *The SAGE encyclopedia of qualitative research methods, volume 1*. Thousand Oaks, CA: SAGE Publications Inc.

Global Campaign for Education UK. (n. d.). *Accessing inclusive education for children with disabilities in Kenya*. Retrieved from

https://www.leonardcheshire.org/sites/default/files/Accessing-inclusive-education-children-disabilities-kenya-gce-appg-report-february-2016.pdf

Gravetter, F. J., & Forzano, L. B. (2012). *Research methods for the behavioural sciences* (5th ed.). Stamford, Connecticut, USA: Cengage Learning.

Grönlund, A., Lim, N., & Larsson, H. (2010). Effective use of assistive technologies for inclusive education in developing countries: Issues and challenges from two case studies. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 6*(4), 5-26. Retrieved from https://files.eric.ed.gov/fulltext/EJ1085011.pdf

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis* (Vol. 6): Upper Saddle River, New Jersey, USA: Pearson Prentice Hall.

Handen, B. L. (2007). Intellectual disability (mental retardation). In E. J. Mash & R. A. Barkley (Eds.), *Assessment of childhood disorders* (4th ed.) (pp. 551-597). New York: The Guilford Press.

Handler, S. M., Fierson, W. M. (2011). the Section on Ophthalmology and Council on Children with Disabilities, American Academy of Ophthalmology, American Association for Paediatric Ophthalmology and Strabismus, & American Association of Certified Orthoptists. Joint technical report—learning disabilities, dyslexia, and vision. *Paediatrics*, *127*(3), 818-856.

Hasselbring, T. S., & Glaser, C. H. W. (2000). Use of computer technology to help students with special needs. *The Future of Children*, 102-122.

Healthy Place. (2017). *Intellectual and learning disabilities in children, students*. https://www.healthyplace.com/neurodevelopmental-disorders/intellectual-disability/intellectual-and-learning-disabilities-in-children-students/

Heckendorf, S. (2009). Assistive technology for individuals who are deaf or hard of hearing. In J. Gierach, *Assessing students' needs for assistive technology (ASNAT): A resource manual for school district teams* (Chapter 13). Retrieved from https://atnetwork.ttaconline.org/Content/docs/ASNAT5thEditionJun09.pdf

Heppner, P.P., Wampold, B.E., Owen, J., Wang, K.T., & Thompson, M.N. (2016). *Research design in counselling* (4th edition). Boston, MA: Cengage Learning.

Heppner, P. P., Wampold, B. E., & Kivlighan, D .M. (2008). *Research design in counseling*. Belmont, CA: Thomson Higher Education.

Hua, Z. (2016). Identifying research paradigms. In Z. Hua (ed.), *Research methods in intercultural communication: A practical guide* (pp. 3-22). Chichester, West Sussex: John Wiley & Sons Inc.

Hussey, J., & Hussey, R. (1997). *Business research*. London: Macmillan Press LT.

Inciong, T. G., Quijano, Y. S., Capulong, Y. T., Gregorio, J. A., & Gines, A. C. (2007). *Introduction to special education*. Manila, Philippines: Rex Book Store, Inc.

Indiana University. (2015). *Assistive technology for different impairments at the ATAC.* Retrieved from http://www.indiana.edu/~iuadapts/impairments/

Jackson, S. L. (2015). *Research methods: A modular approach* (3rd ed.). Stamford, CT: Cengage Learning.

Jamal, T. S., Daghistani, K. J., & Zakzouk, S. M. (2001). Speech abnormality among Saudi Arabian children with hearing impairment. *Bahrain Medical Bulletin*, *23*(1).

Johnson, B., & Christensen, L. (2012). *Educational research: Quantitative, qualitative, and mixed approaches*. Thousand Oaks, California: SAGE Publications, Inc.

Jones, B., Williams, N., & Rudinger, B. (2018). Designing and implementing an assistive technology lab for postsecondary education. *Education Sciences*, *8*(11), 1-9.

José, M. R., Mondelli, M. F. C. G., Feniman, M. R., & Lopes-Herrera, S. A. (2014). Language disorders in children with unilateral hearing loss: A systematic review. *International Archives of Otorhinolaryngology*, *18*(2), 198-203.

Kashkary, S. (2014). Teachers' attitudes towards the integration of disabled children into regular schools in Saudi Arabia. *The Clute Institute International Academic Conference,* 71-79.

Kbar, G., Al-Daraiseh, A., Aly, S., Abidi. M. H., & Mian, S. M. (2016). Assessment of technologies relevant for people with motor hearing and speaking impairment. *IETE Technical Review*, Taylor & Francis.

Kbar, G., Bhatia, A., Abidi, M. H., & Alsharawy, I. (2016). Assistive technologies for hearing, and speaking impaired people: A survey. *Disability and Rehabilitation: Assistive Technology*, Taylor & Francis.

Kennedy, C. R., McCann, D. C., Campbell, M. J., Law, C. M., Mullee, M., Petrou, S., Watkin, P., Worsfold, S., Yuen, H. M., & Stevenson, J. (2006). Language ability after early detection of permanent childhood hearing impairment. *The New England Journal of Medicine*, *354*(20), 2131-2141.

Khan, J. A. (2008). *Research methodology*. New Delhi: APH Publishing Corporation.

Kivunja, C. (2016). How to write an effective research proposal for higher degree research in higher education: Lessons from practice. *International Journal of Higher Education*, *5*(2), 163-172.

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, *6*(5), 26-41.

Klenke, K. (2008). *Qualitative research in the study of leadership*. Bingley: Emerald Group Publishing Limited.

Leximancer Pty Ltd. (2016). *Leximancer User Guide: Release 4.5.*

Leximancer. (2011). Leximancer manual, version 4.

Leximancer. (n.d.). *Text in, insight out*. Retrieved from http://info.leximancer.com/

Lim, S. Y. C., & Simser, J. (2005). Auditory-verbal therapy for children with hearing impairment. *Annals of Academy of Medicine*, *34*(4), 307-3012.

Lin, A. M. Y. (2015). Researcher positionality. In F. M. Hult & D.S. Johnson (Eds). *Research methods in language policy and planning: A practical guide* (pp. 21-32). Chichester, West Sussex: John Wiley & Sons Ltd.

Lin, C-Y. (2012). How to use low-cost devices as teaching materials for children with different disabilities. In Cheein, F. A. (Ed.), *Assistive technologies* (pp. 3-24). Retrieved from http://cdn.intechopen.com/pdfs/31901/InTech-How_to_use_low_cost_devices_as_teaching_materials_for_children_with_different_disabilities.pdf

Littlejohn, S. W., & Foss, K. A. (2009) (Eds). *Encyclopaedia of communication theory*, Thousand Oaks, CA: SAGE Publications, Inc.

Liverpool John Moores University. (n.d.). *How to make sense of the Leximancer analysis: A quick guide to interpreting concept maps*. Liverpool: Author.

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice* (2nd ed.). Hoboken, NJ: John Wiley & Sons.

Magnusson, E., & Marecek, J. (2015). *Doing interview-based qualitative research: A learner's guide*. Cambridge: Cambridge University Press.

Mahdi, H. S., & Al-Dera, A. S. (2013). The impact of teachers' age, gender and experience on the use of information and communication technology in EFL Teaching. *English Language Teaching*, *6*(6), 57-67.

Major, C. H., & Savin-Baden, M. (2010). *An introduction to qualitative research synthesis: Managing the information explosion in social science research*. New York: Routledge.

Marlow, C.R. (2011). *Research methods for generalist social work* (5th ed.). Belmont, CA: Brooks/Cole.

Matkin, N. D., & Wilcox, A. M. (1999). Considerations in the education of children with hearing loss. *Paediatric Clinics of North America*, *46*(1), 143-152.

McKirdy, L. S. (1985). Childhood language disorders. In D. Shaffer, A. A. Ehrhardt, & L. L. Greenhill (Eds), *The clinical guide to child psychiatry* (pp. 79-96). New York: The Free Press.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mertens, D. M. (2010). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative and mixed methods*. Thousand Oaks, California: SAGE Publications, Inc.

Mertens, S. B., Flowers, N., Anfara Jr, V. A., & Caskey, M. M. (2010). Common planning time. *Middle School Journal*, *41*(5), 50-57. Retrieved from https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1000&context=ci_fac

Miles, B. W., & Jozefowicz-Simbeni, D. B. H. (2010). *Naturalistic inquiry* (2nd ed.). In B. Thyer (Ed.), *The handbook of social work research methods* (pp. 415-424). Thousand Oaks, California: SAGE Publications, Inc.

Miller, P. Fader, L. &Vincent, L. J. (2001). Preparing early childhood children educators to work with families who have exceptional needs. In Horm-Wingerd, D. (ed). *New teachers for a new century: The future of early childhood professional preparation* (pp. 89–122). Darby, Pennsylvania: Diane Publishing.

Miller, H., & Kiani, R. (2008). Inter-relationships between hearing impairment, learning disability services and mental health: Are learning disability services 'deaf' to hearing impairments? *Advances in Mental Health and Learning Disabilities*, *2*(2), 25-30.

Mittler, J. (2007). Assistive technology and IDEA. In C. Warger (Ed.), Technology integration: Providing access to the curriculum for students with disabilities. Arlington, VA: Technology and Media Division (TAM). Retrieved from: http://www.tamcec.org/wp-content/uploads/2016/08/AssistiveTech-and-IDEA-Regs.pdf

Moeller, M. P., Tomblin, J. B., Yoshinaga-Itano, C., Connor, C. M., & Jerger, S. (2007). Current state of knowledge: Language and literacy of children with hearing impairment. *Ear & Hearing*, *28*(6), 740-753.

Mogford-Bevan, K. (1993). The implications of hearing impairment for social and language development. In K. Mogford-Bevan & J. Sadler (Eds.), *Child language disability*, *vol. III* (pp. 22-41). Clevedon/Philadelphia/Adelaide: Multilingual Matters Ltd.

Mora, M., Steekamp, A. L., Gelman, O., & Raisinghani, M. S. (2012). On IT and SwE research methodologies and paradigms: A systematic landscape review. In M. Mora, O. Gelman, A. Steenkamp & M. S. Raisinghani (Eds), *Research methodologies, innovations and*

philosophies in software systems engineering and information systems (pp. 149-165). Hershey, PA: Information Science Reference.

Mukherjee, A., & Kamarulzaman, N. H. (2016). Mixed method research: A concept. In M. L. Baran & J. E. Jones (Eds), *Mixed methods research for improved scientific Study* (pp. 39-65). Hershey, PA: Information Science Reference.

Mukherji, P., & Albon, D. (2010). Research methods in early childhood: An introductory guide. London: SAGE Publications Ltd.

Mundy, M-A., Kupczynski, L., & Kee, R. (2012). Teacher's perceptions of technology use in the schools. *SAGE Open,* 1–8. Retrieved from http://journals.sagepub.com/doi/pdf/10.1177/2158244012440813

Najmaei, A. (2016). Using mixed-methods designs to capture the essence of complexity in the entrepreneurship research: An introductory essay and a research agenda. In E.S.C. Berger & A. Kuckertz (Eds), *Complexity in entrepreneurship, innovation and technology research: Application of emergent and neglected methods* (pp. 13-36). Zurich: Springer International Publishing Switzerland.

National Council for Special Education. (2014, April). *Children with special educational needs: Information booklet for parents*. Retrieved from http://ncse.ie/wp-content/uploads/2014/10/ChildrenWithSpecialEdNeeds1.pdf

National Deaf Children's Society. (2015). *Supporting the achievement of hearing impaired children in early years settings: For professionals working with children aged 0 to 4.* London: Author.

Nguyo, W. R. (2015). *Effect of assistive technology on teaching and learning of integrated English among visually impaired learners in special secondary schools in Kenya*

(Doctoral thesis, University of Nairobi, Nairobi). Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/94743/Wachirui_Effect%20of%20assistive%20technology%20on%20teaching%20and%20learning%20of%20integrated%20English%20among%20visually%20impaired%20learners%20in%20special%20secondary%20schools%20in%20Kenya.pdf;sequence=1

Nittrouer, S. (2010). *Early development of children with hearing loss*. San Diego, CA: Plural Publishing.

Northern, J. L., & Downs, M. P. (2002). *Hearing in children*. Baltimore, Maryland: Lippincott Williams & Wilkins.

Nounou, H., Ali, S., & Shalaby, M. (2012). The potential risk factors for a childhood disabilities in Riyadh rural areas, Saudi Arabia. *Asian Biomedicine, 6*(6), 807-813.

Nunnally, J.C. (1978). *Psychometric theory* (2nd ed). New York, NY: McGraw-Hill.

Nyagah, G., Wachiuri, R. N., & Imonje, R. (2017). Relative advantage of assistive technology in the teaching and learning of integrated English among the visually impaired learners in special secondary schools in Kenya. *US-China Education Review A*, *7*(1), 39-48. Retrieved from http://www.davidpublisher.org/Public/uploads/Contribute/58e48e729fca4.pdf

Oira, M. (2014, July). *Assistive technology as a factor of improving education achievement for students with visual impairment at Kibos Secondary School Kisumu County, Kenya* (unpublished master's thesis, Kenyatta University, Nairobi). Retrieved from http://ir-library.ku.ac.ke/bitstream/handle/123456789/11352/Assistive%20technology%20as%20a%20factor%20of%20improving.pdf?sequence=1&isAllowed=y

Ollendick, T. H., & Schroeder, C. S. (Eds.) (2003). *Encyclopaedia of clinical child and paediatric psychology*. New York: Kluwer Academic/Plenum Publishers.

Organisation for Economic Cooperation and Development (OECD) (2007). *Students with disabilities, learning difficulties and disadvantages policies, statistics and indicators*. Paris, France: OECD Publishing.

Pagliano, P. (1998). Students with vision impairment. In A, Ashman & J. Elkins (Eds.), *Educating children with special needs* (3rd ed.) (pp. 383-416). Sydney: Prentice Hall Australia Pty Ltd.

Palmer, M., Groce, N., Mont, D., Nguyen, O. H., & Mitra, S. (2015, July 21). The economic lives of people with disabilities in Vietnam. *PLOS ONE*, p. 1-16. Retrieved from http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0133623&type=printable

Pavan, A. (2013). A new perspective on the quest for education: The Saudi Arabian way to knowledge society. *Higher Education Studies, 3*(6), 25-34.

Pinkton, C. (2014). *Building inclusive schools in Saudi Arabia*. Retrieved from https://education.uoregon.edu/news/building-more-inclusive-saudi-arabia

Poon-McBrayer, K. F., & Lian, M. J. (2002). *Special needs education: Children with exceptionalities.* Sha Tin, Hong Kong: The Chinese University Press.

Power, D. (1998). Deaf and hard of hearing students. In A. Ashman & J. Elkins (Eds.), *Educating children with special needs* (3rd ed.) (pp. 345-381). Sydney: Prentice Hall Australia Pty Ltd.

Pratt, S. (2003). Behavioural intervention and education of children with hearing loss. In C. D. Bluestone, S. E. Stool, C. M. Alper, E. M. Arjmand, M. L. Casselbrant, J. E. Dohar, & R.

E. Yellon (Eds). *Paediatric otolaryngology* (4th edition) (pp. 1825-1834). Philadelphia: Saunders.

Reddy, G. L., Ramar, R., & Kusuma, A. (2004). *Hearing impairment: An educational consideration*. New Delhi, India: Discovery Publishing House.

Republic of Kenya. (2009). *The National Special Needs Education Policy Framework*. Retrieved from http://www.unesco.org/education/edurights/media/docs/446808882707702aafc616d3a2cec918bfc186fc.pdf

Riazi, A. M. (2016). *The Routledge encyclopaedia of research methods in applied linguistics: Quantitative, qualitative, and mixed-methods research*. Abingdon, Oxon: Routledge.

Ridenour, C.S., & Newman, I. (2008). *Mixed methods research: Exploring the interactive continuum*. Carbondale: Southern Illinois University Press.

Robinson, R. V., David, E. J. R., & Hill, M. (2016). Participatory mixed methods research across cultures. In L. A. Jason & D. S. Glenwick (Eds.), *Handbook of methodological approaches to community-based research: Qualitative, quantitative, and mixed methods* (273-282). New York, NY: Oxford University Press.

Royal Embassy of Saudi Arabia, Washington DC. (2014). *About Saudi Arabia: Higher education.* Retrieved from https://www.saudiembassy.net/education

Rubin, A., & Babbie, E. (2009). *Essential research methods for social work* (2nd edition). Belmont, CA: Brooks/Cole.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Essex, England: Pearson Education Limited.

Schoen, L. T. (2011). Conceptual methodological issues in sociocultural research and theory development in education. In D. M. McInerney, R. A. Walker & G. A. D. Liem (Eds), *Sociocultural theories of learning and motivation: Looking back, looking forward* (pp. 11-42). Charlotte, North Carolina: Information Publishing Age, Inc.

Schwab Foundation for Learning. (2000). Assistive technology for children with learning difficulties. *Bridges to reading* (2nd ed.). Retrieved from http://pluk.org/Pubs/ATguide4LD_419k.pdf

Shannon-Baker, P. (2016). Making paradigms meaningful in mixed methods research. *Journal of Mixed Methods Research*, *10*(4), 319-334.

Slack, T., & Parent, M.M. (2006). *Understanding sport organizations: The application of organization theory*. Champaign, IL: Human Kinetics.

Smith, A.E., & Humphreys, M.S. (2006). Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behaviour Research Methods.* *38*(2), 262-279.

Smith, S. L. J. (2010). *Practical tourism research*. Oxfordshire: CABI.

Solomon, N., & Bhandari, P. (2015). *Patent landscape report on assistive devices and technologies for visually and hearing impaired persons*. World Intellectual Property Organization. Retrieved from http://www.wipo.int/edocs/pubdocs/en/wipo_pub_949_1.pdf

Sotiriadou, P., Brouwers, J., & Le, T. (2014). Choosing a qualitative data analysis tool: A comparison of NVivo and Leximancer. *Annals of Leisure Research*, *17*(2), 218–234.

Steed, L. G., & Coakes, S. J. (2001). *SPSS: Analysis without anguish*. Brisbane: John Wiley & Sons.

Struwig, F. W., & Stead, G. B. (2001). *Planning, designing & reporting research*. Cape Town, South Africa: Pearson Education South Africa.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, CA: SAGE Publications, Inc.

Tappen, R. (2013). *Advanced nursing research: From theory to practice*. Sudbury, MA: Jones Bartlett Learning, LLC.

Taylor, A. E. B. (2014). *Diagnostic assessment of learning disabilities in childhood: Bridging the gap between research and practice*. New York, USA: Springer Science + Business Media.

Taylor, B. J., Kermode, S., & Roberts, C. (2006). *Research in nursing and health care: Evidence for practice* (3rd ed). Melbourne: Thomson

Taylor, B. J., Killick, C., & McGlade, A. (2015). *Understanding and using research in social work*. London: SAGE Publications Ltd.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioural sciences.* Thousand Oaks, California: SAGE Publications, Inc.

Teddlie, C., & Tashakkori, A. (2011). Mixed methods research: Contemporary issues in an emerging field. In N. K. Denzin & Y. S. Lincoln (eds), *The SAGE handbook of qualitative research* (pp. 285-300). Thousand Oaks, California: SAGE Publications, Inc.

Trading Economics. (2018a). *Land area (sq. km) in Saudi Arabia*. Retrieved from https://tradingeconomics.com/saudi-arabia/land-area-sq-km-wb-data.html

Trading Economics. (2018b). *Saudi Arabia population*. Retrieved from http://www.tradingeconomics.com/saudi-arabia/population

Turan, Z. (2012). Early intervention with children who have a hearing loss: Role of the professional and parent participation. In S. Naz (Ed.), *Hearing loss* (pp. 117-132). InTech. Retrieved from http://cdn.intechopen.com/pdfs/33866.pdf

U.S.-Saudi Arabian Business Council. (n.d). *The education sector in the Kingdom of Saudi Arabia*. Retrieved from https://www.us-sabc.org/files/public/education_brochure.pdf

UNESCO. (2009). *Towards inclusive education for children with disabilities: A guideline*. Bangkok: UNESCO Bangkok. Retrieved from http://unesdoc.unesco.org/images/0019/001924/192480e.pdf

UNICEF & WHO. (2015). *Assistive technology for children with disabilities: Creating opportunities for education, inclusion and participation: A discussion paper*. Retrieved from https://www.unicef.org/disabilities/files/Assistive-Tech-Web.pdf

UNICEF. (2013). *Inclusive education*. Retrieved from https://www.unicef.org/media/media_67727.html

United Nations. (n. d.). *Convention on the rights of persons with disabilities and optional protocol*. Retrieved from http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf

Walliman, N. (2006). *Social research methods*. London: SAGE Publications Ltd.

Walsh, M., & Wigens, L. (2003). *Introduction to research*. Cheltenham: Nelson Thornes Ltd.

Westwood, P. (2008). *A parent's guide to learning difficulties: How to help your child*. Camberwell, Victoria: Australian Council for Educational Research Ltd.

Westwood, P. (2009). *What teachers need to know about students with disabilities*. Camberwell, Victoria: ACRER Press.

WHO. (2011). *World report on disability*. Geneva: Author. Retrieved from http://www.who.int/disabilities/world_report/2011/report.pdf

Williamson, K. (2002).*Research methods for students, academics and professionals: Information management and systems* (2nd ed.). Wagga Wagga, NSW: Centre for Information Studies.

Willis, C. (2009). *Creating inclusive learning environments for young children: What to do on Monday morning*. Thousand Oaks, California: Corwin Press.

Wilson, S. (2001). What is an indigenous research methodology? *Canadian Journal of Native Education*, *25*(2), 175-179.

Wynbrandt, J. (2010). *A brief history of Saudi Arabia*. New York, NY: Infobase Publishing.

Young, G., & MacCormack, J. (2014). Assistive technology for students with learning disabilities: An evidence-based summary for teachers. Retrieved from https://www.researchgate.net/publication/279961941_Assistive_technology_for_students_with_learning_disabilities_An_evidence-based_summary_for_teachers

Yusuf, M. O., & Fakomogbon, M. A. (2008). Availability, teachers' awareness and attitude towards the use of assistive technologies in special schools in Kwara State, Nigeria. *Conference Paper*. Retrieved from https://www.researchgate.net/publication/316116431_AVAILABILITY_TEACHERS'_AWARENESS_AND_ATTITUDE_TOWARDS_THE_USE_OF_ASSISTIVE_TECHNOLOGIES_IN_SPECIAL_SCHOOLS_IN_KWARA_STATE_NIGERIA

Zhou, G., & Xu, J. (2007). Adoption of educational technology: How does gender matter? *International Journal of Teaching and Learning in Higher Education*, *19*(2), 140-153. Retrieved from https://files.eric.ed.gov/fulltext/EJ901292.pdf

Zimmerman, G. J., & Zebehazy, K. T. (2011). Blindness and low vision. In J. M. Kauffman & D. P. Hallahan (Eds.), *Handbook of special education*. New York: Routledge.

Appendices

SURVEY

This survey questionnaire will be used among educators in schools catering for students with hearing, visual and intellectual disabilities in Saudi Arabia. The research is meant to provide evidence regarding the use of technology in assisting students with hearing, visual and intellectual disabilities in learning, and the perceptions of educators in regard to technology use in -specific institutions of learning. The answers provided by respondents will be used for purposes related to this research only, and no disclosures will be made regarding the respondents or the institutions where they teach. Therefore, in order to carry out the abovementioned research successfully, your contribution by filling this survey is more than welcome. Should you have any queries or things you don't understand, please ask me and by returning this document participants are giving consent.

Thank you very much for participating in this survey.

SECTION A: Respondent Background Information:

Name/nickname "optional":.....

Gender:.....

Institution:.....

Educational Degree:.....

Occupation:.....

Name of school:.....

Teaching experience.....

Experience in using technology.....

Training on the use of assistive technology.....

Section B: Questionnaire - Perceptions about use of technology for students with disabilities (Hearing Impairment, Visual impairments and Intellectual disabilities)

	STATEMENTS	Strongly Agree	Agree	Agree Somewhat	Disagree	Strongly Disagree
1	The use of technology helps children with disabilities (Hearing impairment, Visual impairments and intellectual disabilities) improve their learning.					
2	Technology should be introduced in all schools that cater for students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
3	The Saudi Arabian education sector is doing enough to provide assistive technology to students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
4	My school principal is open to improving the use of technology to help students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
5	My school principal expects me to use technology to support student learning.					
6	My school has an adequate /broad wide range of assistive technologies for use by the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
7	Parents of students in my school have been of great assistance, giving in-kind assistive technology devices to the school.					
8	Learning can be improved considerably if teachers support the use of assistive technologies for the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
9	All stakeholders support the use of technology to support student learning.					
10	The assistive technologies currently in use in my school are effective in helping students with disabilities (hearing impairment, Visual impairments and intellectual disabilities) in their learning.					
11	My school has challenges acquiring assistive technologies for the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
12	Students with disabilities (Hearing impairment, Visual impairments and intellectual disabilities) in my school are able to effectively use assistive technology to support their learning.					

13	I am adept at using assistive technologies when teaching the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
14	Students are more pleased to use assistive technologies when their parents/guardians support the use of such technologies.					
15	As an educator, I'm well-versed in the research on technology tools/aids that can enhance the learning experience among students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
16	My school has trained me adequately (and other teachers) in the use of assistive technologies for the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities).					
17	The use of technology in my school faces too many challenges.					
18	As an educator, I already know what can be done to improve the efficiency of assistive technologies among the students with disabilities (hearing impairment, Visual impairments and intellectual disabilities) in my class.					
19	As an educator, I have identified the skills that students with disabilities (hearing impairment, Visual impairments and intellectual disabilities) need in order to use assistive technologies more efficiently.					
20	The lack of technology designed for Arab users is hindering technology use in my school.					
21	Current assistive technologies need significant improvement (or redesign) if they are to help the hearing impaired students.					

Would you like to participate in an interview?

If yes please provide your contact below. Otherwise, kindly answer the following question.

Email:

Phone number:

Section C: Open-ended /interview questions

1. Does the school you teach in use assistive technology for students with (Hearing, Visual and Intellectual disabilities)?

   .....

2. What types of technological tools are used in your school for students with (Hearing, Visual and Intellectual disabilities)?

   .....

   .....

   .....

3. What is your experience as an educator using technology?

   .....

   .....

   .....

4. What difference do you think technology makes when it is used among students with (Hearing, Visual and Intellectual disabilities) in your school?

   .....

   .....

   .....

5. Have you ever designed a program for students with (Hearing, Visual and Intellectual disabilities) to improve their use of technology? What was it like?

   .....

   .....

   .....

6. How is technology used towards enhancing learning for students with (Hearing, Visual and Intellectual disabilities) disability in your school?

   .....

   .....

   .....

7. What is the roles of technology and its influences on the learning of students with (Hearing, Visual and Intellectual disabilities) disability in your school?
   .....

   .....

   .....

8. What are the challenges faced by your school in the implementation and/or use of technology for the learning of students with the aforementioned disabilities in your school?
   .....

   .....

   .....

9. How do you think the challenges can be overcome?

   .....

   .....

   .....

Thank you for your time

CONSENT FORM For PARTICIPANTS

Research Project: The Use of Technology for Children with Hearing Impairment, Visual Impairment and Intellectual Disabilities in Saudi Arabia": Educators' perceptions and experiences

---

I, ..., have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. Yes/No

I agree to participate in this activity, realising that I may withdraw at any time. Yes/No

I agree that research data gathered for the study may be quoted and published using a pseudonym Yes/No

I agree to the interview having my audio recorded and transcribed. Yes/No

I would like to receive a copy of the transcription of the interview. Yes/No

I am older than18 years of age. Yes/No

....
Participant Date

....
Researcher Date

Ethics Office
Research Development & Integrity
Research Division
Armidale NSW 2351
Australia
Phone *02 6773 3449*
Fax *02 6773 3543*
jo-ann.sozou@une.edu.au
www.une.edu.au/research-services

HUMAN RESEARCH ETHICS COMMITTEE

MEMORANDUM TO: Dr Chris Boyle, Ms Jo Anderson & Mrs Areej Alfaraj

School of Education

This is to advise you that the Human Research Ethics Committee has approved the following:

PROJECT TITLE:	"The Use of Technology for Children with Hearing Impairment, Visual Impairment and Intellectual Disabilities in Saudi Arabia": Educators' perception and experiences
APPROVAL No.:	HE15-273
COMMENCEMENT DATE:	01 November, 2015
APPROVAL VALID TO:	01 November, 2016
COMMENTS:	Nil. Conditions met in full

The Human Research Ethics Committee may grant approval for up to a maximum of three years. For approval periods greater than 12 months, researchers are required to submit an application for renewal at each twelve-month period. All researchers are required to submit a Final Report at the completion of their project. The Progress/Final Report Form is available at the following web address:
http://www.une.edu.au/research/research-services/rdi/ethics/hre/hrec-forms

The NHMRC National Statement on Ethical Conduct in Research Involving Humans requires that researchers must report immediately to the Human Research Ethics Committee anything that might affect ethical acceptance of the protocol. This includes adverse reactions of participants, proposed changes in the protocol, and any other unforeseen events that might affect the continued ethical acceptability of the project.

In issuing this approval number, it is required that all data and consent forms are stored in a secure location for a minimum period of five years. These documents may be required for compliance audit processes during that time. If the location at which data and documentation are retained is changed within that five year period, the Research Ethics Officer should be advised of the new location.

[redacted]

Jo-Ann Sozou
Secretary/Research Ethics Officer

School of Education
University of New England
Armidale NSW 2351
Australia
C/o HDR Coordinator
Phone +61 2 6773 5071

www.une.edu.au

INFORMATION SHEET
For
PARTICIPANTS

We wish to invite you to participate in my research project, described below.

My name is Areej Alfaraj and I am conducting this research as part of my PhD in the School of Education at the University of New England. My supervisors are is Dr Chris Boyle and Ms Jo Anderson.

Research Project

The title of the project: The Use of Technology for Children with Hearing Impairment, Visual Impairment and Intellectual Disabilities in Saudi Arabia": Educators' perceptions and experiences

Aim of the research

The research aims at the following:

i. To probe how technology is used towards enhancing learning for children with hearing impairment, visual impairment and intellectual disability in Saudi Arabia.

ii. To examine the challenges faced by schools in the implementation and/or use of technology for the learning of children with the aforementioned disabilities in Saudi Arabia.

iii. To examine the perceptions that Saudi Arabian teachers have in relation to the use of technology while educating children with the said disabilities.

Interview

We would like to distribute a survey to teachers and principals and to conduct a face-to-face interview with them in nine schools at three regions in Saudi Arabia (Riyadh, Jeddah and Dammam). These schools' names are Al Amal Institute, Al Noor Institute and Institute of Intellectual Education. We are relying on survey questionnaire and survey questions/ interviews to be answered by the participants. These questions address the participants' views of technology assisted learning for children with hearing impairment, visual impairments and intellectual disabilities in Saudi Arabia. After completing the survey questionnaires, all the teachers are given a choice to participate in the following face - to - face interviews or answer the interview questions on their own. The interview will take between 20 and 40 minutes. We will meet every participant face - to - face to explain any enquiries about the questions of the interview, if needed. With their permission, We will make an audio recording of the interview to ensure that I accurately recall the information they provide. After the survey is completed, a transcript will be provided to them if they wish, to check the accuracy of the responses.

School of Education
University of New England
Armidale NSW 2351
Australia
C/o HDR Coordinator
Phone +61 2 6773 5071
www.une.edu.au

INFORMATION SHEET For PARTICIPANTS

Confidentiality	Any information or personal details gathered in the course of the study will remain confidential. No individual will be identified by name in any publication of the results. All names will be replaced by pseudonyms; this will ensure that you are not identifiable.
Participation is Voluntary	Please understand that your involvement in this study is voluntary and We respect your right to withdraw from the study at any time. You may discontinue the survey questionnaire and survey interview questions at any time without consequence and you do not need to provide any explanation if you decide not to participate or withdraw at any time.
Questions	The survey questionnaire and survey interview questions will not be of a sensitive nature: rather they are general, aiming to enable you to provide your views about technology assisted learning used in schools for students with hearing impairment, visual impairments and intellectual disabilities.
Use of information	We will use information from the interview as part of my doctoral thesis, which I expect to complete in 30 - 6 - 2017. Information from the interview may also be used in journal articles and conference presentations before and after this date. At all time, we will safeguard your identity by presenting the information in way that will not allow you to be identified.
Upsetting issues	It is unlikely that this research will raise any personal or upsetting issues but if it does you may wish to contact your local Community Health Centre at: The Kingdom of Saudi Arabia, Riyadh Al-Malaz- Omar bin al-Khattab Rd, Post code 11157 Tel: (0114778888).
Storage of information	We will keep hardcopy recordings, if possible, and notes of the interview in a locked cabinet at the researcher's office at the University of New England's School of Education. Any electronic data will be kept on a password protected computer in the same School. Only the research team will have access to the data.
Disposal of information	All the data collected in this research will be kept for a minimum of five years after successful submission of my thesis, after which it will be disposed of by deleting relevant computer files, and destroying or shredding hardcopy materials.

School of Education
University of New England
Armidale NSW 2351
Australia
C/o HDR Coordinator
Phone +61 2 6773 5071

www.une.edu.au

INFORMATION SHEET
For
PARTICIPANTS

Approval

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No HE15-273 Valid to 1/11/2016).

Contact details

Feel free to contact me with any questions about this research by email at aalfaraj@une.edu.au. You may also contact my supervisors. My Principal supervisors name is Dr Chris Boyle and he can be contacted at chris.boyle@une.edu.au or +61 2 6773 2953 and my Co-supervisors name is Ms Jo Anderson and she can be contacted at jander62@une.edu.au or +61 2 6773 3709

Complaints

Should you have any complaints concerning the manner in which this research is conducted, please contact the General Administration of Special Education at the local contact number:

P.O.Box 3465 – Riyadh 11471

Tel: 00966 11 4882200 Fax: 00966 11 4880308

Email: se_dgo@moe.gov.sa

You can also contact:

Dr, Maisarah Ahmad Ahmad Kittaneh
Lecturer of English at Imam University
Phone no: 00966559880937
Email Address: maisarahkittaneh78@yahoo.com

Or contact the Research Ethics Officer at:

Research Services
University of New England
Armidale, NSW 2351
Tel: +61 2 6773 3449 Fax: +61 2 6773 3543
Email: ethics@une.edu.au

Thank you for considering this request and we look forward to further contact with you.

Regards,
Areej Alfaraj

حروف للترجمة
HROUF FOR TRANSLATION
ترخيص رقم ٣٣١٠ عضوية ١٢٢٧٠٠

Kingdom of Saudi Arabia
Ministry of Education
Ministry of Education Agency (Boys)
General Directorate of Special Education
Department of Support Services

No.: 314102
Date: 2/1/1436 H

To Whom It May Concern

Based on the letter of Saudi Cultural Attaché in Australia dated 23/12/1436 H regarding the application presented by high studies scholar/ Areej Abdulaziz Mohammed Alfarraj (Doctorate Degree) in New England University having Saudi ID No. 1091651099 to get approval on applying the questionnaire to complete the study requirements by applying the questionnaire on research sample (special education teachers – audio – visual – mental) and after studying the research tool, the General Directorate of Special Education in Ministry of Education has no objection on applying the questionnaire on the study sample and providing us with the copy of research after completion and approval.

General Director of Special Education
Dr. Abdullah Fahad Al-Aqeel
Signed
1/1/1436.

نشهد بأن النص المترجم هو ترجمة صادقة وصحيحة للنص المرفق به
WE HEREBY CERTIFY THAT TRANSLATED TEXT IS A FAIR AND ACCURATE TRANSLATION TO ATTACHED TEXT

Tel. 4778922 / 4768234 Fax 4760884 P.O. Box 21973 Riyadh 11485 هاتف ٤٧٧٨٩٢٢ / ٤٧٦٨٢٣٤ فاكس ٤٧٦٠٨٨٤ ص.ب ٢١٩٧٣ الرياض ١١٤٨٥

المملكة العربية السعودية
وزارة التعليم
وكالة الوزارة للتعليم (بنين)
الادارة العامة للتربية الخاصة
ادارة الخدمات المساندة

وزارة التعليم
Ministry of Education

الرقم: ٢١٤١٠٢
التاريخ: ١٤٣٦/١٢/٢
المشفوعات:

الى من يهمه الامر

تفيد الادارة العامة للتربية الخاصة بوزارة التعليم وبناءً على خطاب الملحقية الثقافية السعودية في استراليا المؤرخ في ١٤٣٦/١٢/٢٣هـ بخصوص قيام المبتعثة للدراسات العليا (الدكتوراه) بجامعة نيوانغلاند الطالبة / اريج بنت عبدالعزيز محمد الفراج (هوية وطنية ١٠٩١٦٥١٠٩٩) بطلب الموافقة على تطبيق استبانة لاستكمال متطلبات دراستها من خلال تطبيق الاستبانة على عينة البحث (معلمي التربية الخاصة _ سمعي _ بصري _ فكري)، وبعد دراسة اداة البحث .

عليه تفيدكم بأنه لا مانع من تطبيق استبانتها على عينة الدراسة، على ان يتم تزودنا بنسخه من بحثها بعد استكماله واجازته .

مدير عام التربية الخاصة
[redacted]
د عبدالله بن فهد العثيل
١٤٣٦/١٢/٢٤