May 2019

The Use of Assistive Technology with Students with Severe Intellectual and Developmental Disabilities in Saudi Arabia: Teachers’ Perspectives

Khalid Mohammed Abu Alghayth

University of South Florida, KABUALGHAYTH@GMAIL.COM

Follow this and additional works at: https://digitalcommons.usf.edu/etd

Part of the Special Education and Teaching Commons

Scholar Commons Citation


This Dissertation is brought to you for free and open access by the USF Graduate Theses and Dissertations at Digital Commons @ University of South Florida. It has been accepted for inclusion in USF Tampa Graduate Theses and Dissertations by an authorized administrator of Digital Commons @ University of South Florida. For more information, please contact digitalcommons@usf.edu.
The Use of Assistive Technology with Students with Severe Intellectual and Developmental Disabilities in Saudi Arabia: Teachers’ Perspectives

by

Khalid Mohammed Abu Alghayth

A dissertation submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Curriculum and Instruction with an emphasis in Special Education Department of Teaching and Learning College of Education University of South Florida

Major Professor: Dr. Phyllis Jones, Ph.D.
Dr. John Ferron, Ph.D.
Dr. Sanghoon Park, Ph.D.
Dr. Karen Colucci, Ph.D.

Date of Approval:
May 1, 2019

Keywords: Severe disabilities, autism, special education school, teachnology

Copyright © 2019, Khalid Mohammed Abu Alghayth
DEDICATION

This dissertation is dedicated to my father, Mohammed, and my mother, Salehah. To my wife, Mashael, and my son, Mohammed. To my sister, Maryam, and my brothers Mousa, Essa, Waleed, and Yousof. Thank you all for your love, patience, encouragement, and unending support. I can never thank you enough.
ACKNOWLEDGMENTS

First and foremost, I thank Allah for letting me through all the difficulties. You are the one who let me finish my degree. I will keep on trusting you for my future.

This dissertation would not have been possible without the great and ongoing support of my committee members. Each member of my dissertation committee has provided me with extensive professional guidance and taught me a great deal about both research and life in general. I am especially indebted to my major professor, Dr. Phyllis Jones, who has taught me more than I could ever give her credit for here. She has shown me, by her example, what a good researcher, professor, (and person) should be. I would like to thank her for her diligence and patience to supervise me in this journey. Dr. Jones always offered expert advice and guidance in the past few years. She created many opportunities for me in developing my profession in many ways. It is difficult for me to describe how privileged I feel to work with her. I was also lucky enough to have Dr. Jones as a professor for Philosophy of Inquiry, the most valuable class I have ever taken.

I am grateful to the members of my committee, Dr. John Ferron, Dr. Sanghoon Park, and Dr. Karen Colucci, who have been supportive and worked actively to provide me with the protected academic time to achieve my goals. My committee member have
offered valuable suggestions and answered my numerous questions throughout this process. I can never thank them enough for their unique contributions.

Completion of this work would not have been possible without the support, encouragement, love, and inspiration of my family. I would like to thank my father, the person with the greatest indirect contribution to this work, and the wisest man I have ever known. I am grateful to my mother, whose love and prayers are with me in whatever I pursue. They are the ultimate role models. I wish to thank my loving and supportive wife and my wonderful son, who provide unending inspiration. I would like to thank my brothers and sister, who have been supportive during my journey.
# TABLE OF CONTENTS

LIST OF TABLES.................................................................................................................................iv

LIST OF FIGURES......................................................................................................................................vii

ABSTRACT ...................................................................................................................................................viii

CHAPTER ONE: Introduction...................................................................................................................... 1

  Individuals with Disabilities in Saudi Arabia..................................................................................... 3
  Statement of Problem....................................................................................................................... 4
  The Significance of the Study ........................................................................................................... 6
  Theoretical Framework..................................................................................................................... 7
  Conceptual Framework .................................................................................................................... 8
  The Diffusion of Innovations ............................................................................................................ 8
  Davis's Technology Acceptance Model (TAM)................................................................................... 9
  Student, Environment, Task, and Tools (SETT) Framework .......................................................... 11
  The Purpose of the Study.................................................................................................................. 13
  Research Questions.......................................................................................................................... 14
  Assumptions of the Study.................................................................................................................. 15
  Limitations of the Study................................................................................................................... 15
  Definition of Terms........................................................................................................................... 16
  Developmental Disabilities ............................................................................................................... 16
  Intellectual Disabilities .................................................................................................................... 17
  Autism.................................................................................................................................................... 17
  Multiple Disabilities.......................................................................................................................... 18
  Special Education Institutes ............................................................................................................ 18
  Special Education Teachers.............................................................................................................. 19
  Assistive Technology ....................................................................................................................... 19
  Universal Design for Learning: ....................................................................................................... 20

CHAPTER TWO: Literature Review ........................................................................................................ 21

  Introduction.......................................................................................................................................... 21
  The History of Assistive Technology ............................................................................................... 21
CHAPTER THREE: Method ................................................................. 57
  Introduction ............................................................................. 57
  Research Questions ................................................................ 57
  Research Design .................................................................... 58
  Variables and Demographics ............................................... 61
  Population and Participants .................................................. 61
  Sampling Strategy and Sample Size ..................................... 62
  Instrument ............................................................................. 64
  Piloting the Instrument: .......................................................... 67
  Validity and Reliability .......................................................... 67
  Translation of the Instrument ................................................. 70
  Data Collection and Analysis ................................................ 70
  Summary ............................................................................... 74

CHAPTER FOUR: Results ............................................................. 76
  Introduction ............................................................................. 76
  Sample and Response Rate .................................................... 77
  Demographic Information ....................................................... 78
  Demographics of Grouping Variables .................................. 81
  First Phase: Quantitative Analysis ....................................... 84
    Research Question 1 .............................................................. 84
Research Question 2 .................................................................................. 91
Research Question 3 .................................................................................. 95
Research Question 4.a .............................................................................. 97
Research Question 4.b .............................................................................. 103
Research Question 4.c .............................................................................. 111
Open-ended Question ............................................................................... 118
Second Phase – Qualitative: Findings and Interpretations ................... 121
  Use of AT .................................................................................................. 125
  Considerations ......................................................................................... 130
  Barriers .................................................................................................... 131
  Professional Development Needs ............................................................ 133
Qualitative Interpretations of the Quantitative Data .............................. 136
Summary ................................................................................................. 138

CHAPTER FIVE: Discussion, Implications, Recommendations, and Conclusions ...... 140
  Introduction ............................................................................................. 140
  Implications ............................................................................................ 157
  Recommendations for Future Research ................................................. 159
  Conclusion ............................................................................................... 161

REFERENCES ........................................................................................... 163

APPENDICES ............................................................................................ 182
  Appendix A: Interview Protocol ............................................................... 183
  Appendix B: Instrument ........................................................................... 184
  Appendix C: IRB Approval to Conduct Research Study ......................... 194
  Appendix D: Approval Letter from KSA to Conduct Research Study ........ 197
  Appendix E: IRB Approval Letter ............................................................. 198
LIST OF TABLES

Table 1. Effect Size Suggestions............................................................................................................63
Table 2. Reliability of All Sections ...........................................................................................................68
Table 3. Data Collection and Analysis by Research Questions ..............................................................71
Table 4. Participants’ Demographics ........................................................................................................77
Table 5. Special Education Institutes .......................................................................................................79
Table 6. Teachers’ Previous Training .........................................................................................................80
Table 7. Teachers’ Familiarity with AT ......................................................................................................80
Table 8. Teachers’ Use of AT .....................................................................................................................83
Table 9. Effectiveness of AT .....................................................................................................................85
Table 10. Considerations of Selecting AT .................................................................................................87
Table 11. The Barriers to the Use of AT ....................................................................................................89
Table 12. AT Resources Needed ..............................................................................................................91
Table 13. Results of the Kolmogorov-Smirnov and Shapiro-Wilk Tests .................................................93
Table 14. Results of Levene’s Test ..........................................................................................................94
Table 15. Two Sample T-Test Results for AT Use and Teachers’ Training ............................................95
Table 16. Two Sample T-Test Results for Teachers’ Training and AT Effectiveness .........................96
Table 17. Two Sample T-Test Results for Teachers’ Training and AT Consideration .......................97
Table 18. Two Sample T-Test Results for Teachers’ Training and AT Barriers.................98
Table 19. Two Sample T-Test Results for Teachers’ Training and AT Resources.............98
Table 20. Results of the Kolmogorov-Smirnov and Shapiro-Wilk Tests.......................100
Table 21. Results of Levene’s Test................................................................................102
Table 22. ANOVA for AT Use and Teachers’ Familiarity with AT....................................102
Table 23. Multiple Comparisons in AT Use and to the Familiarity with AT .................103
Table 24. ANOVA for AT Effectiveness and Teachers’ Familiarity with AT..................105
Table 25. ANOVA for AT Considerations and Teachers’ Familiarity with AT...............105
Table 26. ANOVA for Barriers to the Use of AT and Teachers’ Familiarity with AT.....106
Table 27. ANOVA for AT Resources and Teachers’ Familiarity with AT....................106
Table 28. Kolmogorov-Smirnov and Shapiro-Wilk Tests........................................107
Table 29. Results of Levene’s Test................................................................................109
Table 30. ANOVA for AT Use and SPED Institutes.......................................................110
Table 31. Tukey Post Hoc Test in AT Use SPED Institute............................................111
Table 32. ANOVA for AT Effectiveness and SPED Institutes........................................112
Table 33. ANOVA for AT Considerations and SPED Institutes....................................112
Table 34. ANOVA for AT Barriers and SPED Institutes................................................113
Table 35. ANOVA for AT Resources Needed and SPED Institutes.................................113
Table 36. Professional Development............................................................................115
Table 37. Personal Devices............................................................................................116
Table 38. Barriers..........................................................................................................117
Table 39. Interview Guide..............................................................................................120
Table 40. Interviewees Demographics .................................................................................. 121
LIST OF FIGURES

Figure 1. Individuals with Disabilities in Saudi Arabia..........................................................3

Figure 2. Technology Acceptance Model (TAM) ......................................................................10

Figure 3. The TPACK Framework and its Knowledge Components.........................................38

Figure 4. Sequential Explanatory Mixed Methods .................................................................59

Figure 5. Teachers’ Use of Low-tech with their Students .......................................................83

Figure 6. Teachers’ Use of Mid-tech with their Students.........................................................84

Figure 7. Teachers’ Use of High-tech with their Students.......................................................84

Figure 8. The Influence of Social Systems and Innovations on the Use of AT .......................151
ABSTRACT

This study explored teachers’ perspectives of AT use, effectiveness of AT, elements teachers’ take into consideration when selecting AT, barriers, and resources needed for effective use of AT with students with severe intellectual and developmental disabilities. In order to answer this study’s research questions, I employed a sequential explanatory mixed methods design. I conducted a self-administered online survey and online interviews to collect data from participants. This study consisted of two phases, quantitative followed by qualitative interviews. A total of 92 special education teachers from four special education institutes were surveyed, and five teachers in the second phase were interviewed to provide interpretations for the data analyzed from the first phase. Results demonstrated that there was a lack of AT use, with teachers reporting higher use of low-tech than mid-tech and high-tech. The most reported barriers were lack of AT devices, lack of funding, and lack of training. The results also demonstrated that there were statistical differences in the use of AT between the four special education institutes, teachers with AT training, and teachers’ familiarity with AT. In the second, qualitative, phase, four major themes emerged from the interviews, as well as several sub-themes. The four themes were (a) the use of AT, (b) considerations, (c)
barriers, and (d) professional development. These themes and sub-themes made it possible to interpret and elaborate on the data collected in the first, quantitative, phase.
CHAPTER ONE:
INTRODUCTION

With the number of technology applications and tools that can be used in education settings increasing rapidly, technology has received wide attention from educators, and it plays a significant role in school settings (Wong & Law, 2016). Technology now is considered as an essential part of education in schools (Leddy, 2010; Wehmeyer et al., 2011). Current generations of students rely increasingly on technology in their academic lives. Martin (2006) claims that preparing today’s students for tomorrow requires using technology. In other words, it is necessary that it be included in their learning activities. In classrooms, students count on their teachers to provide them with the appropriate tools and strategies that help them learn. This means teachers play a major role in integrating technology and making it useful and effective in the educational process.

The effectiveness and the importance of technology in classrooms have been shown in numerous studies (Dyal, Cappenter & Wright, 2009; Garner & Campbell, 1987), and the advanced use of technology in education has changed the way students learn in classrooms (Furio, Juan, Seguí, & Vivo, 2015). With it, learning environments can be more active and interactive for students in a variety of subjects (de Koning-
Veenstra, Steenbeek, van Dijk, & van Geert, 2014), and students can be even more effective (Taskm & Kandemir, 2010).

International Business Machines (IBM) (1991) pointed out, "For most people, technology makes things easier. For persons with disabilities, technology makes things possible" (p. 2). For individuals with disabilities, using assistive technology (AT) is an essential way that helps them communicate with others. One of the most significant goals in using AT among individuals with disabilities is helping them become more independent (Mechling, 2011). The World Health Organization (WHO) (2017), believes there are about 1 billion individuals around the world who are in need of AT. This number could increase by 2030 to about 2 billion people (WHO, 2017).

All students with disabilities may use and benefit from AT services and devices, including students with mild to moderate disabilities. The term “mild disabilities” is used in describing individuals who have learning disabilities, behavioral disturbances, and mild intellectual disabilities (Edyburn, 2006). Students with these disabilities may require a variety of supports in different areas in school settings. They may have difficulties in areas such as reading, writing, calculating, attention, and memory (Meese, 2001). Hence, AT devices and services may help reduce some of these difficulties.

The more complex disabilities are, the greater the necessity for AT in the lives of individuals with those disabilities. Lancioni, Sigafoos, O’Reilly, and Singh (2012) believe that the students with disabilities who are seen as most eligible for AT services fall into two groups: students with physical disabilities and communication disorders, and students with severe intellectual and developmental disabilities (Lancioni et al., 2012).
Weber and Demchak (1996) have a similar perspective on who is most in need of AT and when it is most significant to use AT with individuals with disabilities. Weber and Demchak (1996) also state that among all types of AT devices and services provided to individuals with different types of disabilities, students with severe disabilities receive the most attention from educators and researchers. Definition (1991) believes that these individuals were labeled as people with severe intellectual disabilities. Lee and Templeton (2008) identify people with severe and/or multiple disabilities as those who have severe intellectual disabilities and may also have physical or sensory disabilities. Individuals with severe disabilities require more support to be more integrated into their communities, and AT devices and services may assist them in overcoming the barriers they may face in areas such as independent living, learning, communication, and self-care (Definition, 1991; Lee & Templeton, 2008).

**Individuals with Disabilities in Saudi Arabia**

According to the General Authority for Statistics (GAS) (2017), Saudi Arabia has a population of about 32.5 million. The percentage of individuals with all types of disabilities (mild to moderate and moderate to severe disabilities) in Saudi is about 7.1% of the population, with males representing about 3.7% and females 3.4%. Individuals with mild to moderate disabilities represent about 70% of the total number of people with disabilities, while people with severe disabilities represent about 30% (GAS, 2017).
According to the GAS (2017), the highest number of all people with disabilities in Saudi Arabia was found in the Capital city, Riyadh with a percentage of 25.13%. Saudi students with disabilities receive their education in different educational settings. Students with mild to moderate disabilities receive their education in special education classes in general education schools and get support from resource rooms. Some students with mild disabilities, such as learning disabilities, get their education with their peers in general education classrooms and get support in the resource rooms as well. On the other hand, most students with severe disabilities receive their education in special education institutes. Those institutes usually educate a large number of students at all educational school levels--elementary, middle, and high school.

Statement of Problem

The use of AT with students with disabilities has been studied worldwide from different aspects. Some of the studies have addressed issues such as AT effectiveness and the importance of AT among students with various types of disabilities (Dyal,
Moreover, numbers of studies have addressed issues related to teachers’ knowledge and attitudes toward the use of AT with students with disabilities (Ajuwon & Chitiyo, 2016; Flanagan, Bouck, & Richardson, 2013). Additional studies have been conducted on the resources and challenges teachers encounter in their schools (Davis, Barnard-Brak, & Arredondo, 2013; Flanagan et al., 2013; Jacobsen, 2012). Moreover, although research shows that students with severe intellectual disabilities are more in need of AT devices and services (Lancioni et al., 2012; Weber & Demchak, 1996), there is a lack of studies on how teachers use the AT devices and how they deliver the appropriate AT services to their students with severe intellectual and developmental disabilities.

In Saudi Arabia, several studies have been conducted on the use of AT with students with disabilities (Alfaraj & Kuyini, 2014; Alharbi, 2018; Al-Mogyrah, 2017; Alsolmi, 2017; Keetam, 2013). Two studies have been conducted on teachers’ use of AT with students with Down syndrome (Alfaraj & Kuyini, 2014; Al-Mogyrah, 2017), and another study has been conducted on the use of AT among students with visual impairments (Alsolmi, 2017). Furthermore, Alharbi (2018) and Keetam (2013) conducted studies on AT use among general and special education teachers of students with different types of disabilities. They have addressed important issues related to teachers’ attitudes, experience, and knowledge regarding the use of AT with students with disabilities in Saudi Arabia.

The Saudi Arabian studies referred to above have been conducted on teachers of students with disabilities in inclusive schools. Students with disabilities enrolled in
Inclusive schools in Saudi Arabia usually have mild to moderate disabilities. There is generally a lack of research, however, regarding students with severe disabilities enrolled in special education institutes in the country, both in terms of how they are taught and, more specifically, the use of AT. Although students with severe intellectual and developmental disabilities are in great need of AT devices and services (Lancioni et al., 2012; Weber & Demchak, 1996), there is little known about the use of AT among this group of students, particularly in special education institutes in Saudi Arabia. In other words, our knowledge of the use of AT in those institutes is still sparse, as no single study has been conducted on how teachers use AT with students with severe intellectual and developmental disabilities. There is, therefore, a need to study the use of AT with students with severe intellectual and developmental disabilities, including factors such as the types of AT used, considerations when selecting AT, resources needed, and barriers from the standpoint of teachers.

To meet this need, the purpose of this study is to explore teachers’ perspectives of their use of AT with students with severe intellectual and developmental disabilities in four special education institutes in Saudi Arabia: (1) the Intellectual Education Institute for Boys in western Riyadh, (2) the Intellectual Education Institute for Girls in western Riyadh, (3) the Intellectual Education Institute for Boys in eastern Riyadh, and (4) the Intellectual Education Institute for Girls in eastern Riyadh.

**The Significance of the Study**

Results of research on the use of AT with students with severe intellectual and developmental disabilities in special education institutes from teachers’ standpoint will
have a significant contribution to the fields of special education, AT, and severe intellectual and developmental disabilities, especially in Saudi Arabia. Moreover, this study will provide teachers, researchers, educators, and decision-makers in the Department of Special Education in the Ministry of Education in Saudi Arabia with a better understanding of the current issues related to the use of AT in such institutes, the challenges that hinder the use of AT, and the support that teachers need to be able to use AT appropriately and successfully to benefit students with severe intellectual and developmental disabilities in Saudi special education institutes.

Theoretical Framework

To understand teachers’ perspectives on those aspects of AT use detailed above, there is a critical need for a philosophy that assists in understanding teachers’ experiences and perspectives and in gaining a deeper understanding of the issues being studied. According to Creswell (2008), interpretivist researchers believe that people endeavor to understand the world they work in, therefore they develop their own meanings based on their experiences with particular objects. Furthermore, Rubin and Rubin (1995) stated, “objects and events are understood by different people differently, and those perceptions are the reality, or realities that social science should focus on” (p. 35). Thus, researchers rely upon people’s perspectives or experiences to understand the issue being investigated (Creswell, 2013).

The interpretive paradigm is “systematic analysis of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive at understandings and interpretations of how people create and maintain their social
worlds” (Neuman, 2011, pp. 101-102). Reliance upon this philosophy by educational researchers has been increasing rapidly since the 1990s, and it has been highly influential in the field (Check & Schutt, 2011; Howe, 1998).

To achieve its purposes, the current study is situated in an interpretive paradigm. This means that participants in the second qualitative phase are given an opportunity, through semi-structured interviews, to freely express themselves and to describe and explain their perspectives and experiences (Creswell, 2013) regarding the use of AT with their students with severe intellectual and developmental disabilities in special education institutes. This allows me, as a researcher, to listen to the participants, explore their perspectives regarding the use of AT, and analyze their interpretations (Denzin, 2001).

**Conceptual Framework**

This study is framed by theories that relate to the use of AT with students with severe intellectual and developmental disabilities. Teachers’ perspectives on their use of AT in special education institutes are explored and discussed based on several theories and models: (a) the diffusion of innovations framework, (b) the technology acceptance model (TAM) framework, and (c) the SETT framework.

**The Diffusion of Innovations**

This study is guided by one of the theories that provides a comprehensive philosophical vision for utilizing AT in schools. The diffusion of innovations theory was first set forth by Rogers in 1962 (Rogers, 2003). In this theory, Rogers defined an
innovation as “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (p. 12). Diffusion, according to Rogers, is "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). In the current study, AT is considered an innovation. Rogers said, “An innovation presents an individual or an organization with a new alternative or alternatives, as well as new means of solving problems” (p. 12). Various AT devices can provide special education teachers with alternatives, and they can also be used to solve problems.

Rogers stated that there are four major elements that could influence the diffusion of innovations: (a) innovations, (b) communication channels (Rogers defined this element as “the means by which messages get from one individual to another” [p. 18]), (c) time, and (d) a social system, which according to Rogers is “a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (p. 23). To better understand the social system in this theory, note that Rogers said, “The structure of the social system can facilitate or impede the diffusion of innovations” (p. 25). In this study, all teachers, administrators, and Individualized Education Plan (IEP) team members including family members, students, and all members involved in planning and utilizing AT may influence the use of AT. Using diffusion of innovations theory, I examine which of those elements could play a role in teachers’ implementation of AT with their students in the four special education institutes.
Davis's Technology Acceptance Model (TAM)

The TAM framework has been applied widely in studying the use of technology, especially users’ acceptance of technology (Chuttur, 2009). The TAM framework was suggested and explained in Davis’s doctoral dissertation in 1985 (Davis, 1985). This framework is originally based on the model of the theory of reasoned action (TRA), which was created in 1975 by Fishbein and Ajzen. The TRA is based on the idea that “individual behavior is driven by behavioral intention where behavioral intention is a function of an individual’s attitude toward the behavior and subjective norms surrounding the performance of the behavior” (Masrom, 2007, p. 2).

Davis (1985) stated that users' motivations are based on three main factors: (a) perceived ease of use (PEOU), (b) perceived usefulness (PU), and (c) the attitude toward using the system. Perceived ease of use refers to “the degree to which an individual believes that using a particular system would be free of physical and mental effort,” and PU refers to "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1985, p. 26). The users’ attitudes toward the use of technology can be influenced by PEOU and PU, and PEOU has a direct influence on (PU) (Figure 2). Both PEOU and PU can be influenced by external variables (Davis, 1985), which might limit teachers' considerations of using AT among their students with disabilities in the classrooms.
According to Davis (1985), there is an "intervening motivational response on the part of the user. Namely, the characteristics of the system affect how motivated users are to use the system, which in turn affects their own actual system use or non-use" (p. 11). Teachers' considerations regarding the use of AT might be influenced by PEOU and PU. Therefore, in this research, the TAM framework is applied to measure the challenges that influence teachers' considerations and their use of AT.

**Student, Environment, Task, and Tools (SETT) Framework**

The SETT framework is a detailed set of guidelines developed by Joy Zabala to assist IEP team members in selecting the most appropriate AT for students with disabilities based on four major areas (Zabala, 1995). According to Zabala (1995), the following elements and questions in the SETT should be taken into consideration when choosing the AT devices:

**The Student:**

1. What does the Student need to do?

2. What are the Student's special needs?
3. What are the Student's current abilities?

**Environment:**

1. What materials and equipment are currently available in the environment?

2. What is the physical arrangement? Are there special concerns?

3. What is the instructional arrangement? Are there likely to be changes?

4. What supports are available to the student?

5. What resources are available to the people supporting the student?

**The Tasks:**

1. What activities take place in the environment?

2. What activities support the student's curriculum?

3. What are the critical elements of the activities?

4. How might the activities be modified to accommodate the student's special needs?

5. How might technology support the student's active participation in those activities?

**The Tools:**

1. What strategies might be used to invite increased student performance? What no-tech, low-tech, and high-tech options should be considered when developing a
system for a student with these needs and abilities doing these tasks in these environments?

2. How might these tools be tried out with the student in the customary environments in which they will be used?

Zabala (1995) indicated that IEP team members should carefully review and evaluate the student, the environment, and the tasks before selecting the appropriate tools for the students. In this research, the SETT framework is applied to measure teachers’ considerations when making decisions about the use of AT devices and services among their students with disabilities. Some of the items in the survey instrument and some questions in the interview focus on how teachers select AT devices and services.

The Purpose of the Study

The purposes of this study are as follows:

• to explore teachers’ use of AT with students with severe intellectual and developmental disabilities in special education institutes in Riyadh, Saudi Arabia;

• to identify the challenges teachers face, from their standpoint, in using AT in their classrooms;
• to investigate the AT resources and support that teachers of students with severe intellectual and developmental disabilities believe they need to effectively use AT in special education institutes;

• to explore the differences between three grouping variables—previous AT training, special education institute, and teachers’ familiarity with AT—and teachers’ perspectives on their use of AT.

Research Questions

This study is guided by the following questions:

1. How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes? The following three sub-questions help understand the factors that relate to the use of AT.

   1.a. What types of AT do teachers report using with their students and how frequently?

   1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?

   1.c. What elements do teachers report considering when selecting AT for their students?

2. How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?
3. What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?

4. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on
   a. their previous training experiences?
   b. their familiarity with AT?
   c. their special education institutes?

**Assumptions of the Study**

I have assumed that all of the participants have been honest and accurate in responding to the online survey questionnaire and the interview questions. I have also assumed that the sample represents the population from which is drawn.

**Limitations of the Study**

There are at least two limitations to this study. The first limitation is related to the sample size of the first quantitative phase. The response rate was relatively small. Only 92 teachers, which represents about 32% of the total population, participated in this study. This implies that it is not possible to generalize from the results. Another limitation is related to the survey distribution, which absolutely influenced the response rate. I could not travel to the special education institutes and recruit teachers myself;
therefore I used the snowball strategy and sent a link to the online survey questionnaire to mediators who distributed it to all teachers in the four special education institutes.

**Definition of Terms**

According to Handleman (1986), the term severe developmental disabilities is considered as an umbrella to encompass people with severe intellectual disabilities, autism, and multiple disabilities. Therefore, throughout this research, this umbrella will be used to describe the students with severe intellectual and developmental disabilities.

**Developmental Disabilities**

According to Jones (2017), “Sometimes the broader term ‘developmental disabilities’ is used to be inclusive of both ASD and intellectual disabilities” (p. 4). The term developmental disabilities according to the ARC of Indiana:

“Includes, but is not limited to, people who have an intellectual disability, autism, cerebral palsy, severe seizure disorder or a severe head injury that occurs before the age of 22.” Under federal law, developmental disability means a severe, chronic disability of an individual that:

- is attributable to a mental or physical impairment or combination of mental and physical impairments;
- is manifested before the age of 22;
- is likely to continue indefinitely.
Results in substantial functional limitations in three or more of the following areas of major life activity:

- Self care;
- Receptive and expressive language;
- Learning;
- Mobility;
- Self-direction;
- Capacity for independent living;
- Economic self-sufficiency.

**Intellectual Disabilities**

The term of intellectual disabilities has been defined many times through years by researchers in different fields. One of the most common definitions of intellectual disabilities in the field of education is the American Association on the Intellectual and Developmental disabilities (AAIDD) in 2010, and it defines the intellectual disabilities as “a disability characterized by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. This disability originates before the age of 18.”

**Autism**

Autism is “a disorder that is present from birth or very early in development that affects essential human behaviors such as social interaction, the ability to communicate
ideas and feelings, imagination, and the establishment of relationships with others." (National Research Council, 2001, p. 11). Another definition defines autism as “a neurodevelopmental disorder characterized by persistent deficits in social communication and restricted repetitive behaviors (RRBs)” (Ha et al., 2015, p. 273).

**Multiple Disabilities**

According to IDEIA (Sec. 300.8, c), the term multiple disabilities refers to "concomitant [simultaneous] impairments (such as intellectual disability-blindness, intellectual disability-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in a special education program solely for one of the impairments. The term does not include deaf-blindness.”

**Special Education Institutes**

The special education institutes in Saudi Arabia refer to the educational placements of students with moderate to severe intellectual and developmental disabilities. The Saudi Ministry of Education has provided a set of conditions for students with severe intellectual and developmental disabilities to be enrolled in institutes as follows:

(a) The students with severe cognitive disability should have an IQ score of 50 and below; (b) the students should have a deficit in two or more adaptive behavior skills; (c) the students should be between ages six to fifteen to be eligible for the services in the special education institutes; (d) and the students with severe cognitive disabilities should not have severe behavior disorders that
impede him or her from experiencing the benefits of the institute’s special education services. (Eastern Intellectual Education Institute in Riyadh, 2007, para. 5, as cited in Alquraini, 2011)

**Special Education Teachers**

Special education teachers of students with severe intellectual and developmental disabilities in this research specifically refer to teachers who teach in special education institutes in Riyadh, Saudi Arabia. Those teachers usually have a bachelor’s degree for teaching students with autism or intellectual disabilities.

**Assistive Technology**

There are a variety of definitions of AT, but almost all of them agree that AT can support students with disabilities in different ways in the classrooms. Individuals with Disabilities Education Act, 2004, (IDEA) defines the assistive technology in the school settings as “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability.”

Assistive technology, as this act considers it, has two different types (a) devices and (b) services. The other definition that IDEA uses to define AT services is “service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device.” The services that IDEA means include:

(a) The evaluation of the needs of such child, including a functional evaluation of the child in the child's customary environment; (b) Purchasing, leasing, or
otherwise providing for the acquisition of assistive technology devices by such child; (c) Selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices; (d) Coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs; (e) Training or technical assistance for such child, or, where appropriate, the family of such child; and (f) Training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of such child.

**Universal Design for Learning:**

The Universal Design for Learning (UDL) means that all people regardless of their abilities should have an access to all services in the environment (Mace et al., 1991).
CHAPTER TWO: LITERATURE REVIEW

Introduction

This chapter discusses topics related to teachers’ use of AT with students who experience severe intellectual and developmental disabilities, reviews, and synthesizes existing research on these topics. The topics include the history of AT; legislation and regulations in Saudi Arabia; legislation and regulations of AT in the U.S.; teachers’ use of AT with students with disabilities, particularly those with severe intellectual and developmental disabilities; the use of AT in Saudi Arabia; considerations regarding AT; categories of AT; Universal Design for Learning; the effectiveness of AT use; barriers to the use of AT; and finally, the resources needed by teachers to successfully use AT in the classroom.

The History of Assistive Technology

Assistive technology was not generally and formally used among students with disabilities in schools when the first special education laws and regulations were issued in the late 1970s to support students with disabilities (Hager, 1999). Most of the devices were not easily available (Hager, 1999), and the use of AT was not a significant issue at that time because the primary focus was on providing access to education for students
with disabilities (Day & Huefner, 2003). Educating these students along with their peers without disabilities was the major contribution of the legislation (Day & Huefner, 2003), and it opened the door to getting a variety of services and rights for individuals with disabilities. Subsequently, the U.S. Congress passed the first AT-related law in 1988—the Technology Related Assistance for Individuals with Disabilities Act (PL. 100-407)—to financially support the use of AT with students with disabilities in schools (Dyal, Carpenter, & Wright, 2009).

According to the Individuals with Disabilities Educational Act (IDEA, 2004), the Assistive Technology Act of 2004, and the Technology Related Assistance for Individuals with Disabilities Act of 1988, states are required to support schools to ensure that all students with disabilities have equal access to AT devices and services in schools. Moreover, other pieces of federal legislation include support for AT as part of their directives—for instance, Sections 504 and 508 (a 1998 amendment) of the Rehabilitation Act of 1973 (Day & Huefner, 2003). The Americans with Disabilities Act (2000) is another piece of federal legislation that supports the use of AT (Day & Huefner, 2003). In brief, one significant goal of these laws and regulations was to ensure that students with disabilities have access to AT devices and services in school settings.

As a result, in the 1990s, AT devices and services, such as communication devices and computers, were evident in school settings for students with disabilities (Blackhurts, 1997). Among all types of technology used in schools, there was a variety of AT services and devices to meet the needs of students with disabilities in school settings. Today, the numbers of AT devices and services are increasing rapidly to
support students with disabilities and help them become more independent (Mechling, 2011; Wong & Law, 2016).

The significance of the growing interest in AT in special education can be attributed to two factors: (a) legislation and (b) the growing use of technology (Lee & Templeton, 2008). Another reason why there is an increase in the use of AT devices and services in the field of special education is the increased attention paid by researchers and educators to AT (Weber & Demchak, 1996). In addition, the federal government and its laws have led to the use of AT in schools (Weber & Demchak, 1996).

**Education System in Saudi Arabia**

The Saudi Ministry of Education was founded in 1953. The Saudi education system is derived from the Islamic religion as the official religion of Saudi Arabia. Since then, the educational system in Saudi Arabia has established its philosophy and policy based on the Islamic religious traditions and laws. At all educational school levels—elementary, middle, and high school, students take a number of Islamic classes. Females and males receive their education in separate schools at all educational levels including higher education. The Saudi educational system ensures all individuals a free and appropriate education at all educational school levels. In regard to higher education, all Saudi citizens have the right for free graduate and undergraduate studies. Moreover, Saudi government provides all students in higher education with a monthly salary during their college years. Furthermore, Saudi government provides eligible non-citizens with scholarships to study in Saudi universities for free.
With regard to special education in Saudi Arabia, it began with people’s efforts where there were no organized official educational services provided for individuals with disabilities before 1950s (Al-Mousa, 2008). In 1958, the Ministry of Education provided people who were blind in Riyadh with evening classes in schools called “Scientific Institutes” (Ministry of Education, 2012). In 1962, the Special Education Department in the Ministry of Education was founded and aimed, as Ministry of Education (1995) stated, to achieve the following:

(a) discover each child’s skills and abilities, in order to develop them through appropriate programs and activities; (b) give children every opportunity for education and help them achieve their highest potential; (c) raise children with an awareness of Islamic teachings and morals; (d) develop acceptable social behavior and prepare children for a stable life; (e) provide stability for children with disabilities and needed medical, psychological, and social care, and help children become as independent as possible; (f) prepare children for possible work in order for them to be productive and self-supporting members of society; and (g) educate the general public about disabilities and foster greater understanding of how to interact with children with disabilities. (As cited in Al-Ajmi, 2006, p. 12)

Legislation and Regulations in Saudi Arabia

Most countries have their own laws and regulations to ensure the rights and needs of individuals with disabilities are recognized, including laws that address the need for AT in schools. In Saudi Arabia, there are several regulations that underline,
enhance, and guarantee the rights of education for people with disabilities. For instance, the Legislation of Disability was enacted in 1987 to ensure that the rights of people with disabilities are equal to those of other individuals in Saudi society (Almalki, 2013; Al-Mousa, 1999; Alquraini, 2011). In addition, in 2000 the Provision Code was passed to guarantee a free appropriate public education for all individuals with disabilities (Prince Salman Center for Disability Research, 2004). Also, the Regulations of Special Education Programs and Institutes (RSEPI) were issued in 2001 to provide further support for individuals with disabilities and require more services, such as IEPs and transition services (Alquraini, 2013).

However, there is a lack of support for the use of AT with students with disabilities in these Saudi laws and regulations (Alquraini, 2012; Al rubiyea, 2010). Alquraini (2013) stated that

The RSEPI does not underscore technology as an important service that should be provided for students with disabilities. Therefore, the schools in Saudi Arabia do not provide either assistive technology services or devices to be integrated in the effective teaching strategies and that can support students with disabilities to live independently and accesses the general curriculum. (p. 608)

This shows the need for more legislation to enhance the use of AT with students with disabilities in Saudi Arabia and ensure that they get the needed AT devices and services. The RSEPI was modeled after the U.S. regulations (Alquraini, 2013). U.S. laws on AT use could influence Saudi laws that ensure the right for students with disabilities
to use AT in schools. The following section briefly discusses regulations of AT in the U.S.

**Regulation of Assistive Technology in the U.S.**

In the U.S., the use of AT has been supported for decades by legislation such as the Rehabilitation Act of 1973, the Education for All Handicapped Children Act of 1975, the Tech Act of 1988, and IDEA 2004. These regulations ensure that individuals who experience disabilities are provided with the needed AT.

The Rehabilitation Act of 1973 also addressed the need for AT in the life of individuals with disabilities. Section 504 of this act states that students with disabilities should have access to school buildings so they can have access to school services (Caverly & Fitzgibbons, 2007, p. 38).

The Department of Education has made a commitment to support its obligation under Sections 504 and 508 of the Rehabilitation Act of 1973, as amended, to ensure the accessibility of its programs and activities to individuals with disabilities (U.S. Department of Education).

Moreover, the Rehabilitation Act of 1973 ensured the rights of students with disabilities to use AT devices and services and access the curriculum in school settings (Lewis & Doorlag, 2003).

In 1975, the Education for All Handicapped Children Act was enacted. This legislation addressed significant aspects of the needs of individuals with disabilities, including AT. According to the Act, most students with disabilities had not previously had their educational needs met because access to a free appropriate public education
requires AT intervention (Rehabilitation Research and Design & Disability Center, 2004).

Use of AT with students with disabilities was supported and funded in the Education of the Handicapped Act Amendments of 1986 to improve access educational programs (Rehabilitation Research and Design and Disability Center, 2004). In the same year, the Rehabilitation Act Amendments of 1986 were passed, which required equal access to computers and other AT devices and services for individuals with disabilities (Rehabilitation Research and Design and Disability Center, 2004, The Center for an Accessible Society). The Rehabilitation Act Amendments of 1998 discussed technology access in more detail and required access to advanced electronics and other services (Rehabilitation Research and Design and Disability Center, 2004, The Center for an Accessible Society).

In 1988, significant legislation related to AT was signed into law. The Tech Act has been one of the most significant and valuable acts supporting access for students with disabilities to AT devices and services in school settings (Bryant et al., 1998, p. 55). According to Rehabilitation Research and Design and Disability Center (2004), this was the “first legislation specifically related to AT.” Marino et al. (2006) called it "the first substantive federal legislation dedicated solely to AT" (p. 19).

More importantly, in The Tech Act, AT services and devices were officially defined for the first time (Jacobsen, 2012). Later, the laws that included AT used the definitions this act provided (Tech Act: Technology Related Assistance for Individuals with Disabilities Act). One of the aims of the Act was to support and fund training for
people who experience disabilities and provide them with AT devices and services (Dyal, Carpenter, & Wright, 2009). Another aim, as Behrmann and Jerome (2002) pointed out, was to ensure all individuals with disabilities and their families get access to AT devices and services. However, the Act set no standards for how AT services and devices would be delivered or for services providers. Instead it focused more on funding the training programs (Jacobsen, 2012).

In 1990, another legislation related to AT was enacted. The Americans with Disabilities Act enhanced the use of transportation and telecommunication among individuals with disabilities in its titles II and IV (Lissner, 1995). Additionally, the Individuals with Disabilities Education Act of 1990 ensured a free appropriate public education for individuals with disabilities, and required the schools to provide the necessary AT (Merbler, Hadadian, & Ulman, 1999).

**Teachers’ Use of AT with Students with Disabilities**

The use of AT can be viewed from several aspects, such as category of AT (low-tech, mid-tech, or high-tech), types of disabilities, types of tasks, and the frequency of the AT use in the classrooms. Studies have shown how these aspects are related to each other in the use of AT in classrooms. In the following section, the use of AT is discussed based on the type of disability (severe intellectual and developmental disabilities), the types of task (tasks related to reading, writing, and communication), the categories of AT, and the frequency of the AT use in classrooms as reported by teachers.

Students who experience severe intellectual and developmental disabilities usually experience difficulties in certain areas in their lives in the classroom that might
affect their learning process, such as communication, reading, writing, engaging in activities, and adapting to the environment (Cannella-Malone, Konrad, & Pennington, 2015; Lancioni, Sigafoos, O'Reilly, & Singh, 2012). Such difficulties may lead these individuals to depend on people around them such as caregivers or family members (Lancioni et al., 2012). The goal of using AT is to help them become more independent (Mechling, 2011). Research has shown the importance and effectiveness of AT use with these students in the classroom across curriculum areas (Dyal, Cappenter, & Wright, 2009; Garner & Campbell, 1987; Stasolla, Caffo`, Picucci, & Bosco, 2013). Additionally, the use of AT can improve the quality of life for people with severe disabilities (Reichle, 2011). The benefits of AT use, particularly among students with severe intellectual and developmental disabilities, is discussed in depth later in the chapter.

Although studies have shown that individuals who experience disabilities could significantly benefit from AT devices and services (Dyal, Cappenter, & Wright, 2009; Parette, Blum, & Boeckmann, 2009; Reichle, 2011; Sullivan & Lewis, 2000), there is a lack of studies on how teachers use the AT devices and how they deliver the appropriate AT services to their students with disabilities (Quinn et al., 2009). According to WHO (2018), there are approximately 1 billion individuals with disabilities around the world in need of AT, yet only 1 in 10 such people have access to AT devices and services.

This lack of AT use among students with disabilities has been noticed in the literature (Alfaraj & Kuyini, 2014; Alkahtani, 2013; Bouck, Maeda, & Flanagan, 2012; Flanagan, Bouck, & Richardson, 2013). Flanagan, Bouck, and Richardson (2013) conducted a study to explore the use of AT by special education teachers of students
who experience disabilities. They used a survey to collect data on teachers' use of AT, the perceived effectiveness of AT, and factors that impact AT use in classrooms during literacy instruction. A total of 51 middle school teachers from 166 schools completed the survey. When teachers were asked about the types of AT they used (low-tech or high-tech) and how frequently they used it, they indicated that high-tech was used less frequently than low-tech among teachers. Although teachers indicated that the use of high-tech such as speech-to-text devices and screen readers is very effective among their students with disabilities, the results showed that high-tech devices were “never being used” (Flanagan et al., 2013, p. 29).

Bouck et al. (2012) analyzed and discussed data that had been collected by the National Longitudinal Transition Study-2 about using AT among students with mild disabilities. Although results showed that students who used AT had positive outcomes, the percentage of students who used AT in high school was 7.8%, and only 1.1% of students used AT after graduating from high school. That shows the lack of the use of AT among students with disabilities in schools.

Despite research that indicates the importance of AT use, particularly among individuals who experience severe intellectual and developmental disabilities (Lancioni et al., 2012; Weber & Demchak, 1996), AT devices and services are used less frequently with this group of students (Ajuwon & Chitiyo, 2016). Ajuwon and Chitiyo (2016) conducted a study to investigate teachers’ implementation of AT with students with disabilities in Nigeria. The researchers surveyed a total of 165 special education teachers to explore their perspectives regarding their AT use and challenges they face when
considering AT use with their students. Among other findings, teachers reported that among all students with different types of disabilities, the percentage of all students with Down syndrome and autism using AT is smaller than the AT-use percentage for any other category of student.

Quinn et al. (2009) used data collected by the National Assistive Technology Research Institute to examine AT use status among students with disabilities. A total of 628 students with disabilities participated in this study. The findings showed that 27.71% of students using AT were those who experience multiple disabilities, students with learning disabilities represented 16.72%, students with orthopedic impairments were 14.66%, students with autism represented 13.93%, and the percentage of students with intellectual disabilities was 12.17%. These findings showed that the use of AT with students with these disabilities was higher than it was among students with other types of disabilities examined in this study, such as speech language impairments (1.47%), deafness (0.29%), or emotional disturbance (0.95%). However, the authors stated, “The low number of students with high-incidence disabilities participating in the study raises questions about whether and how AT is being considered for such students” (Quinn et al., 2009). They suggested more research on AT use among students with disabilities.

Bausch et al. (2008) examined the status of implementing AT among students who experience disabilities in schools. The researchers surveyed a total of 699 participants. The staff of the National Assistive Technology Research Institute developed the survey for this purpose. The participants were professionals, from 14 states and about 60 schools, who used AT with their students aged 3–21 and grade level
from preschool to twelfth grade with different disabilities. They were asked to reflect on the AT services their students received. Of the 699 survey respondents, 225 were female students, 468 were male students, and six were unidentified gender. The results showed that the number of participants who stated that their students did not receive AT services was 110. The authors believed this number to be very high. They stated "Such a trend is alarming, because successful implementation of AT devices is not possible without the support of AT services" (p. 11). The professionals reported, of 699 students, there were two students who did not use AT devices. The researchers indicated that there was a lack of awareness among professionals regarding AT services and a lack of AT services among students. They suggested that awareness of AT services should be increased, and there should be training for teachers and other professionals in the field of education.

The Use of AT in Saudi Arabia

Only a few studies have been carried out on AT use among students with disabilities in Saudi Arabia (Alfaraj & Kuyini, 2014; Alharbi, 2018; Alkahtani, 2013; Al-Moghyrah, 2017; Alsolmi, 2017). Several issues have been addressed in the literature, such as teachers’ attitudes and experiences of AT implementation with students with Down syndrome (Alfaraj & Kuyini, 2014; Al-Moghyrah, 2017) and knowledge and perspectives of teachers of students with visual impairments (Alsolmi, 2017). Other studies have discussed AT among general and special education teachers of students with different types of disabilities in inclusive classrooms (Alharbi, 2018; Alkahtani, 2013).
In a study conducted by Al-Moghyrah (2017) to explore attitudes on AT use of special education teachers of students with Down syndrome in inclusive schools in Riyadh, a total of 50 teachers from five inclusive schools participated in a survey. Among other findings, teachers reported that they believe AT is a beneficial and effective tool for students with Down syndrome. The results also showed the barriers teachers encountered. Teachers reported a lack of skills regarding AT use and a lack of time, support, and resources. These results suggest there is a need for more support for AT implementation in schools.

Another study was conducted by Al-Faraj and Kuyini (2014) to explore teachers' perspectives on the use of technology among students with Down syndrome. A total of 20 special education teachers from two schools participated. The researchers used a qualitative survey that included open-ended questions. The results showed that the educational tool used most by the participants was the computer. Some participants also reported that they used other tools such as projectors, iPads, and televisions. In addition, the findings showed a general lack of awareness among some teachers of the benefits of using technology in the classroom. In terms of barriers, teachers reported that lack of tools; lack of Arabic-language software, and lack of training hindered their use of technology in the classrooms.

Most recently, Alharbi (2018) conducted a study to investigate knowledge and use of AT among elementary special education teachers in Saudi inclusive schools. A survey was used to collect data from 346 participants. Among other findings, most of
the special education teachers reported that they did not use AT with their students in schools.

Alkahtani (2013) surveyed a total of 127 general and special education teachers and interviewed three to gather data on their knowledge, skills, and use of AT in their classrooms. Findings showed that most of the teachers (93.7%) did not use AT evaluation, approximately 94% did not consider the AT devices and services in their students’ IEPs, and about 91.3% of the participants reported that AT devices were not available in the schools. These results showed that there was a lack of AT use among the participants, as well as a lack of knowledge and skills.

Although these studies addressed important issues related to teachers’ attitudes, experience, and knowledge regarding the use of AT among their students with disabilities, they were conducted in inclusive schools. Students with disabilities who are enrolled in inclusive schools in Saudi Arabia usually have mild to moderate disabilities.

There is, however, a lack of research on students with severe disabilities in special education institutes in Saudi Arabia, including a lack of research on the use of AT. As indicated previously, students with severe intellectual and developmental disabilities have a greater need for AT devices and services (Lancioni et al., 2012). There is little known about Saudi teachers’ use of AT with these students, particularly in special education institutes.

Moreover, no study has been conducted on the use of AT with students with severe intellectual and developmental disabilities in special education institutes. Also, no study has addressed the elements that should be considered when selecting, using,
and evaluating the use of AT among students with severe intellectual and developmental disabilities in Saudi Arabia. Given the lack of research, there is a critical need to study teachers’ perspectives on their use of AT in special education institutes, and other related aspects such as the types of AT that have been used with students with intellectual and developmental disabilities, procedures that have been considered by teachers, resources needed, and barriers.

**Considerations Regarding AT Use**

When using AT devices and services, a number of factors should be taken into consideration before, during, and after the implementation. One of the most significant considerations and initial steps is to plan for the AT in the IEP. Recently, a study has been carried out by Chambers et al. (2018) to explore teachers' perspectives of the use of iPads in K-12 schools with students with disabilities. The study included 393 teachers and other professionals from the United States, UK, Canada, and Australia. Among other findings, about 33% of participants reported the use of iPad was incorporated in the IEPs. The role of the IEP team members is critical for successful use of AT devices and services. Zabala (1995) indicated that IEP team members should carefully review and evaluate the student, the environment, and the tasks before they select the appropriate tools.

During development of students’ IEPs, AT services or devices should be considered from different aspects. Based on the students’ disabilities and needs, IEP team members should first decide whether the students need AT services and devices or not (IDEA, 2004). The IEP team should also consider what the most suitable AT
services and devices are for meeting the needs of each student. Overall, all IEP team should be knowledgeable regarding the use of AT with their students (Chambers, 1997). Providing AT may not be effective for students with disabilities unless those students know how to use that AT (Lancioni et al., 2012). In other words, students’ ability to use AT is critical.

**SETT Model**

Zabala (1995) developed the SETT framework to help IEP team members consider the most important factors when deciding on the use of AT for students with disabilities. This framework provides detailed guidelines for selecting the most appropriate AT devices and services based on four major areas: the students and their abilities to use AT, the environment and how it supports the use of AT, the tasks and how they will be done using AT tools, and finally the tools and how they improve students’ performance. More specifically, the following questions in the SETT framework should be taken into consideration when selecting AT (Zabala, 1995):

**The Student:**

1. What does the student need to do?

2. What are the student's special needs?

3. What are the student's current abilities?

**The Environment:**
1. What materials and equipment are currently available in the environment?

2. What is the physical arrangement? Are there special concerns?

3. What is the instructional arrangement? Are there likely to be changes?

4. What supports are available to the student?

5. What resources are available to the people supporting the student?

The Tasks:

1. What activities take place in the environment?

2. What activities support the student's curriculum?

3. What are the critical elements of the activities?

4. How might the activities be modified to accommodate the student's special needs?

5. How might technology support the student's active participation in those activities?

The Tools:

1. What strategies might be used to invite increased student performance? What no-tech, low-tech, and high-tech options should be considered when developing
a system for a student with these needs and abilities doing these tasks in these environments?

2. How might these tools be tried out with the student in the customary environments in which they will be used?

Following the SETT guidelines, considering AT devices and services requires collaboration among IEP team members. According to the IDEA (2004), decisions about using AT with students with disabilities should be made by the IEP team members. In other words, it is not appropriate for a teacher to make an individual decision regarding AT use. About 80% of states expected IEP team members to collaboratively make decisions regarding students’ need for and use of AT, however, no specific criteria were provided for making those decisions (Bausch et al., 2008). SETT framework can guide the IEP team members to make collaborative decisions regarding AT use (Bouk, Flanagan, Miller, & Bassette, 2012).

**Education Tech Points Model**

Bowser and Reed created the education tech points model in 1995 to provide teachers with a framework for considering, choosing, and using the appropriate AT for individuals who experience disabilities. This model of AT planning is considered guidance for IEP team members during the referral, development, and evaluation of a student’s IEP (Edyburn, 2001; Reed & Browser, 2012). The education tech points framework contains a series of key questions that guide and assist in making decisions about selecting and using AT. The key points are as follows: (a) referral; (b) evaluation;
(c) extended assessment; (d) plan development; (e) implementation; and (f) periodic review (Bowser & Reed, 1995; Edyburn, 2001).

**Technological Pedagogical and Content Knowledge**

The technological pedagogical and content knowledge (TPACK) framework originated from the pedagogical content knowledge (PCK) framework of Lee Shulman (1986, 1987) (Koehler & Mishra, 2009). The PCK framework proposed that teachers should have knowledge of both pedagogy and content (what they already know and how to teach it) (Bouck, 2016). Koehler and Mishra (2009) believed that good teaching that integrates technology contains three main elements: pedagogy, content, and technology. Therefore, Koehler and Mishra (2009) built on PCK to include technology.

![Figure 3. The TPACK framework and its knowledge components.](image)

In TPACK, content knowledge (CK) refers to what teachers know about the lesson they teach, and the pedagogical knowledge (PK) means teachers’ deep understanding of how to apply that with technology in classroom with students who experience disabilities (Koehler & Mishra, 2009). The TPACK framework can be applied
in teachers’ preparation and also as a guide for teachers making decisions about AT devices and services (Bouck, 2016).

**Categories of AT**

Generally, AT devices have been divided into three categories: low-tech, mid-tech, and high-tech (Constantinescu, 2015; Ganschow, Philips, & Schneider, 2001). Some consider only two types of AT among individuals with severe disabilities: low-tech and high-tech (Reichle, 2011). However, all three categories of AT will be considered in this research.

**Low-tech**

The nonelectronic AT devices are usually known as low-tech. These tools are accessible, cheap, and easy to adapt for students with disabilities (Alkahtani, 2013; Constantinescu, 2015; Cook & Hussey, 2002). Also, such devices are easy to use because they can be customized based on students’ specific abilities and needs (e.g., flashcards, adapted chairs and tables, manual communication boards, pen or pencil grips, canes, and highlighters). These low-tech devices do not require training nor the ongoing maintenance high-tech devices require.

**Mid-tech**

Mid-tech devices usually refer to the electronic devices that are easy to use with students with disabilities, require only little training, and their maintenance is not
complicated (Alkahtani, 2013; Constantinescu, 2015). Examples of some mid-tech devices include talking calculators, adapted keyboards, and electronic dictionaries.

**High-tech**

The high-tech devices are generally expensive and difficult to find (Cook & Hussey, 2002). Such devices with complex features require more training; advanced skills to be able use them, and ongoing maintenance. Examples of high-tech tools incorporate electronic tablets such as iPads, iPods, or other advanced devices.

Universally, the low-tech, mid-tech, and high-tech categorization of AT seems to be used most often, and it is generally based on the level of the technology, cost, and availability (Constantinescu, 2015). Cook and Hussey (2002) believe that "as the field advances, there will be new considerations that will further stretch our concepts and force new ways of categorizing and describing assistive technology" (p. 9), and that, as a result of the increasing number of AT devices, "yesterday’s high tech is tomorrow’s low tech" (Cook & Hussey, 2002, p. 9).

Using the appropriate type of AT depends on the students’ needs and abilities (Zabala, 1995). The IEP team may consider the type of AT that best suits the student and the availability of the device during development of the IEP (IDEA, 1997). Families in the U.S. should know that, once the IEP team has selected suitable AT devices and services for the student, these AT devices and services should be provided for free regardless of the high cost of high-tech devices (IDEA, 1997).
Students with Disabilities and Universal Design for Learning

The Universal Design for Learning (UDL) framework was developed based on the idea that all people regardless of their abilities should have access to all services in the environment (Mace et al., 1991). The first time the term “universal design” appeared was in the 1950s (Rose & Meyer, 2002). In the beginning, this idea received widespread attention in Europe, Japan, and the U.S., and the main focus was on individuals with physical disabilities and their access to buildings (Rose & Meyer, 2002). The World Design Congress in 1987 passed the decision that designers should consider the needs of individuals with disabilities in designing buildings (Adaptive Environments, 2006).

The UDL framework becomes more important today with the increasing numbers of modern and complicated tools and services. Individuals with disabilities may face barriers accessing resources and information, thus UDL bridges the gap to assist them in gaining access to what they need. Zascavage and Winterman (2009) contend that UDL assists teachers in creating different methods of teaching in the classrooms, and AT plays an important role in making this a success. Moreover, UDL supports including students with disabilities, particularly students with severe intellectual and developmental disabilities, to communicate and participate in the school settings and in their communities as well (Rao, Smith, & Lowrey, 2017).

The Effectiveness of AT

In a survey of 393 professionals and teachers of students with disabilities in the UK, USA, Australia, and Canada, Chambers et al. (2018) found that the participants'
perspectives of student use of iPad was very positive. Numerous studies show the benefit of using AT devices and services among individuals with disabilities (Cannella-Malone, Konrad, & Pennington, 2015; Davies & Stock, 2012; Dyal, Cappenter, & Wright, 2009; Edyburn, 2006; Palmer, Wehmeyer, Davies & Stock, 2012; Wisconsin Assistive Technology Initiative, 1998). Legislation and regulations that ensure full access to AT for individuals with disabilities have been promulgated because of the benefit and importance of AT in their lives. In regard to students with severe intellectual and developmental disabilities, AT plays a significant role in their education (Jones et al., 2015). This group of students may use interactive software in learning, as Weber and Demchak (1996) pointed out. Garner and Campbell (1987) believe that AT can be used to create opportunities to include students with disabilities with their peers who do not have disabilities to develop their communication skills and other skills in their community. In addition, AT devices and services can enable access to general education in the classroom and participation in activities (Dyal, Cappenter, & Wright, 2009). Moreover, using AT decreases the difficulties that students with disabilities face in learning (Blackhurt & Edyburn, 2000). "For most people, technology makes things easier. For persons with disabilities, technology makes things possible" (IBM, 1991, p. 2).

In some areas, individuals with severe intellectual and developmental disabilities face more difficulties than their peers. Those areas include communication, living skills, management skills, reading, writing, science, and math. Because of the restrictions in these areas, children with severe intellectual and developmental disabilities require assistance to live as independently as possible. Assistive technology can be a great
support for individuals with severe intellectual and developmental disabilities to overcome these difficulties in their educational and social lives.

**Communication**

Individuals with severe intellectual and developmental disabilities usually experience difficulties in their ability to communicate (Jones, 2017). Those with communication disorders usually have deficits in expressive language and/or receptive language and in understanding and processing verbal and nonverbal symbols (American Speech-Language-Hearing Association, 1993). Assistive technology services and devices can be a solution to helping these individuals improve their communication skills. Studies show that AT services and devices can meet the communication needs and enhance the communication skills of individuals with intellectual disabilities.

In a survey of 1,617 family members of individuals with intellectual disabilities by Palmer, Wehmeyer, Davies and Stock (2012), results showed that approximately 13% of participants said that their family member with a disability used a communication device to assist them in communicating with others. Approximately 11% claimed their family members did not have access to a communication device, but believed they could benefit from communication devices. Moreover, 54% (n = 84) of those participants who indicated that their family members used communication devices said that they need more than one communication device. In general, the use of communication devices has increased among individuals with intellectual disabilities aged 1–22 years, from 20% in 1999 to 24% in 2012, and for those aged 22 years and older, from 4.9% to
7% (Palmer, Wehmeyer, Davies & Stock, 2012). Finally, Al Faraj and Kuyyini (2014) indicated that use of AT by individuals with Down syndrome improve their communication skills.

**Reading**

Reading abilities and skills among individuals with severe intellectual and developmental disabilities differ from those of their peers. Individuals with Down syndrome, which is associated with intellectual disabilities, face problems in reading (Feng et al., 2008). While they are two years behind their age, Feng et al. (2008) believe this gap may increase as they grow up. Feng et al. (2008) claim that a study in the U.K. showed that 35% of students with Down syndrome were not able to read at the age of 8–9 years. In addition, learning reading skills is more difficult for individuals with intellectual disabilities than it is for their peers, and this difficulty leads to more problems and barriers (Van Wingerden, Segers, Van Balkom, & Verhoeven, 2017).

When individuals with severe intellectual and developmental disabilities face barriers and difficulties in reading, the need for AT services and devices becomes more significant. Teachers of students with severe intellectual and developmental disabilities can teach their students reading and reduce their difficulties by using pictures with words and texts (Cannella-Malone, Konrad, & Pennington, 2015; Wisconsin Assistive Technology Initiative, 1998). Moreover, using AT in teaching reading with these students can motivate them to read more (Al Faraj & Kuyyini, 2014). Another advantage of using AT in reading with students with intellectual and developmental
disabilities is that doing so can enable them to access the same curriculum as their peers, allowing them to be more integrated into the classroom (Wood, 2015).

**Writing**

Students with disabilities in general education settings usually face difficulties in writing at the early childhood level (National Center for Educational Statistics, 2011), and these writing difficulties are even more pronounced among students with severe intellectual and developmental disabilities (Lancioni et al., 2012). Due to their motor and cognitive deficits, these students may not be able to use a regular pen or pencil, or a regular computer in writing (Lancioni et al., 2012). Research has shown that AT can be one of the best ways to assist students with such disabilities and improve their writing (Sitko, Laine, & Sitko, 2005). For instance, for those students with severe intellectual and developmental disabilities who can use the regular computer keyboard, the writing process can be easier and faster when using a word-processing program that predicts words for users (Antonucci et al., 2006; Bouck, Meyers, Hunley, Satsangi & Savage, 2015; Edyburn, 2006; Williams 2002). For other students who cannot use the regular computer keyboard, they have options such as pointing devices or a head-operated joystick (Brodwin et al., 2004; Evans et al., 2000).

**Barriers to the Use of AT**

A variety of challenges faced by special education teachers and their students limit their use of AT services and devices. This, of course, limits the benefits students might earn from using AT in the classroom. These barriers play critical roles in reducing
the achievement of desired educational goals. In that sense, the barriers to AT use have been studied and discussed in research worldwide. Numerous studies have shown that AT devices and services are not used as much as they could be to assist students with disabilities in schools (Ajuwon & Chitiyo, 2016; Alkahtani, 2013; Al-Moghyrah, 2017), because certain barriers hinder special education teachers from using AT among their students with disabilities (Chambers et al., 2018; Davis, Barnard-Brak, & Arredondo, 2013; Flanagan et al., 2013).

Among the most important factors in using AT with students with severe intellectual and developmental disabilities are teachers’ knowledge, attitudes, and ability to deal with AT and utilize it successfully. Michaels and McDermott (2003) indicated that researchers are "almost universally in agreement that the success of students with disabilities with AT is related directly to the AT knowledge, skills, and dispositions of special education teachers" (p. 29). However, a lack of knowledge among special education teachers regarding the use of AT has been noticed in a number of studies (Ajuwon & Chitiyo, 2016; Alkahtani, 2013; Al-Moghyrah, 2017; Bausch & Hasselbring, 2004; Hawsawi, 2007).

Bausch and Hasselbring (2004) described the tasks, skills, and knowledge that AT providers should have when considering AT for students with disabilities as follows:

(a) Assess/evaluate students who have been referred for AT. (b) Match students to the most appropriate devices. (c) Consult with school faculty and/or individual teachers. (d) Train students, teachers, and families on using a specific
device. (E) Collaborate with IEP team members. (F) Provide professional development trainings to school staff. (G) Purchase equipment. (H) Collaborate with other staff to include students with disabilities into the general education classroom. (I) Adapt and modify the curriculum. (J) Follow-up and evaluate AT implementation. (p. 101)

In other words, without mastering these skills and completing the required skills, or what Bausch and Hasselbring (2004) refer to as “job responsibilities” AT services providers, including teachers, cannot fully benefit students with disabilities. Another study shows that most special education teachers could recognize only the low-tech devices among 30 different AT items, and about 80% of them were interested in taking training programs on the use of AT (Wahl & Buzolich, 2001).

Usually, such skills and knowledge can be obtained from training programs. This, however, is associated with another significant barrier, which is the lack of training of teachers, families, and other service providers (Chambers et al., 2018; Davis, et al., 2013; Flanagan et al., 2013; McGregor & Pachuski, 1996). The lack of special education teachers’ training in the use of AT devices has been reported in a number of studies (Alkahtani, 2013; Flanagan et al., 2013; Jost & Mosley, 2011; Ribeiro & Moreira, 2010). It was reported in Alkahtani’s study (2013) that about 92.9% (n = 118) of teachers participating in her study never attended any training on AT. Similarly, Ribeiro and Moreira (2010) stated that 84% of teachers did not have AT training.

Based on the results of a study conducted by Wahl (2002), Bausch and Hasselbring (2004) alleged that AT training programs at the pre-service level are not
sufficient. If these programs are insufficient, special education pre-service teachers might not be sufficiently prepared to use AT with students with disabilities, and that may become a challenge for them and their students when they become teachers.

Another challenge that teachers of students with severe intellectual and developmental disabilities may face when considering AT use with their students in classrooms is the lack of experienced or trained staff who can assist teachers and their students in using AT (Bausch & Hasselbring, 2004). Individualized education plan team members are generally not prepared to decide whether students need AT services and devices, and the staff in schools are also not sufficiently prepared to assist (McGregor & Pachuski, 1996; Todis, 1996). The National Council on Disability study (2000) stated:

More and more individuals with disabilities and elders find themselves in need of assistive technology to remain independent and productive, yet access to expertise to assist in obtaining such technology is limited. While modest investments have been made in increasing the pool of individuals with assistive technology knowledge and skills, we continue to fall further and further behind the need (Barrier: awareness and expertise section, ¶ 1).

This report shows how such a barrier could limit the benefit of AT to students with disabilities. Judge and Parrette (1998) stated that some families had said that even they know more about AT than do the services providers who should be assisting them.

Other barriers to using or accessing AT devices and services have been reported in the literature. One of the common barriers found is the lack of access to and the inability to use AT devices. The large number of AT devices is sometimes considered a
barrier (Bausch & Hasselbring, 2004; Davis, Barnard-Brak, & Arredondo, 2013). According to Davis et al. (2013), more than 20,000 AT devices can be used in schools to assist students with disabilities. With the increasing numbers of AT devices, individuals with disabilities, their teachers, and their families may face challenges keeping up to date with the new AT devices, yet they need to know how to use them appropriately to benefit from those devices (Bausch & Hasselbring, 2004; Davis et al., 2013; Judge & Parrette, 1998). Davis et al. (2013) stated, “the complexity of AT delivery to students with disabilities is intricate and multi-faceted” (p. 16).

Recently, Al-Mogyrah (2017) explored the perspectives of 50 teachers regarding the barriers that hinder their use of AT among students with Down syndrome in inclusive schools in Riyadh, Saudi Arabia. He found that the most frequently reported barrier among the participants was that there were some teachers who negatively influenced their colleagues regarding AT use. Also, it was reported that there was a lack of efficient AT devices in schools. Most of the AT devices in Saudi Arabia did not support Arabic-language software. Lack of time in class, lack of training programs on AT, and lack of families’ cooperation with teachers were also reported as barriers among teachers.

A quantitative study was conducted by Ajuwon and Chitiyo (2016) to examine the AT-related challenges and barriers faced by special educators in Nigeria. The researchers surveyed 165 special educators. They found that there was a lack of AT training, a lack of AT in classrooms because of financial issues, unmet maintenance
costs, a lack of integration of AT with the curriculum, and a lack of electricity to run the AT. These were the most common barriers cited in the study.

Other barriers to the use of technology among Saudi teachers of students with Down syndrome have been reported in a study conducted by Alfaraj and Kuyini (2014). Among other findings, teachers reported that there was a lack of materials, a lack of preparedness among teachers on the technology use, a lack of students’ ability to use the AT, and a lack of Arabic-language software and computers.

Flanagan et al. (2013) conducted a study to explore what special education teachers in middle school perceived as barriers that hinder their use of AT among students with disabilities. Among other findings, the most reported barrier that teachers perceived was the high cost of the AT devices. About 75% of teachers reported that the high cost limited their use of AT with their students. The next most reported factor was the lack of teacher training on AT. About 47% of teachers indicated that there was a need for additional training on AT, and 43% of them reported that they faced difficulties using AT with their students. Because of barriers such as the high cost, difficulty of use, and limited availability of most of the high-tech devices, teachers reported that their use of high-tech was less frequent than their use of low-tech (Flanagan et al., 2013).

According to Wahl (2002), the National Center for Education Statistics gathered and analyzed data regarding the obstacles to using AT devices and services with students with disabilities. The results showed that among the five barriers found, the most common were the “human resource” and the availability of the AT (Wahl, 2002).
The findings also showed that teachers and administrators with more experience were more prepared for using AT than those who had earned their certificate more recently.

Hawsawi (2007) investigated the barriers to the use of technology among teachers of students with intellectual disabilities. In this descriptive study, the researcher developed a survey to collect data from 128 male teachers of students with intellectual disabilities. The findings were divided into categories as barriers related to teachers, school administration, and students. The most frequently reported barriers related to teachers were as follows: (a) a lack of in-service training on the use of AT; (b) a lack of the preparation in using AT in the pre-service level; (c) teachers’ belief that using AT requires more effort; and (d) a lack of knowledge regarding AT. The most frequently reported barriers related to school administration were as follows: (a) a lack of technicians and maintenance services in schools; (b) a lack of devices; and (c) the curriculum does not include guidelines to use technology and it does not state the importance and necessity of using instructional technology in classrooms. Those barriers to using technology that related to students were reported as follows: (a) misuse by students; (b) teachers think that students’ physical and sensory issues limit their ability to use technology; and (c) students’ cognitive deficits mean they have difficulties using technology in classrooms.

Resources Needed

Assistive technology devices and services among students with severe intellectual and developmental disabilities in schools are surrounded by factors that may affect their use and effectiveness. Such factors can either increase the use of AT and
its effectiveness, or they can limit it. Numbers of barriers have been identified in the literature, and these barriers are considered as gap that limit AT use. To reduce the barriers that teachers face in schools when considering AT, and to fill the gap between challenges and successful use, it is critical to know what is needed for more effective and successful use of AT. That makes teachers’ voice important in this point. Providing teachers with the needed resources and support might increase and improve their use of AT among their students (Nam, Bahn, & Lee, 2013). Special education teachers have reported the greatest need for those resources that insure successful use of AT with students with disabilities in schools. Among the resources teachers have reported as necessary for successful use of AT, access to training programs was reported in most of the studies (Abner & Lahm, 2002; Alfaraj & Kuyini, 2014; Al-Mogyrah, 2017; Chambers et al., 2018; Flanagan et al., 2013). For instance, Chambers et al. (2018) surveyed a total of 393 professionals and teachers of students with disabilities and found that 70% of participants indicated there was a need for training on the use of iPad. Other needed resources such as AT devices, financial support, and technical support were also reported in some studies (Alfaraj & Kuyini, 2014; Al-Mogyrah, 2017).

Several resources have been reported by teachers of students with Down syndrome in inclusive schools in a study conducted by Al-Mogyrah (2017) in Riyadh. Teachers indicated that the curriculum they use should include and encourage the use of AT. These teachers also reported needing more financial support to schools so they can get needed AT devices for their students. In addition, they identified a need for in-service training to increase their AT knowledge and skills and a need for AT courses for
pre-service teachers. Finally, teachers indicated that they need more support in terms of materials, maintenance and technical support, and on-shelf lessons for teachers.

Other resources needed for AT use have been found in other studies (Alfaraj & Kuyini, 2014; Flanagan et al., 2013). For instance, Alfaraj and Kuyini (2014) stated that when teachers were asked about the factors that improve the use of technology among students with Down syndrome, the primary resources they reported needing were classroom computers and iPads. Flanagan et al. (2013) found that teachers were in need of additional AT training, time to use AT in classrooms, materials, and support on how to use AT.

Summary

This chapter has discussed topics relevant to the use of AT among students with disabilities in school settings. The chapter presented a history of AT and of the most significant laws and regulations related to AT, such as the Rehabilitation Act of 1973, the Education for All Handicapped Children Act of 1975, the Technology Related Assistance for Individuals with Disabilities Act of 1988 (The Tech Act), and the Americans with Disabilities Act of 1990. The chapter went on to discuss studies related to the use of AT among students with disabilities, particularly students with severe intellectual and developmental disabilities. The chapter then reviewed several studies on the use of AT among students with disabilities in Saudi Arabia. The definitions of and differences among the three AT categories (low-tech, mid-tech, and high-tech), the barriers to AT use encountered by teachers, and the resources most needed by special
education teachers for successful use of AT were presented and discussed at the end of the chapter.

The literature discussed in this chapter shows that there is a lack of research regarding the use of AT with students with severe intellectual and developmental disabilities in special education institutes in Saudi Arabia. There is, therefore, a critical need to explore teachers’ perspectives on their implementation of AT with students with severe intellectual and developmental disabilities in those institutes. This study will be guided by the following questions:

1. How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes? The following three sub-questions help understand the factors that relate to the use of AT.
   1.a. What types of AT do teachers report using with their students and how frequently?
   1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?
   1.c. What elements do teachers report considering when selecting AT for their students?

2. How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?

3. What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?
4. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on

   a. their previous training experiences?
   
   b. their familiarity with AT?
   
   c. their special education institutes?
CHAPTER THREE:

METHOD

Introduction

The purpose of this study was to explore AT use, effectiveness of AT, considerations when selecting AT, barriers, and resources needed from the standpoint of teachers of students with severe intellectual and developmental disabilities in Riyadh, Saudi Arabia. In this chapter, I present the methods used to address the research questions. This includes sections on research design, variables, demographics, population and participants, sampling strategy and sample size, instrumentation, piloting the instrument, validity and reliability, translation of the instrument, data collection, and data analysis.

Research Questions

This study is guided by the following questions:
1. How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes? The following three sub-questions help understand the factors that relate to the use of AT.

   1.a. What types of AT do teachers report using with their students and how frequently?
1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?

1.c. What elements do teachers report considering when selecting AT for their students?

2. How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?

3. What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?

4. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on
   a. their previous training experiences?
   b. their familiarity with AT?
   c. their special education institute?

Research Design

To get in-depth understanding of the issue being studied and a comprehensive picture of the nature of the AT use and the related aspects among teachers of students with severe intellectual and developmental disabilities in special education institutes, both quantitative and qualitative research were utilized. The research design was a sequential explanatory mixed methods design, an approach in which the researcher collects the data in two phases (Ivankova, Creswell, & Stick, 2006). The rationale used in
selecting this method was that the first, quantitative, phase would provide me with results on AT use, barriers, and resources needed, along with the relationship between several variables. The second phase would then provide qualitative data that would assist me in extending and explaining the quantitative data (Creswell, 2015).

In the first phase, I obtained quantitative data via an online survey questionnaire and then analyzed the data. In the second phase, I gathered qualitative data through semi-structured interviews and analyzed that qualitative data to elaborate and interpret the analyzed quantitative data (Clark & Creswell, 2008; Ivankova, Creswell, & Stick, 2006). The last step was integrating the quantitative and qualitative findings (see Figure 4).
Figure 4. Sequential explanatory mixed methods (Creswell, 2015, p. 544).
The emphasis in this sequential explanatory mixed approach (Creswell & Creswell, 2017) was on the first phase. The online survey questionnaire covered all the research questions; the interviews, on the other hand, provided more in-depth information about what had been found.

Variables and Demographics

In this study, I examined the relationship of several grouping variables and teachers’ perspectives on their use of AT, including their perspectives regarding the barriers and the needed resources in their special education institutes:

- **The outcome variables**: Teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources).

- **The grouping variables**: Teachers’ training, familiarity with AT, and special education institutes.

The survey included demographic questions to provide more information about the participants in this study, although not all of these questions are included in the study’s statistical data analysis. The demographic questions asked about teachers’ gender, age, years of experience, level of education, special education institute, previous AT training, and familiarity with AT.

Population and Participants

The target population in this study was special education teachers of students with severe intellectual and developmental disabilities in special education institutes in
Riyadh, Saudi Arabia. According to the Ministry of Education, Education Development Center in Riyadh Region (2018) there are about four special education institutes in Riyadh. Those institutes are divided by gender, and each institute is divided into smaller institutes as follows:

- There are two institutes for males in Riyadh (east and west). Both are divided into elementary, middle, and high institutes. Both institutes (east and west) serve students with severe intellectual and developmental disabilities. There are about 185 male teachers in both institutes, and about 274 students.

- There are also two institutes for females in Riyadh (east and west). Both are divided into elementary, middle, and high institutes. Both institutes (east and west) serve students with severe intellectual and developmental disabilities. There are about 106 female teachers in both institutes, and about 289 students.

That means the total of special education teachers of students with severe intellectual and developmental disabilities in special education institutes in Riyadh is about 291 teachers (Education Development Center in Riyadh Region, 2018). Special education teachers who teach in those institutes usually have diplomas in special education with a concentration in one of the disabilities, such as intellectual disabilities, autism, multiple disabilities, or behavior disorders.

**Sampling Strategy and Sample Size**

**Sampling Strategy**

A purposeful sampling strategy was employed to recruit participants for this study. Because the purpose of this study was to explore the perspectives of teachers of
students with severe intellectual and developmental disabilities on AT use in four special education institutes in Riyadh and to get as many interpretations and explanations as possible about the issue being studied, a purposeful sampling was a logical choice. Researchers can utilize a purposive sampling technique to "select people or sites who can best help us understand our phenomenon" (Creswell, 2015, p. 205). There are numbers of purposive sampling strategies that researchers can utilize (Patton, 2015); I used snowball sampling (Creswell, 2015). Simply put, the snowball strategy is "a form of purposeful sampling that typically precedes after a study begins and occurs when the researcher asks participants to recommend other individuals to be sampled" (Creswell, 2015, p. 208). Particularly in the second phase of the study, I asked participants to recommend other special education teachers to be interviewed. I also asked a number of teachers, during the first phase, to send the online survey questionnaire link to their colleagues in order to recruit as many participants as possible.

Sample Size

To find the appropriate sample size for this study, I used G*Power software. Several points should be considered when utilizing G*Power software: (1) effect size, (2) significance level, and (3) the desired power (Cozby, 2012; Creswell, 2012). In regard to effect size, I used the table below, which shows the conventions Cohen (1988) suggested, and I chose $d = .50$ for a medium effect size.
Table 1

Effect size suggestions

<table>
<thead>
<tr>
<th>ES</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small effect size</td>
<td>.20</td>
</tr>
<tr>
<td>Medium effect size</td>
<td>.50</td>
</tr>
<tr>
<td>Large effect size</td>
<td>.80</td>
</tr>
</tbody>
</table>

I used an alpha level of 0.05 in this study, and as Cozby (2012) indicated “researchers usually use a power between .70 and .90 to determine sample size,” I decided to use .80 in this study. With these values, the G*Power software provided me with the appropriate number of participants for this study as a total of 176 teachers.

Instrumentation

In this study, a self-administered online survey (Qualtrics) and online interviews (FaceTime) were utilized to gather data from participants. The online survey consisted of items derived from a review of the literature and were designed to answer the research questions. The domains and items covered the use of all three categories of AT with students with severe intellectual and developmental disabilities, teachers’ perspectives regarding the effectiveness of those categories, considerations taken when selecting AT for students, barriers that limit teachers’ AT use, and resources needed. I used three categories of AT (low-tech, mid-tech, and high-tech) and defined them with examples on the first page of the survey. I gave additional examples each time the categories were mentioned. In regard to selecting AT for students, all items given in the
survey questionnaire were suggested in the literature and recommended by the SETT framework.

In regard to the items on barriers, I provided participants with a list of the 12 barriers reported most often in previous studies by teachers of students with disabilities. The items on the list of resources needed for effective use of AT were also those reported most frequently in the literature. At the end of the survey, I gave participants a chance to write comments and provide more answers on any of the items and domains. Details regarding the validity and reliability of the survey are provided in the next section (“Piloting the Instrument”).

The first page of the survey described the purpose of the study; defined AT, including the three categories of low-tech, mid-tech, and high-tech; stated the participants’ rights; provided a statement of informed consent; and gave instructions and the researcher’s contact information. The survey consisted of five sections as follows: (1) demographics, (2) the use of AT (types and frequency, teachers’ perspectives regarding the AT effectiveness, and elements when selecting AT), (3) the barriers to the use of AT, (4) resources, and (5) an open-ended question.

The demographics section included questions about teachers’ gender, age, years of experience, level of education, the name of the special education institute they worked at, AT training, types of training, number of training courses or programs taken, and their familiarity with AT. The item of the AT familiarity was derived and adapted with permission from Constantinescu (2015). The second section of the survey, focused on the use of AT, consisted of three parts: (a) types and frequency of AT use, (b)
effectiveness, and (c) considerations. Teachers were asked in the first part about the
types of AT (low-tech, mid-tech, high-tech) and how frequently they used them (1= Never, 2= 1–2 Days a week, 3= 2–3 Days a week, 4= 3–4 Days a week, 5= Almost every
day). In the second part of this section, focused on effectiveness, teachers were asked
about the effectiveness of the use of each AT type (low-tech, mid-tech, high-tech) with
students. They were given a 5-point Likert scale to respond (1= Not effective at all, 2= Slightly effective, 3= Moderately effective, 4= Very effective, and 5= Extremely
effective).

In the third part of this section, considerations, teachers were asked about the
elements they consider when selecting AT for their students. For each listed element, they were given a 5-point Likert scale to indicate how often they considered the element (1= Never, 2= Rarely, 3= Sometimes, 4= Often, and 5= Always), and the fifth statement was negatively worded item (1= Always, 2= Often, 3= Sometimes, 4= Rarely, and 5= Never).

The third section of the survey, barriers to the use of AT, included 12 items using a 5-point Likert scale (1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly agree). The fourth section, resources, included four items using a 5-point Likert scale (1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly agree). The last section included a general open-ended question, which asked the participants to write any comments regarding AT use, considerations, effectiveness, barriers, and/or resources needed. The estimated time needed to complete the survey was less than 10 minutes.
At the end of the survey, there was a link to another survey telling the participants that if they would be willing to participate in a 30-to-45-minute online interview, they could write their email addresses. In the second phase, after I had collected and analyzed the quantitative data, I conducted semi-structured interviews to gather in-depth data in order to interpret and elaborate the quantitative results.

**Piloting the Instrument:**

I conducted a pilot study to test the survey instrument to determine whether there was a lack of clarity and to identify its weaknesses and strengths. Johnson and Brooks (2010) suggested the appropriate number of participants for the pilot study, which was about 30 participants. Hence, I disseminated the instrument to more than 50 teachers of students with intellectual and developmental disabilities in inclusive schools in Riyadh and other cities in Saudi Arabia using an online survey (Qualtrics). After 10 days, with one reminder sent on the seventh day, the survey was closed. A total of 24 surveys were returned, 18 of which were completed. I could not reach a larger pilot group due to time constraints. Although the number of participants in this pilot study was low, from the results I was able to identify the items that needed clarification or other modification. Additionally, using the Cronbach’s alpha test, I tested the reliability of the instrument and the results indicated that it was reliable. More details about the reliability of the instrument are discussed in the next section.
Validity and Reliability

Validity refers to "the extent to which the instrument measures what it is intended to measure" (Frey, 2006, p. 136). I used content and face validity tests to measure the validity of the survey instrument. Literature review and professors’ reviews were used to support and measure the content validity (Lamb, Annetta, & Vallett, 2014). I contacted four professors in Saudi universities who were familiar with the use of AT with students with disabilities. It is always important to have professors with expertise in the same field and topic check the validity of the instrument (Lamb, Annetta, Meldrum, & Vallett, 2012). Furthermore, the selected professors were also fluent in both Arabic and English and could review both versions. The professors were asked to check the instrument’s face validity including its accuracy, appearance, and clarity.

Creswell (2008) stated, “Reliability refers to whether scores to items on an instrument are internally consistent (i.e., Are the item responses consistent across constructs?), stable over time (test-retest correlations), and whether there was consistency in test administration and scoring” (p. 233). I applied a Cronbach’s alpha test using SPSS software (Vanderstoep & Johnston, 2009) to check the reliability and internal consistency (Cronbach, 1951) of the survey instrument used in this study. I checked the items in the second section, the use of AT, as follows: part I, AT types and frequency; part II, effectiveness; and part III, considerations. Also, I checked the items in the section on barriers to the use of AT, which included 12 items, and the items in the fourth section, resources, which included four items. The results of the Cronbach’s
alpha test were .77 and showed that the survey was reliable for all items. The following table shows the Cronbach's alpha for all sections.

Table 2

<table>
<thead>
<tr>
<th>Section</th>
<th>Number of items</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of AT</td>
<td>11</td>
<td>.61</td>
</tr>
<tr>
<td>Barriers</td>
<td>12</td>
<td>.72</td>
</tr>
<tr>
<td>Resources</td>
<td>4</td>
<td>.70</td>
</tr>
</tbody>
</table>

In regard to the credibility of the findings and interpretations, two strategies were suggested: member checking and auditing (Creswell, 2015; Creswell & Miller, 2000; Lincoln & Guba, 1985; Park & Lee, 2010). Hence, to ensure the credibility of the data gathered from the participants, I conducted both member checking and an external audit. Member checking, simply put, is checking with participants to confirm the responses recorded for them were accurate. Directly after transcribing each interview, I emailed the participant the transcript to allow him or her to check and review the data that had been obtained during the interview. After a few days, I received confirmations from all, which did not involve any corrections.

The external audit strategy, on the other hand, is hiring individuals who are familiar with the issue being studied to review the data and provide feedback (Creswell, 2015). In order to ensure the accuracy of the qualitative findings, three doctoral students with expertise in special education reviewed the interview questions and the findings, including themes and sub-themes that resulted from the participants’ answers. All suggestions given by the auditors were taken into consideration.
Translation of the Instrument

The participants in this study are native Arabic speakers. Thus, it was necessary to translate the English survey instrument that I developed into Arabic so participants could understand it. I took several steps to check the quality of the translation. First, the final English version of the instrument was sent to three professors with expertise in special education at the University of South Florida (USF) to review and approve it. After that, I translated the instrument into Arabic. The Arabic version was sent to a Certified Office of Translation in Riyadh, Saudi Arabia so they could check it, compare it to the English version, and make any necessary changes. The final step was the back-translation technique. I sent only the Arabic version of the instrument to two faculty members in Saudi Arabia who are experts in both languages to translate it back into English. All of the professors’ suggestions were taken into consideration.

Data Collection and Analysis

I contacted the Ministry of Education at the Education Department in Riyadh and asked for permission to conduct the study. After getting the permission letter from Saudi Arabia, I completed the IRB application at USF to get their approval to conduct the study in Riyadh. After receiving the official permission letter from USF, I launched the online survey using Qualtrics software. The survey link was distributed to four teachers, who played the role of mediators and distributed it to all teachers in the four special education institutes using their WhatsApp groups, which included only teachers in their institutes. After 10 days, the mediators sent a reminder message in WhatsApp to
teachers. Twenty days after distributing the survey, another reminder was sent. I gave participants several additional days and then closed the survey. To collect the qualitative data in the second phase of this study, I had included a link at the end of the survey that pointed to another survey, which asked participants whether they would be willing to participate in a 30-to-45-minute online interview using Zoom, Skype, FaceTime, or any other conferencing software. The additional link was used to separate interviewees’ contact information from their survey and keep the surveys anonymous.

This study consisted of two phases, quantitative and qualitative. In the first stage, I employed descriptive and inferential statistics to analyze the data gathered from the online survey. Descriptive statistics including frequencies, percentage means, and standard deviation were explained in tables and figures. Moreover, to answer the fourth question (4.a), a two-sample t-test was employed to measure the significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their training experiences.

To answer questions 4.b and 4.c, one-way analysis of variance (ANOVA) was employed to measure the significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their familiarity with AT (4.b) and their special education institutes (4.c).

I tested several assumptions prior to employing a two-sample t-test: (1) normality, (2) homogeneity of variance, and (3) assumption of independence. I also
tested these three assumptions for the ANOVAs that were assessed in this study. I utilized the Statistical Package for the Social Sciences (SPSS) software version 22 to analyze the data. I analyzed data from the survey’s open-ended question using content analysis and created categories and sub-categories from the obtained data (Creswell, 2012; Hsieh & Shannon, 2005; Mayring, 2004).

In the study’s second phase, I conducted semi-structured interviews to gather in-depth data from the participants and also to assist in explaining and interpreting results obtained from the survey. The interview questions focused on outcomes from the first phase. More details regarding those outcomes are discussed in detail in Chapters 4 and 5. All interviews were recorded and transcribed. I used thematic analysis and coded the common themes and sub-themes in the transcribed interviews (Creswell, 2012; Mayring, 2004).

The following table summarizes the study’s research questions and associates them with the related data analysis methods.

Table 3

<table>
<thead>
<tr>
<th>Data collection and analysis by research questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Question</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>1.a. What types of AT do teachers report using with their students and how frequently?</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Phase2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Semi-structured interviews: Based on the quantitative data needing to be elaborated.</td>
</tr>
<tr>
<td>- Thematic analysis.</td>
</tr>
<tr>
<td>Research Question</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1.c. What elements do teachers report considering when selecting AT for their students?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2. How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3. What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table 3

Continued

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.a. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their previous training experiences?</td>
<td>Phase1 - Survey: Inferential statistics: Two-sample t-test.</td>
</tr>
<tr>
<td></td>
<td>Phase2 - Semi-structured interviews: Based on the quantitative data needing to be elaborated. - Thematic analysis.</td>
</tr>
<tr>
<td>4.b. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their familiarity with AT?</td>
<td>Phase1 - Survey: Inferential statistics: One-way analysis of variance (ANOVA).</td>
</tr>
<tr>
<td></td>
<td>Phase2 - Semi-structured interviews: Based on the quantitative data needing to be elaborated. - Thematic analysis.</td>
</tr>
<tr>
<td>4.c. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their special education institutes?</td>
<td>Phase1 - Survey: Inferential statistics: One-way analysis of variance (ANOVA).</td>
</tr>
<tr>
<td></td>
<td>Phase2 - Semi-structured interviews: Based on the quantitative data needing to be elaborated. - Thematic analysis.</td>
</tr>
</tbody>
</table>

Summary

In order to answer this study’s research questions, I employed a sequential explanatory mixed methods design. I conducted a self-administered online survey (Qualtrics) and online interviews (FaceTime) to collect data from participants. Research
design, variables, demographics, population, participants, sampling strategy, instrumentation, validity, reliability, and pilot study were discussed in greater detail in this chapter. I analyzed study data in two phases: in the first, quantitative, phase, I employed descriptive and inferential statistics; in the second, qualitative, phase, I analyzed the data gathered from the semi-structured interviews using thematic analysis.
CHAPTER FOUR:

RESULTS

Introduction

The purpose of this study was to explore teachers’ perspectives on their use of AT with students with severe intellectual and developmental disabilities in special education institutes in Riyadh, Saudi Arabia. A mixed methods sequential explanatory design was selected for the study. As explained in the previous chapter, the data were collected in two phases. First, data were collected by means of an online survey questionnaire, which was followed by an analysis of the data. Second, qualitative data were collected by means of semi-structured interviews and subsequently analysed. This chapter describes the sample and demographic information, discusses the findings of the two phases in relation to the research questions, and concludes with a short summary.

This study was guided by the following questions:

1. How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes? The following three sub-questions help understand the factors that relate to the use of AT.

1.a. What types of AT do teachers report using with their students and how frequently?
1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?

1.c. What elements do teachers report considering when selecting AT for their students?

2. How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?

3. What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?

4. Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on
   a. their previous training experiences?
   b. their familiarity with AT?
   c. their special education institutes?

Sample and Response Rate

As explained in the previous chapter, the target population of this study was special education teachers of students with severe intellectual and developmental disabilities in special education institutes in Riyadh, Saudi Arabia. There are approximately 291 male and female special education teachers in the four special education institutes in Riyadh (Department of Education in Riyadh Region, 2018). The link for the online survey questionnaire was disseminated to all 291 teachers in the four
institutes concerned: the Intellectual Education Institute for Boys in western Riyadh, the Intellectual Education Institute for Girls in western Riyadh, the Intellectual Education Institute for Boys in eastern Riyadh, and the Intellectual Education Institute for Girls in eastern Riyadh. A total of 148 surveys were returned, with a response rate of 51%. In 56 surveys, only the demographics and a few other items were answered, and those surveys were therefore excluded. A total of 92 surveys were fully completed (N=92).

**Demographic Information**

With a view to gaining a better understanding of the participants and their background, data were collected regarding their demographic information.

**Gender**

The study sample included 40 males, representing a response rate of 43.5%, and 52 females, representing a response rate of 56.5% from the four special education institutes, as presented in Table 4.

**Age**

Table 4 presents the frequency and percentages of the participants in terms of age. Age was divided into four groups: younger than 30 years, 31 to 35 years, 36 to 40 years, and more than 40 years. Forty-four of the teachers (47.8%) were older than 40, 9 teachers (9.8%) were aged between 36 and 40, 23 teachers (25.0%) were aged between 31 and 35, and 16 teachers (17.4%) were younger than 30.
Experience

Of the 92 teachers, 45 (48.9%) had more than 15 years’ experience of teaching students with disabilities, 8 (8.7%) had 11 to 15 years’ experience, 26 (28.3%) had 6 to 10 years’ experience, and 13 (14.1%) had 1 to 5 years’ experience.

Qualifications

Seventy-eight (84.8%) of the teachers – the majority – had a bachelor’s degree in special education, 12 teachers (13%) had a master’s degree, and only two teachers (2.2%) had a diploma in special education.

Number of Training Courses

Of the 49 teachers who had received previous training on the use of AT, 29 teachers reported that they had attended only one or two training courses, 14 teachers had attended three to five training courses, and only 6 teachers reported that they had attended more than five training courses.

Type of Training

As illustrated in Table 4, of the 49 teachers who had received previous training on AT, 7 (7.6%) reported that they had received training during their college years, 33 (35.8%) had received training through the professional development training programs provided by the Ministry of Education, and 20 (21.7%) had undertaken self-training.
Table 4

Participants’ demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Population</th>
<th>Sample</th>
<th>Percent of Total Population</th>
<th>Percent of Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>185</td>
<td>40</td>
<td>21.7</td>
<td>43.5</td>
</tr>
<tr>
<td>Female</td>
<td>106</td>
<td>52</td>
<td>49</td>
<td>56.5</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30 years</td>
<td>16</td>
<td></td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>31-35</td>
<td>23</td>
<td></td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>36-40</td>
<td>9</td>
<td></td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>More than 41 years</td>
<td>44</td>
<td></td>
<td>47.8</td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5 years</td>
<td>13</td>
<td></td>
<td>14.1</td>
<td></td>
</tr>
<tr>
<td>6-10 years</td>
<td>26</td>
<td></td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>11-15 years</td>
<td>8</td>
<td></td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>More than 15 years</td>
<td>45</td>
<td></td>
<td>48.9</td>
<td></td>
</tr>
<tr>
<td>Qualification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>78</td>
<td></td>
<td>84.8</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td>12</td>
<td></td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>2</td>
<td></td>
<td>2.2</td>
<td></td>
</tr>
</tbody>
</table>
Table 4

Continued

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Training</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 Training Courses</td>
<td>29</td>
<td>31.5</td>
</tr>
<tr>
<td>3-5 Training Courses</td>
<td>14</td>
<td>15.2</td>
</tr>
<tr>
<td>More than 5 Training Courses</td>
<td>6</td>
<td>6.5</td>
</tr>
<tr>
<td>None</td>
<td>43</td>
<td>46.7</td>
</tr>
<tr>
<td><strong>Type of Training</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During College</td>
<td>7</td>
<td>7.6</td>
</tr>
<tr>
<td>Professional Development</td>
<td>33</td>
<td>35.8</td>
</tr>
<tr>
<td>Programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Learning</td>
<td>20</td>
<td>21.7</td>
</tr>
<tr>
<td>None</td>
<td>43</td>
<td>46.7</td>
</tr>
</tbody>
</table>

Demographics of Grouping Variables

**Special Education Institute**

Table 5 presents the frequency and the percentages of the participants in terms of the special education institute at which they work. It demonstrates that there were a higher number of participants from the two girls’ special education institutes than from the two boys’ institutes. Twenty-eight teachers (30.4%) were from the Intellectual Education Institute for Girls in eastern Riyadh, and 24 (26.1%) from the Intellectual
Education Institute for Girls in western Riyadh. By contrast, 22 teachers (23.9%) were from the Intellectual Education Institute for Boys in western Riyadh, and only 18 (19.6%) from the Intellectual Education Institute for Boys in eastern Riyadh.

Table 5

*Special education institutes*

<table>
<thead>
<tr>
<th>Special Education Institute</th>
<th>Population</th>
<th>Sample</th>
<th>Percent</th>
<th>Percent of Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Intellectual Education Institute for Boys in eastern Riyadh</td>
<td>110</td>
<td>18</td>
<td>16.3</td>
<td>19.6</td>
</tr>
<tr>
<td>The Intellectual Education Institute for Girls in eastern Riyadh</td>
<td>61</td>
<td>28</td>
<td>46</td>
<td>30.4</td>
</tr>
<tr>
<td>The Intellectual Education Institute for Boys in western Riyadh</td>
<td>75</td>
<td>22</td>
<td>29.3</td>
<td>23.9</td>
</tr>
<tr>
<td>The Intellectual Education Institute for Girls in western Riyadh</td>
<td>45</td>
<td>24</td>
<td>53.3</td>
<td>26.1</td>
</tr>
<tr>
<td>Total</td>
<td>291</td>
<td>92</td>
<td>31.6%</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Training

In regard to teachers’ previous training on the use of AT with students with disabilities, a total of 49 teachers (53.3%) reported that they had received training on the use of AT, while 43 (46.7%) reported that they had not received any previous training, as presented in Table 6 presents.
Table 6

*Teachers’ previous training*

<table>
<thead>
<tr>
<th>Training</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>53.3</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>46.7</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Familiarity with AT**

Teachers were asked about their familiarity with AT, and four options were given. Thirty-one teachers (33.7%) reported that they were familiar with both the theoretical knowledge and practical use of AT, 19 (20.7%) were more familiar with the theoretical knowledge than with the practical use, 24 (26%) were more familiar with the practical use of AT, while 18 (19.6%) were not familiar with either the theoretical knowledge or the practical use of AT. Table 7 presents the AT familiarity among participants.

Table 7

*Teachers’ familiarity with AT*

<table>
<thead>
<tr>
<th>Familiarity with AT</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiar with both the theoretical knowledge and the practical use of AT</td>
<td>31</td>
<td>33.7</td>
</tr>
<tr>
<td>Familiar with the theoretical knowledge more</td>
<td>19</td>
<td>20.7</td>
</tr>
<tr>
<td>Familiar with the practical use more</td>
<td>24</td>
<td>26</td>
</tr>
</tbody>
</table>
Table 7

Continued

<table>
<thead>
<tr>
<th>Familiarity with AT</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not familiar with either theoretical knowledge or practical use</td>
<td>18</td>
<td>19.6</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>100.0</td>
</tr>
</tbody>
</table>

First Phase: Quantitative Analysis

As indicated previously, in the first phase of the sequential explanatory mixed methods design, the researcher starts by collecting and analyzing the quantitative data. In this phase, therefore, descriptive, inferential statistics and content analysis were utilized to analyze the data collected from the online survey questionnaire.

Research Question 1

How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes? This question is divided into three sub-questions, which are addressed below.

Sub-question 1.a: What types of AT do teachers report using with their students and how frequently?

To answer the first sub-question, I collected descriptive statistics and analyzed the data by calculating the frequency, percentage, mean, and standard deviation. The participants were asked about the types of AT they use (low-tech, mid-tech, high-tech)
and how frequently (1= Never, 2= 1-2 Days a week, 3= 2-3 Days a week, 4= 3-4 Days a week, and 5= Almost every day).

First, in regard to the first item (low-tech), a majority of 59 teachers (64.1%) indicated that they used low-tech almost every day, only 2 (2.2%) had never used low-tech, while the remaining teachers used low-tech 1 to 4 days a week, as illustrated in Table 8 and Figure 5.

Second, as presented in Table 8 and Figure 6, 26 of the participants – less than one third (28.3%) – reported that they used mid-tech 2 to 3 days a week, 19 participants (20.7%) used mid-tech almost every day, while only 4 participants (4.3%) had never used mid-tech.

Finally, there is an obvious lack of high-tech use among the participants, as demonstrated in Table 8. Representing a response rate of 47.8%, approximately half of the participants (N=44) indicated that they had never used high-tech with their students, approximately one quarter (N=25), representing 27.2%, used high-tech only 1 to 2 days a week, while only 4 participants (4.3%) reported daily high-tech use.

As presented in Table 8, the mean of the low-tech use among the participants – 4.36, with a standard deviation of 1.01 – was the highest of all the AT categories, the mid-tech mean was 3.27, with a standard deviation of 1.19, and the lowest mean was for the high-tech use: 1.91, with a standard deviation of 1.11. The total mean for all types was 9.54.
Table 8

Teachers’ use of AT

<table>
<thead>
<tr>
<th>Type of AT</th>
<th>Never</th>
<th>1-2 days a week</th>
<th>2-3 days a week</th>
<th>3-4 days a week</th>
<th>Almost everyday</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Low-Tech</td>
<td>2</td>
<td>2.2</td>
<td>4</td>
<td>4.3</td>
<td>12</td>
<td>13.0</td>
<td>15</td>
</tr>
<tr>
<td>Mid-Tech</td>
<td>4</td>
<td>4.3</td>
<td>24</td>
<td>26.1</td>
<td>26</td>
<td>28.3</td>
<td>19</td>
</tr>
<tr>
<td>High-Tech</td>
<td>44</td>
<td>47.8</td>
<td>25</td>
<td>27.7</td>
<td>14</td>
<td>15.2</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 5. Teachers’ use of low-tech with their students.
Figure 6. Teachers’ use of mid-tech with their students.

Figure 7. Teachers’ use of high-tech with their students.
Sub-question 1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?

In answering this question, I used descriptive statistics, including frequency, mean, standard deviation, and percentage, to analyze and describe the data. The participants were asked about the effectiveness of each type of AT, and the following scale was used: 1= Not effective at all, 2= Slightly effective, 3= Moderately effective, 4= Very effective, and 5= Extremely effective. The total mean of teachers’ perspectives regarding the low-tech effectiveness was 4.25, which was close to the mid-tech effectiveness mean of 4.10. The lowest average mean of teachers’ perspectives of AT effectiveness (3.81) was for the high-tech category. The total mean of AT effectiveness for all three categories was 12.17, with a standard deviation of 2.08. Table 9 presents the frequency, percentage, mean, and the standard deviation of each item.

Table 9
Effectiveness of AT

<table>
<thead>
<tr>
<th>Type of AT</th>
<th>Not effective at all (1)</th>
<th>Slightly effective (2)</th>
<th>Moderately effective (3)</th>
<th>Very effective (4)</th>
<th>Extremely effective (5)</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Low-Tech Use</td>
<td>0</td>
<td>00.0</td>
<td>1</td>
<td>1.1</td>
<td>12</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>Mid-Tech Use</td>
<td>0</td>
<td>00.0</td>
<td>5</td>
<td>5.4</td>
<td>12</td>
<td>13</td>
<td>43</td>
</tr>
<tr>
<td>High-Tech Use</td>
<td>2</td>
<td>2.2</td>
<td>16</td>
<td>17.4</td>
<td>9</td>
<td>9.8</td>
<td>35</td>
</tr>
</tbody>
</table>
Sub-question 1.c. What elements do teachers report considering when selecting AT for their students?

In answering this question, I collected descriptive statistics and analyzed the data by calculating the frequency, mean, percentage, and standard deviation. As illustrated in Table 10, the participants were asked about the elements they take into consideration when selecting the types of AT. The following scale was used: 1= Never, 2= Rarely, 3= Sometimes, 4= Often, and 5= Always. Item 5 was coded as: 1=Always, 2= Often, 3=Sometimes, 4=Rarely, and 5= Never, as negatively worded item.

The majority of the participants (47.8%) reported that they had always taken each student's ability into consideration before selecting the appropriate AT. Approximately 43.5% of participants indicated that they had often taken each student's preferences into consideration before selecting the appropriate AT. Thirty-nine percent of the participants reported that they had often taken the availability of AT in their institutes into consideration before deciding which AT best suited their students. Approximately one third (37%) of participants indicated that they had never met with the IEP team members to discuss and select the appropriate AT for their students, while approximately 29% reported that they had done so rarely. Almost half of the participants (40.2%) reported that they had often decided by themselves which AT best suited their students, and this was followed by 37% of the participants who indicated that they had always decided by themselves. The mean for all items in this question was calculated as 18.18.
Table 10

Considerations of selecting AT

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I take into consideration each student's ability before selecting the AT</td>
<td>1</td>
<td>1.1</td>
<td>1.1</td>
<td>9</td>
<td>9.8</td>
<td>37</td>
<td>40.2</td>
</tr>
<tr>
<td>I take into consideration each student's preferences before selecting the AT</td>
<td>0</td>
<td>0.0</td>
<td>7.6</td>
<td>20</td>
<td>21.7</td>
<td>40</td>
<td>43.5</td>
</tr>
<tr>
<td>I take into consideration the availability of the AT in my institute before I</td>
<td>6</td>
<td>6.5</td>
<td>5.4</td>
<td>17</td>
<td>18.5</td>
<td>1.13</td>
<td>39.1</td>
</tr>
<tr>
<td>decide what AT best suit my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I meet with the Individualized Education Program (IEP) team members to</td>
<td>34</td>
<td>37.0</td>
<td>27</td>
<td>29.3</td>
<td>23</td>
<td>25.0</td>
<td>5</td>
</tr>
<tr>
<td>discusses and select the appropriate AT for my students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I decide myself what AT devices best suit my students</td>
<td>1</td>
<td>1.1</td>
<td>8.7</td>
<td>12</td>
<td>13.0</td>
<td>37</td>
<td>40.2</td>
</tr>
</tbody>
</table>
Research Question 2

How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?

In order to answer this question, I collected descriptive statistics, including frequency, percentage, mean, and standard deviation. The participants were asked about the barriers to the use of AT with their students, and the following scale was used: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly agree, as presented in Table 11. Approximately half of the participants – 48.9% – strongly agreed that the high cost of certain AT devices hindered them from using AT with their students, and this was followed by 37% of the participants who agreed with this sentiment. More than half of the participants – 53.3% – indicated that they strongly agreed that there was a lack of funding in their institutes for purchasing the needed AT devices, and more than one third of participants (39.1%) concurred. In regard to the access to AT in special education institutes, 40.2% of participants agreed that there was a lack of devices they required, 34.8% of participants strongly agreed, while 15.2% disagreed. Approximately one third of participants (34.8%) reported that they agreed that there was a lack of knowledge with regard to the use of AT, while 22.8% disagreed. Less than half of the participants (41.3%) strongly agreed that there was a lack of training on the use of AT, and 35.9% agreed. Just over half of the participants (53.3%) agreed that there was a lack of or no support for them on how to deal with certain AT devices in the classrooms, while 33.7% reported that they strongly agreed with this barrier. In response to the following statement “Some of the AT devices are too difficult
for me to use” 33.7% of the participants indicated neutral, followed by 26.1% who disagreed, and 23.9% who agreed. The participants were also asked whether certain of the AT devices were too difficult and complex for their students to use; the results demonstrate that nearly one third of them (31.5%) disagreed, 29.3% agreed, while 21.7% reported neutral. The majority of participants (54.3%) strongly disagreed that their students did improve as a result of using AT, while 34.8% disagreed. Close to half of the participants (53.3%) reported that they strongly disagreed that their students sometimes preferred not to use AT, while 38% disagreed. Regarding the maintenance services for AT devices in special education institutes, 47.8% of participants agreed that there was a lack of or no maintenance services for AT devices in their institutes, while 28.3% strongly agreed. Thirty percent of participants agreed that using AT in the classroom required additional time and effort, which sometimes made it difficult to use AT, while 29% disagreed. The results also demonstrate that the total mean of items was 40.57. Table 11 presents the frequency and percentage of each barrier, the mean, and standard deviation of each item.
Table 11

The barriers to the use of AT

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>The high cost of some AT devices prevents me from using AT with students.</td>
<td>0</td>
<td>0.00</td>
<td>7</td>
<td>7.6</td>
<td>6</td>
<td>6.5</td>
<td>34</td>
</tr>
<tr>
<td>There is a lack of funding on purchasing the needed AT devices.</td>
<td>1</td>
<td>1.1</td>
<td>1</td>
<td>1.1</td>
<td>5</td>
<td>5.4</td>
<td>36</td>
</tr>
<tr>
<td>There is a lack of AT devices that I need to use.</td>
<td>2</td>
<td>2.2</td>
<td>14</td>
<td>15.2</td>
<td>7</td>
<td>7.6</td>
<td>37</td>
</tr>
<tr>
<td>There is a lack of teachers’ knowledge of using AT.</td>
<td>6</td>
<td>6.5</td>
<td>21</td>
<td>22.8</td>
<td>13</td>
<td>14.1</td>
<td>32</td>
</tr>
<tr>
<td>There is a lack of training in AT use</td>
<td>3</td>
<td>3.3</td>
<td>8</td>
<td>8.7</td>
<td>10</td>
<td>10.9</td>
<td>33</td>
</tr>
<tr>
<td>There is a lack of support for teachers in how to deal with AT devices in the classroom.</td>
<td>0</td>
<td>0.00</td>
<td>3</td>
<td>3.3</td>
<td>9</td>
<td>9.8</td>
<td>49</td>
</tr>
<tr>
<td>Some of AT devices are too difficult for me to use.</td>
<td>7</td>
<td>7.6</td>
<td>24</td>
<td>26.1</td>
<td>31</td>
<td>33.7</td>
<td>22</td>
</tr>
</tbody>
</table>
Table 11

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some of AT devices are too difficult and complex for my students to use.</td>
<td>0</td>
<td>00.0</td>
<td>29</td>
<td>31.5</td>
<td>20</td>
<td>21.7</td>
<td>27</td>
</tr>
<tr>
<td>I do not think that my students make an improvement by using AT.</td>
<td>50</td>
<td>54.3</td>
<td>32</td>
<td>34.8</td>
<td>6</td>
<td>6.5</td>
<td>1</td>
</tr>
<tr>
<td>My students sometimes do not prefer to use AT.</td>
<td>49</td>
<td>53.3</td>
<td>35</td>
<td>38.0</td>
<td>4</td>
<td>4.3</td>
<td>1</td>
</tr>
<tr>
<td>There is a lack or no maintenance services for the AT devices in my</td>
<td>4</td>
<td>4.3</td>
<td>5</td>
<td>5.4</td>
<td>13</td>
<td>14.1</td>
<td>44</td>
</tr>
<tr>
<td>institute.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using AT in the classroom requires additional time and effort, which</td>
<td>19</td>
<td>20.7</td>
<td>27</td>
<td>29.3</td>
<td>8</td>
<td>8.7</td>
<td>28</td>
</tr>
<tr>
<td>makes it difficult sometimes to use AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Research Question 3

What resources and support do teachers of students with severe intellectual and developmental disabilities believe needed to effectively use AT in special education institutes?

In order to answer this question, I obtained descriptive statistics, including frequency, percentage, mean, and standard deviation. The participants were asked about the resources needed for effective AT use, and the following scale was used: 1=Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly agree.

More than half the participants (65.2%) strongly agreed that teachers should be provided with the required training on using AT. The majority of participants (84.8%) indicated that they strongly agreed that adequate financial support should be provided to institutes to enable them to provide teachers with more AT devices, while the remainder of the participants (15.2%) agreed. Forty-five percent of teachers strongly agreed that teachers needed AT experts in special education institutes to provide technical assistance and support. Teachers were asked whether maintenance services should be provided to help teachers repair devices, and a majority (60.9%) strongly agreed. Table 12 presents the frequency and percentage of each item. The total mean of all items was 18.28.
<table>
<thead>
<tr>
<th>Resources</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers should be provided with the needed training on using AT.</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>1.1</td>
<td>30</td>
<td>60</td>
<td>65.2</td>
</tr>
<tr>
<td>Adequate financial support should be provided to institutes to enable them to provide teachers with more assistive technology devices.</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>14</td>
<td>78</td>
<td>84.8</td>
</tr>
<tr>
<td>Teachers need AT expert in the institute to provide technical assistance and support.</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>1.1</td>
<td>32</td>
<td>42</td>
<td>45.7</td>
</tr>
<tr>
<td>Maintenance services should be provided to help teachers repair devices.</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>2.2</td>
<td>33</td>
<td>56</td>
<td>60.9</td>
</tr>
</tbody>
</table>
Research Question 4.a.

Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their previous training experiences?

In order to answer this question, a two-sample t-test were conducted to determine whether there was a significant difference between teachers’ previous training and their perspectives of their AT use, effectiveness of AT, considerations, barriers, and resources needed. As Table 6 demonstrates, a total of 49 teachers (53.3%) reported that they had received training on the use of AT, while 43 teachers (46.7%) reported that they had not received any previous training. Prior to conducting a two-sample t-test to analyze and answer this question, the following assumptions were tested:

Assumption of normality. To assess the normality, I conducted the Kolmogorov-Smirnov and Shapiro-Wilk tests. The significance values of both tests were greater than 0.05 in both groups (yes and no) in three dimensions (use of AT, considerations, and the barriers). The values of both tests were statistically significant, with p < .05 in both groups (yes and no) in the resources dimension, as presented in Table 13. With regard to the dimension of effectiveness, the p-value in the Kolmogorov-Smirnov test was statistically significant at .000 for the no group, and not statistically significant at .062 for the yes group; while in the Shapiro-Wilk test, the p-values were .003 for the no group and .004 for the yes group. However, the skewness values were close to 0 and moderately skewed at ±.692, and the kurtosis was ±1.2. This suggested that there was
no consequential violation of this assumption. The results of both tests for all dimensions are illustrated in Table 13.

Table 13

Results of the Kolmogorov-Smirnov and Shapiro-Wilk tests by teachers’ training

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Training</th>
<th>Kolmogorov-Smirnov</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value  df p</td>
<td>Value df p</td>
</tr>
<tr>
<td>Use</td>
<td>Yes</td>
<td>.099 49 .200</td>
<td>.974 49 .342</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>.112 43 .200</td>
<td>.963 43 .186</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Yes</td>
<td>.123 49 .062</td>
<td>.921 49 .003</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>.202 43 .000</td>
<td>.917 43 .004</td>
</tr>
<tr>
<td>Considerations</td>
<td>Yes</td>
<td>.114 49 .150</td>
<td>.980 49 .579</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>.100 43 .200</td>
<td>.973 43 .404</td>
</tr>
<tr>
<td>Barriers</td>
<td>Yes</td>
<td>.108 49 .200</td>
<td>.965 49 .152</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>.111 43 .200</td>
<td>.973 43 .413</td>
</tr>
<tr>
<td>Resources</td>
<td>Yes</td>
<td>.157 49 .004</td>
<td>.888 49 .000</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>.192 43 .000</td>
<td>.884 43 .000</td>
</tr>
</tbody>
</table>

Note: a=.05, Skw= Skweness, Krt= Kurtosis,

Assumption of homogeneity of variance. In order to test the homogeneity of variance, Levene’s test for equality of variance was conducted with a view to establishing whether or not this assumption had been violated. The results demonstrate that there was no violation of the homogeneity of variance, and this assumption was
met for all questions and sub-questions. Table 14 presents the results of Levene’s test for each dimension.

Table 14

Results of Levene’s test

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of AT</td>
<td>.616</td>
</tr>
<tr>
<td>AT Effectiveness</td>
<td>.696</td>
</tr>
<tr>
<td>Considerations</td>
<td>.349</td>
</tr>
<tr>
<td>Barriers</td>
<td>.166</td>
</tr>
<tr>
<td>Resources</td>
<td>.539</td>
</tr>
</tbody>
</table>

*Note: a=.05*

**Assumption of independence.** Based on the nature of this study and the survey questionnaire used to collect the data, no participant could belong to more than one group in a grouping variable.

**AT use and teachers’ training.** The results of the two-sample t-test demonstrate that the mean of teachers with previous training experience in AT was 10.18, which was greater than the mean of teachers without such previous training experience (8.83). The findings also demonstrate that the difference in teachers’ use of AT with their students based on whether or not they had previous training was statistically significant – \( t=2.85, p=.005 \) with a significance level of 0.05 – which indicates that \( p <.05 \). In other words, the findings indicate that teachers’ previous training experience in the use of AT had a statistical significant influence on AT use in the four institutes in Riyadh.
Table 15

Two sample t-test results for AT use and teachers’ training

<table>
<thead>
<tr>
<th>Previous Training on AT Use</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>10.18</td>
<td>2.15</td>
<td>90</td>
<td>2.853</td>
<td>.005</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>8.84</td>
<td>2.38</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: a=.05.*

The effect size was computed using the following equation:

\[
Cohen's\, sd = \frac{\text{Mean Difference}}{\text{Standard Deviation}}
\]

to determine if it was small, medium, or large. The mean difference between the two groups (yes and no) was 1.34, the standard deviation was 2.26, and the effect size was therefore 0.59; which, according to Cohen (1988), is a medium effect size.

**AT effectiveness and teachers’ training.** The results of the two-sample t-test indicate that the mean of teachers with previous training experience in AT was 12.37, which was slightly greater than 11.5 – the mean of teachers without previous training on the use of AT. The findings also demonstrate that difference in teachers’ perspectives on the effectiveness of AT, based on whether they had previous training or not, was not statistically significant – t=.95, *p*.345. In other words, the findings indicate that teachers’ previous training experience in the use of AT did not have any statistical significant influence on how they perceive the effectiveness of AT in the four special education institutes in Riyadh (see Table 16).
Table 16

Two sample t-test results for teachers’ training and AT effectiveness

<table>
<thead>
<tr>
<th>Previous Training on AT Use</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>12.37</td>
<td>2.07</td>
<td>90</td>
<td>.950</td>
<td>.345</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>11.95</td>
<td>2.10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05.

Considerations and teachers’ training. The results of the two-sample t-test indicate that the mean of teachers with previous training experience in AT was 18.29, which was slightly higher than the mean of teachers without previous training on the use of AT, which was 18.07. The findings also demonstrate that the difference in teachers’ perspectives on factors to be taken into consideration in AT selection, based on whether they had previous training or not, was not statistically significant – t=.380, p=.705. In other words, the findings indicate that teachers’ previous training on the use of AT did not have any significant statistical influence on how they perceive the effectiveness of AT in the four special education institutes in Riyadh (see Table 17).

Table 17

Two sample t-test results for teachers’ training and AT considerations

<table>
<thead>
<tr>
<th>Previous Training on AT Use</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>18.29</td>
<td>2.88</td>
<td>90</td>
<td>.380</td>
<td>.705</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>18.07</td>
<td>2.52</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05

Barriers and teachers’ training experience. The results of the two-sample t-test indicate that the mean of teachers with previous training experience in AT was 39.06,
which was less than the mean of teachers without previous training on the use of AT, i.e. 42.30. The findings also demonstrate that the difference in teachers' perspectives on the barriers to the use of AT based on whether they had previous training or not was statistically significant – $t=-2.429$, $p=.017$, which is $p <.05$. The results demonstrate that teachers' previous training on the use of AT had a significant statistical influence on how teachers perceive the barriers to the use of AT in the four special education institutes in Riyadh. In other words, teachers with training experience face fewer barriers than teachers without (see Table 18). The mean difference between the two groups (yes and no) was 3.24, with a standard deviation of 6.39. Therefore the effect size was -0.5, which is a medium effect size.

Table 18

<table>
<thead>
<tr>
<th>Previous PD on AT Use</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>39.06</td>
<td>5.56</td>
<td>90</td>
<td>-2.429</td>
<td>.017</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>42.30</td>
<td>7.21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $a=.05,$

**Resources needed and teachers' training.** The results of the two-sample t-test indicate that the mean of teachers with previous training experience in AT was 18.04, which was slightly less than the mean of teachers without previous training in the use of AT, i.e. 18.59. The findings also demonstrate that the difference in teachers' perspectives on the resources needed for AT, based on whether they had previous training or not, was not statistically significant – $t=-1.809$, $p=.074$. In other words, the findings indicate that
teachers’ previous training on the use of AT did not have any significant statistical influence on how teachers perceive the resources needed for AT in the four special education institutes in Riyadh (see Table 19).

Table 19

<table>
<thead>
<tr>
<th>Previous Training on AT Use</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>18.04</td>
<td>1.43</td>
<td>90</td>
<td>-1.809</td>
<td>.074</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>18.59</td>
<td>1.30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: a=.05*

**Research Question 4.b.**

Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their familiarity with AT?

In order to answer this question, one-way analysis of variance (ANOVA) was employed to test the significant differences between teachers’ familiarity with AT and their perspectives on their AT use, the effectiveness of AT, considerations, barriers, and resources needed. As indicated in Table 7, approximately 33.7% of teachers reported that they were familiar with both the theoretical knowledge and practical use of AT, 20.7% were more familiar with the theoretical knowledge than with practical use of AT, 26.1% were more familiar with the practical use of AT, and 19.6% were not familiar with either the theoretical knowledge or the practical use of AT.
Prior to conducting ANOVA to analyze the data and answer this question, the following assumptions were tested:

**Assumption of normality.** I utilized the Kolmogorov-Smirnov and Shapiro-Wilk tests in order to test this assumption. In the Kolmogorov-Smirnov test, the p-values were not statistically significant – $p > .05$ in all dimensions except for three groups (Familiar with Both T and P in the resources dimension, More familiar with T in the dimensions of considerations, barriers and resources, and Familiar with P in the dimensions of use, effectiveness, and resources). The p-values in the Shapiro-Wilk test were $p > .05$ in all dimensions except the resources dimension in two groups, i.e. Familiar with both T and P, and More familiar with T, and it was also significant in the effectiveness dimension for More familiar with P and the barrier dimension for More familiar with T. Although the p-value was statistically significant $p < .05$ in some groups, all values of the skewness were close to 0 and were moderately skewed at ±.940, which indicated that there was no consequential violation of the assumption of normality. All the findings of both tests are illustrated in Table 20.
Table 20

*Kolmogorov-Smirnov and Shapiro-Wilk tests results by teachers’ familiarity with AT*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Familiarity with AT</th>
<th>Kolmogorov-Smirnov</th>
<th>Shapiro-Wilk</th>
<th>Skw</th>
<th>Krt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value</td>
<td>df</td>
<td>p</td>
<td>Value</td>
</tr>
<tr>
<td>Use</td>
<td>Fw/Both</td>
<td>.115</td>
<td>31</td>
<td>.200</td>
<td>.958</td>
</tr>
<tr>
<td></td>
<td>Fw/T</td>
<td>.193</td>
<td>19</td>
<td>.061</td>
<td>.931</td>
</tr>
<tr>
<td></td>
<td>Fw/P</td>
<td>.211</td>
<td>24</td>
<td>.007</td>
<td>.926</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>.182</td>
<td>18</td>
<td>.119</td>
<td>.941</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Fw/Both</td>
<td>.118</td>
<td>31</td>
<td>.200</td>
<td>.939</td>
</tr>
<tr>
<td></td>
<td>Fw/T</td>
<td>.177</td>
<td>19</td>
<td>.122</td>
<td>.931</td>
</tr>
<tr>
<td></td>
<td>Fw/P</td>
<td>.183</td>
<td>24</td>
<td>.037</td>
<td>.900</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>.196</td>
<td>18</td>
<td>.066</td>
<td>.913</td>
</tr>
<tr>
<td>Considerations</td>
<td>Fw/Both</td>
<td>.135</td>
<td>31</td>
<td>.157</td>
<td>.965</td>
</tr>
<tr>
<td></td>
<td>Fw/T</td>
<td>.217</td>
<td>19</td>
<td>.018</td>
<td>.938</td>
</tr>
<tr>
<td></td>
<td>Fw/P</td>
<td>.147</td>
<td>24</td>
<td>.192</td>
<td>.942</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>.209</td>
<td>18</td>
<td>.037</td>
<td>.920</td>
</tr>
<tr>
<td>Barriers</td>
<td>Fw/Both</td>
<td>.102</td>
<td>31</td>
<td>.200</td>
<td>.971</td>
</tr>
<tr>
<td></td>
<td>Fw/T</td>
<td>.273</td>
<td>19</td>
<td>.001</td>
<td>.845</td>
</tr>
<tr>
<td></td>
<td>Fw/P</td>
<td>.134</td>
<td>24</td>
<td>.200</td>
<td>.936</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>.165</td>
<td>18</td>
<td>.200</td>
<td>.956</td>
</tr>
<tr>
<td>Resources</td>
<td>Fw/Both</td>
<td>.238</td>
<td>31</td>
<td>.000</td>
<td>.815</td>
</tr>
<tr>
<td></td>
<td>Fw/T</td>
<td>.204</td>
<td>19</td>
<td>.036</td>
<td>.875</td>
</tr>
<tr>
<td></td>
<td>Fw/P</td>
<td>.182</td>
<td>24</td>
<td>.038</td>
<td>.928</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>.222</td>
<td>18</td>
<td>.019</td>
<td>.907</td>
</tr>
</tbody>
</table>
Note: $a=.05$, Skw= Skweness, Krt= Kurtosis, Fw/Both= Familiar with both the theory and the practical use of AT, Fw/T = Familiar with the theory more than the practical use of AT, Fw/P = Familiar with the practical use of AT more than the theory, NFw/Both, Not familiar with both the theory and the practical use of AT.

**Assumption of homogeneity of variance.** I conducted Levene’s test in order to test whether or not this assumption had been violated. There was no violation of the homogeneity of variance, and this assumption was therefore met, as presented in Tables 21. The following table presents the results of Levene’s test for all dimensions.

Table 21

*Results of Levene’s test*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of AT</td>
<td>.239</td>
</tr>
<tr>
<td>AT Effectiveness</td>
<td>.264</td>
</tr>
<tr>
<td>Considerations</td>
<td>.083</td>
</tr>
<tr>
<td>Barriers</td>
<td>.099</td>
</tr>
<tr>
<td>Resources</td>
<td>.292</td>
</tr>
</tbody>
</table>

*Note: a=.05*

**Assumption of independence.** Based on the nature of this study and the survey questionnaire used to collect the data, no participant could belong to more than one group in a grouping variable.

*AT use and teachers’ familiarity with AT.* With a significance level of 0.05, the results demonstrate that the p-value was .007, which is regarded as statistically significant. This means the differences in teachers' use of AT with their students based
on their familiarity with AT were statistically significant, as the findings indicate that 
\[ p < .05. \]

Table 22

*ANOVA for AT use and teachers’ familiarity with AT*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>63.96</td>
<td>3</td>
<td>21.32</td>
<td>4.295</td>
<td>.007</td>
</tr>
<tr>
<td>Within Groups</td>
<td>436.77</td>
<td>88</td>
<td>4.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>500.73</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: \( a = .05 \)*

The following equation was used to calculate the effect size:

\[
\eta^2 = \frac{\text{Treatment Sum of Squares}}{\text{Total Sum of Squares}}
\]

Therefore, \( \eta^2 = 0.127 \), which is a medium effect size.

A multiple comparison test (Tukey post hoc test) was utilized in order to find out 
more about the groups’ differences. As presented in Table 23, the findings of the Tukey 
post hoc test indicate that there was a significant difference between teachers who 
reported that they were familiar with both theory (T) and practice (P) and teachers who 
reported that they were not familiar with either T or P (\( p = .011 \)). In addition, the results 
demonstrate that the difference between teachers who were familiar with P and 
teachers who were not familiar with either T or P was statistically significant (\( p = .011 \)). 
Table 23 presents further details about the differences of means in all groups.
Table 23

*Multiple comparisons in AT use and to the familiarity with AT*

<table>
<thead>
<tr>
<th>Teachers’ Familiarity w/AT</th>
<th>Teachers’ Familiarity w/AT</th>
<th>Mean Differences (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fw/Both</td>
<td>Fw/T more</td>
<td>.78098</td>
<td>.64910</td>
<td>.626</td>
</tr>
<tr>
<td></td>
<td>Fw/P more</td>
<td>-.11156</td>
<td>.60573</td>
<td>.998</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>2.09677</td>
<td>.66019</td>
<td>.011</td>
</tr>
<tr>
<td>Fw/T more</td>
<td>Fw/Both</td>
<td>-.78098</td>
<td>.64910</td>
<td>.626</td>
</tr>
<tr>
<td></td>
<td>Fw/P more</td>
<td>-.89254</td>
<td>.68413</td>
<td>.562</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>1.31579</td>
<td>.73278</td>
<td>.282</td>
</tr>
<tr>
<td>Fw/P more</td>
<td>Fw/Both</td>
<td>.11156</td>
<td>.60573</td>
<td>.998</td>
</tr>
<tr>
<td></td>
<td>Fw/T more</td>
<td>.89254</td>
<td>.68413</td>
<td>.562</td>
</tr>
<tr>
<td></td>
<td>NFw/Both</td>
<td>2.20833</td>
<td>.69466</td>
<td>.011</td>
</tr>
<tr>
<td>NFw/Both</td>
<td>Fw/Both</td>
<td>-2.09677</td>
<td>.66019</td>
<td>.011</td>
</tr>
<tr>
<td></td>
<td>Fw/T more</td>
<td>-1.31579</td>
<td>.73278</td>
<td>.282</td>
</tr>
<tr>
<td></td>
<td>Fw/P more</td>
<td>-2.20833</td>
<td>.69466</td>
<td>.011</td>
</tr>
</tbody>
</table>

*Note: a=.05, Fw/Both= Familiar with both the theory and the practical use of AT, Fw/T more= Familiar with the theory more than the practical use of AT, Fw/P more= Familiar with the practical use of AT more than the theory, NFw/Both, Not familiar with both the theory and the practical use of AT.*

*AT effectiveness and teachers’ familiarity with AT.* With a significance level of 0.05, the results demonstrate that the p-value was .775, which is not statistically significant.
In other words, the differences in teachers' perspectives of AT effectiveness based on their familiarity with AT were not statistically significant.

Table 24

ANOVA for AT effectiveness and teachers’ familiarity with AT

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>4.92</td>
<td>3</td>
<td>1.64</td>
<td>.370</td>
<td>.775</td>
</tr>
<tr>
<td>Within Groups</td>
<td>390.30</td>
<td>88</td>
<td>4.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>395.22</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $a=.05$.

AT Considerations and teachers’ familiarity with AT. With a significance level of 0.05, the results indicate that $p=.069$, which is not statistically significant. This means that the differences in teachers' reported considerations of AT based on their familiarity with AT were not statistically significant.

Table 25

ANOVA for AT considerations and teachers’ familiarity with AT

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>51.31</td>
<td>3</td>
<td>17.10</td>
<td>2.449</td>
<td>.069</td>
</tr>
<tr>
<td>Within Groups</td>
<td>614.55</td>
<td>88</td>
<td>6.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>665.86</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $a=.05$.

Barriers to the use of AT and teachers’ familiarity with AT. With a significance level of 0.05, the findings indicate that the p-value was .410, which is not statistically
significant. In other words, the differences in teachers' perspectives on the barriers to the use of AT, based on their familiarity with AT, were not statistically significant.

Table 26
ANOVA for barriers to the use of AT and teachers' familiarity with AT

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>125.36</td>
<td>3</td>
<td>41.79</td>
<td>.971</td>
<td>.410</td>
</tr>
<tr>
<td>Within Groups</td>
<td>3785.11</td>
<td>88</td>
<td>43.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3910.47</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: α=.05.

AT Resources needed and teachers' familiarity with AT. With a significance level of 0.05, the findings indicate that the p-value was .092, which is not significant. Therefore, the differences in teachers' perspectives of AT resources needed, based on their familiarity with AT, were not statistically significant.

Table 27
ANOVA for AT resources and teachers' familiarity with AT

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>12.24</td>
<td>3</td>
<td>4.08</td>
<td>2.211</td>
<td>.092</td>
</tr>
<tr>
<td>Within Groups</td>
<td>162.41</td>
<td>88</td>
<td>1.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>174.65</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: α=.05.
Research Question 4.c.

Are there significant differences in teachers’ perspectives on their implementation of AT (i.e., types and frequency of AT use, effectiveness, considerations, barriers, and resources) based on their special education institutes?

In answering this question, one-way analysis of variance (ANOVA) was utilized to test the significant differences between the four special education institutes and teachers’ perspectives of their AT use, effectiveness of AT, considerations, barriers, and resources needed. As presented in Table 5, 30.4% of teachers were from the Intellectual Education Institute for Girls in eastern Riyadh, 26.1% were from the Intellectual Education Institute for Girls in western Riyadh, 23.9% were from the Intellectual Education Institute for Boys in western Riyadh, and 19.6% were from the Intellectual Education Institute for Boys in eastern Riyadh. All previously discussed ANOVA assumptions were tested and met.

Assumption of normality. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the assumption of normality. The significance values of both tests were greater than 0.05 in most dimensions for all groups, except in some cases where p-values were statistically significant at p<.05, as presented in Table 28. However, all values of the skewness were close to 0 and were moderately skewed at ±.752, which suggested that the assumption of normality had not been violated. All results of the Kolmogorov-Smirnov and Shapiro-Wilk tests are presented in Table 28.
### Table 28

*Kolmogorov-Smirnov and Shapiro-Wilk tests results by the SPED institutes*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>SPED Institute</th>
<th>Kolmogorov-Smirnov</th>
<th></th>
<th></th>
<th>Shapiro-Wilk</th>
<th></th>
<th></th>
<th></th>
<th>Skw</th>
<th>Krt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>df</td>
<td>p</td>
<td>Value</td>
<td>df</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USE</td>
<td>E.B</td>
<td>.166</td>
<td>18</td>
<td>.200</td>
<td>.965</td>
<td>18</td>
<td>.704</td>
<td>-.135</td>
<td>-.397</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>.124</td>
<td>28</td>
<td>.200</td>
<td>.965</td>
<td>28</td>
<td>.466</td>
<td>-.370</td>
<td>.312</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.189</td>
<td>22</td>
<td>.039</td>
<td>.934</td>
<td>22</td>
<td>.150</td>
<td>-.418</td>
<td>.132</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.172</td>
<td>24</td>
<td>.066</td>
<td>.955</td>
<td>24</td>
<td>.340</td>
<td>.528</td>
<td>.453</td>
<td></td>
</tr>
<tr>
<td>Effectiveness</td>
<td>E.B</td>
<td>.260</td>
<td>18</td>
<td>.002</td>
<td>.924</td>
<td>18</td>
<td>.153</td>
<td>-.666</td>
<td>-.081</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>.123</td>
<td>28</td>
<td>.200</td>
<td>.914</td>
<td>28</td>
<td>.025</td>
<td>-.693</td>
<td>.665</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.220</td>
<td>22</td>
<td>.007</td>
<td>.927</td>
<td>22</td>
<td>.106</td>
<td>-.705</td>
<td>-.176</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.161</td>
<td>24</td>
<td>.110</td>
<td>.925</td>
<td>24</td>
<td>.074</td>
<td>-.424</td>
<td>-.679</td>
<td></td>
</tr>
<tr>
<td>Considerations</td>
<td>E.B</td>
<td>.140</td>
<td>18</td>
<td>.200</td>
<td>.967</td>
<td>18</td>
<td>.745</td>
<td>.301</td>
<td>.240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>.164</td>
<td>28</td>
<td>.053</td>
<td>.954</td>
<td>28</td>
<td>.252</td>
<td>.238</td>
<td>.923</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.131</td>
<td>22</td>
<td>.200</td>
<td>.963</td>
<td>22</td>
<td>.552</td>
<td>-.381</td>
<td>1.331</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.162</td>
<td>24</td>
<td>.105</td>
<td>.917</td>
<td>24</td>
<td>.049</td>
<td>-.358</td>
<td>-.022</td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td>E.B</td>
<td>.156</td>
<td>18</td>
<td>.200</td>
<td>.961</td>
<td>18</td>
<td>.624</td>
<td>.102</td>
<td>-.284</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.100</td>
<td>22</td>
<td>.200</td>
<td>.958</td>
<td>22</td>
<td>.446</td>
<td>-.530</td>
<td>-.022</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.162</td>
<td>24</td>
<td>.104</td>
<td>.925</td>
<td>24</td>
<td>.075</td>
<td>-.060</td>
<td>-.146</td>
<td></td>
</tr>
<tr>
<td>Resources</td>
<td>E.B</td>
<td>.220</td>
<td>18</td>
<td>.021</td>
<td>.886</td>
<td>18</td>
<td>.033</td>
<td>.184</td>
<td>-1.320</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>.201</td>
<td>28</td>
<td>.005</td>
<td>.857</td>
<td>28</td>
<td>.001</td>
<td>-.752</td>
<td>-.197</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.175</td>
<td>22</td>
<td>.077</td>
<td>.909</td>
<td>22</td>
<td>.046</td>
<td>-.114</td>
<td>-.888</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.215</td>
<td>24</td>
<td>.006</td>
<td>.904</td>
<td>24</td>
<td>.026</td>
<td>-.226</td>
<td>-1.254</td>
<td></td>
</tr>
</tbody>
</table>
Note: a=.05, Skw= Skweness, Krt= Kurtosis, E.B= The Intellectual Education Institute for Boys in eastern Riyadh, E.G= The Intellectual Education Institute for Girls in eastern Riyadh, W.B= The Intellectual Education Institute for Boys in western Riyadh, W.G= The Intellectual Education Institute for Girls in western Riyadh.

**Assumption of homogeneity of variance.** Levene’s test was conducted in order to examine whether or not the assumption of homogeneity of variance had been violated. There was no violation of the homogeneity of variance, and therefore this assumption was met. Table 29 presents the results of Levene’s test for each sub-question.

Table 29

*Results of Levene’s test*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of AT</td>
<td>.718</td>
</tr>
<tr>
<td>AT Effectiveness</td>
<td>.932</td>
</tr>
<tr>
<td>Considerations</td>
<td>.920</td>
</tr>
<tr>
<td>Barriers</td>
<td>.845</td>
</tr>
<tr>
<td>Resources</td>
<td>.337</td>
</tr>
</tbody>
</table>

*Note: a=.05*

**Assumption of independence.** Based on the nature of this study and the survey questionnaire used to collect the data, no participant could belong to more than one group in a grouping variable.

*AT use and the four special education institutes.* With a significance level of 0.05, the findings demonstrate that \( p=.000 \) which is considered statistically significant, as \( p<.05 \).
These results indicate that the differences in teachers' use of AT with their students based on the special education institute were statistically significant (see Table 30).

Table 30
ANOVA for AT use and SPED institutes

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>136.78</td>
<td>3</td>
<td>45.59</td>
<td>11.024</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>363.95</td>
<td>88</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>500.73</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $a=.05$, $\eta^2=.273$ (a large effect size).

A Tukey post hoc test was conducted to obtain further details about the differences in all groups. As presented in Table 31, the results of the Tukey post hoc test demonstrate that there were significant differences in the use of AT between teachers based on the four special education institutes. First, there was a significant difference in AT use between teachers at the boys’ institute in eastern Riyadh and the girls’ institute in eastern Riyadh – $p=.004$. Another significant difference in AT use was between the boys’ institute in western Riyadh and the girls’ institute in western Riyadh – $p=.000$.

Furthermore, the findings demonstrate that the difference between the boys’ institute in eastern Riyadh and the girls’ institute in western Riyadh was statistically significant – $p=.028$. Finally, there was a significant difference between the boys’ institute in western Riyadh and the girls’ institute in eastern Riyadh – $p=.000$. In general, the results indicate that the significant differences were between both boys’ institutes and both girls’ institutes, which means that female teachers who teach in the
girls’ institutes tend to make more use of AT. Table 31 presents further details relating to the differences of mean in all groups.

Table 31

*Tukey post hoc test in AT use SPED institutes*

<table>
<thead>
<tr>
<th>SPED Institutes</th>
<th>Mean Differences (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.B</td>
<td>E.G</td>
<td>-2.13889</td>
<td>.61439</td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>.74747</td>
<td>.64634</td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>-1.80556</td>
<td>.63411</td>
</tr>
<tr>
<td>E.G</td>
<td>E.B</td>
<td>2.13889</td>
<td>.61439</td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>2.88636</td>
<td>.57940</td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>.33333</td>
<td>.56572</td>
</tr>
<tr>
<td>W.B</td>
<td>E.B</td>
<td>-.74747</td>
<td>.64634</td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>-2.88636</td>
<td>.57940</td>
</tr>
<tr>
<td></td>
<td>W.G</td>
<td>-2.55303</td>
<td>.60026</td>
</tr>
<tr>
<td>W.G</td>
<td>E.B</td>
<td>1.80556</td>
<td>.63411</td>
</tr>
<tr>
<td></td>
<td>E.G</td>
<td>-.33333</td>
<td>.56572</td>
</tr>
<tr>
<td></td>
<td>W.B</td>
<td>2.55303</td>
<td>.60026</td>
</tr>
</tbody>
</table>

*Note: a=.05, E.B= The Intellectual Education Institute for Boys in eastern Riyadh, E.G= The Intellectual Education Institute for Girls in eastern Riyadh, W.B= The Intellectual Education Institute for Boys in western Riyadh, W.G= The Intellectual Education Institute for Girls in western Riyadh, SPED= Special Education.*

*AT effectiveness and special education institutes.* The results indicate that the p-value was .355, which is not statistically significant. This means that the differences in
teachers' perspectives of AT effectiveness based on the four special institutes were not statistically significant (see Table 32).

Table 32
ANOVA for AT effectiveness and SPED institutes

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>14.24</td>
<td>3</td>
<td>4.75</td>
<td>1.096</td>
<td>.355</td>
</tr>
<tr>
<td>Within Groups</td>
<td>380.98</td>
<td>88</td>
<td>4.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>395.22</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05.

AT Considerations and SPED Institutes. The findings indicate that $p=.324$, which is not significant. In other words, the differences in teachers' perspectives of AT effectiveness based on the four special education institutes were not statistically significant (see Table 33).

Table 33
ANOVA for AT considerations and SPED institutes

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>25.65</td>
<td>3</td>
<td>8.55</td>
<td>1.175</td>
<td>.324</td>
</tr>
<tr>
<td>Within Groups</td>
<td>640.21</td>
<td>88</td>
<td>7.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>665.86</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05.

Barriers to AT use and special education institutes. The results indicate that $p=.490$, which is not significant. The differences in teachers' perspectives of the barriers to the
use of AT based on the four special education institutes were not statistically significant (see Table 34).

Table 34
ANOVA for AT barreirs and SPED institutes

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>105.45</td>
<td>3</td>
<td>35.15</td>
<td>0.813</td>
<td>0.490</td>
</tr>
<tr>
<td>Within Groups</td>
<td>3805.02</td>
<td>88</td>
<td>43.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3910.47</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05.

AT Resources needed and special education institutes. The findings indicate that the p-value was .147, which is not statistically significant. Thus, the differences in teachers' perspectives of AT resources needed between the four special education institutes were not statistically significant (see Table 35).

Table 35
ANOVA for AT resources needed and SPED institutes

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>10.26</td>
<td>3</td>
<td>3.42</td>
<td>1.831</td>
<td>0.147</td>
</tr>
<tr>
<td>Within Groups</td>
<td>164.39</td>
<td>88</td>
<td>1.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>174.65</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a=.05.
Open-ended Question

At the end of the survey, the participants were asked the following question:
Please provide any comments or suggestions regarding your use of AT with your students, AT effectiveness, considerations you take when selecting AT, barriers, and/or resources needed.

Of the 92 participants, only 37% (n=34) responded and added their comments. In order to analyze the collected data, I used content analysis and created data categories and sub-categories. The following three major categories were identified from the participants’ responses:

I. Professional Development

II. Personal Devices

III. Barriers

Each of these categories have sub-categories, as demonstrated in Tables 36, 37, and 38. Most of the comments focused on professional development and related issues. Surprisingly, a large number of comments revealed that teachers – and specifically those who worked for the Intellectual Education Institute for Girls in eastern and western Riyadh – tended to bring their own devices to the institutes and to pay for the necessary maintenance. Other comments related to barriers that were not covered in the survey questionnaire, such as classrooms and families.
Table 36

Professional development

<table>
<thead>
<tr>
<th>Sub-categories</th>
<th>Criteria</th>
<th>Descriptions and Examples</th>
</tr>
</thead>
</table>
| Practical Knowledge  | Comments about the type of professional development needed by the participants | Some of the participants indicated that they preferred and needed the professional development to be focused more on the practical use of AT, rather than the form of lectures or presentations. Examples:  
- “As teachers we need training on how to use AT not presentation on what AT is”  
- “I want to know how to design lessons”  
- “The training courses provided for teachers should be more effective and that accures through focusing on teachers’ skills” |
| Sustainability       | Comments on how professional development should be provided.             | Some of the participants suggested that professional development should be provided regularly so that they could gain more benefit. Example:  
- “I think once or twic training courses per a semester on the use of AT would be better for us” |
| High-tech            | Refers to the devices or the types of AT specified by respondents.        | Teachers reported there was a need for more professional development on the use of high-tech, since the focus of their training was primarily on low-tech. Example:  
- “I have attended two training courses so far, and there were so much information about using cards and pictures, but the new devices were not covered.” |
Table 37

*Personal devices*

<table>
<thead>
<tr>
<th>Sub-categories</th>
<th>Criteria</th>
<th>Explanations and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ Needs and Wants</td>
<td>Comments on why teachers preferred to bring their own devices to the institutes.</td>
<td>Female teachers reported that they brought their own laptops, iPhones, and iPads to the classrooms because they felt their students were in need of such devices. Example: - “some of the students learn better by playing games, and I had no choice other than bringing my devices to the classroom.”</td>
</tr>
<tr>
<td>Variety of options</td>
<td>Reference to the advantage of using personal devices.</td>
<td>Female teachers indicated that they had more options in the classrooms when they brought their own devices. Example: - “when I bring them, I can use more teaching strategies.”</td>
</tr>
<tr>
<td>Cost</td>
<td>Reference to the high cost of maintenance.</td>
<td>The participants said they paid their own maintenance costs. Example: - “I had to pay to fix my computer.”</td>
</tr>
</tbody>
</table>
Table 38

*Barriers*

<table>
<thead>
<tr>
<th>Sub-categories</th>
<th>Criteria</th>
<th>Explanations and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding</td>
<td>Comments on how lack of funding could limit teachers’ use of AT.</td>
<td>Teachers indicated they always suffered from the lack of funding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- “I think money can solve most of the problems in regard to the use of AT.”</td>
</tr>
<tr>
<td>Families</td>
<td>Reference to how families could sometimes contribute to the lack of AT use.</td>
<td>Responses indicate that some families do not provide their children with AT at home and that has a negative impact on their children's ability to use AT.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- “A few students do not use AT at home, and families do not encourage that, so their children lack of the necessary skills required to use some devices.”</td>
</tr>
<tr>
<td>Classrooms</td>
<td>Comments on how some classrooms could be a barrier to the use of AT.</td>
<td>Responses indicated that the small size of their classrooms made it difficult for teachers to use a number of different AT devices.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- “All AT should be in the classrooms not in the resources room”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- “There is a big TV with its’ table and I cannot keep it in my classroom, there is no room for it.”</td>
</tr>
</tbody>
</table>

*Second Phase – Qualitative: Findings and Interpretations*

This section presents the qualitative data and how these data interpreted the quantitative findings. After analyzing the data collected through the online survey
questionnaire, some of the results needed to be explained and elaborated on. Therefore, a decision was made to conduct interviews as a means of providing further interpretations. Before conducting the interviews, certain results in the following topics needed to be elaborated on:

I. Teachers’ Use of AT

The results demonstrate that there were statistically significant differences between teachers’ use of AT with their students in the four institutes. The total mean of teachers’ use of AT in both the Intellectual Education Institutes for Girls in eastern and western Riyadh was higher than in the two boys’ institutes. In other words, female teachers reported higher use of AT with their students than male teachers. It was therefore important to conducting interviews with a view to establishing the reasons behind these differences.

II. Considerations

In regard to teachers’ considerations when selecting the appropriate types of AT to use with their students, more than one third (37%) of the participants reported that they had never met with the IEP team members to discusses and select the appropriate AT for their students, while 29% reported that they had done so only rarely. Moreover, approximately 40% reported that they had often decided by themselves what type of AT to use, and 37% of the participants indicated that they had always decided by
themselves. The lack of collaboration among teachers regarding the selection of AT for students needed to be interpreted.

III. **Barriers to the Use of AT**

Although most of the participants agreed or strongly agreed with most of the barriers given in the survey, more barriers were provided by the participants themselves in the open-ended question. It was therefore critical to ask teachers about other barriers that limited their use of AT with their students. Moreover, the quantitative results indicated that the use of high-tech among the participants was significantly limited, and it was therefore important to ask specifically about that point.

IV. **Resources Needed**

Forty-six percent of the participants reported they had never undergone training in the use of AT. Furthermore, most of the participants reported an urgent need for professional development in the use of AT. Consequently, further explanation was required from teachers regarding what type of professional development they needed and what factors prevented them from attending AT training course or programs.

In the second phase, I collected qualitative data to gather in-depth information through semi-structured interviews with five teachers. The interviews consisted of four open-ended questions with sub-questions; further sub-questions were available based on interviewees’ answers (Table 39). The FaceTime interviews lasted between 35 and 45 minutes. After conducting the member checking process, the following step was coding
and identifying major themes and sub-themes. Next, I implemented the external audit strategy, which included three doctoral students who had backgrounds in special education and were familiar with qualitative research. They reviewed the transcripts, evaluated themes and sub-themes that emerged from the collected data, and provided feedback.

Table 39

**Interview Guide**

1- Please describe your use of AT with your students?
   a. How do you use AT?
   b. What types of AT do you usually use?
   c. Do you use your own devices? Why/Why not?

2- Please tell me about the elements you take into consideration when you select AT for your students?
   a. Please tell me how you plan for AT use in the IEP?
   b. Do you discuss your use of AT with IEP team members?
   c. Please tell me about your collaboration with colleagues in terms of selecting and using AT?

3- Please tell me about the barriers that limit your use of AT in general with your students?
   a. Please tell me about the barriers that limit your use of high-tech?

4- What resources do you think you need for effective AT use with your students?
   a. Please tell me about the accessibility of professional development on the use of AT?
   b. Please tell me about your experience with AT professional development?
   c. What do you think you still need in terms of professional development regarding AT use?
Table 40

Interviewee’s demographics

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Gender</th>
<th>Years of Experience</th>
<th>Previous AT Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher #1</td>
<td>Female</td>
<td>7</td>
<td>No</td>
</tr>
<tr>
<td>Teacher #2</td>
<td>Female</td>
<td>21</td>
<td>Yes</td>
</tr>
<tr>
<td>Teacher #3</td>
<td>Male</td>
<td>10</td>
<td>Yes</td>
</tr>
<tr>
<td>Teacher #4</td>
<td>Male</td>
<td>10</td>
<td>No</td>
</tr>
<tr>
<td>Teacher #5</td>
<td>Male</td>
<td>16</td>
<td>Yes</td>
</tr>
</tbody>
</table>

After analyzing the data collected from the five interviews in order to elaborate the quantitative data (Creswell, 2012; Plano Clark, 2011), the following four major themes – together with several sub-themes – emerged: the use of AT, considerations, barriers, and professional development needs.

**Use of AT**

**Research Question 1.** How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of AT in special education institutes?

As previously discussed, the quantitative data revealed that there were statistical differences in the use of AT between the boys’ and girls’ institutes, as the two girls’ institutes reported higher use of AT. To address these differences in the use of AT through in-depth interviews, it was important to understand first how teachers use AT with their students. First, teachers were asked to describe how they use of AT with their students. The following sub-themes emerged during the interviews: adaptation, personal devices, and sensory learning tools.
Adaptation. Female teachers stated that sometimes when using their own iPhones during a lesson, they were unable to find specific apps or videos for students with severe disabilities. They usually use videos designed for general education students or for students with mild disabilities, with some adaptations. They cut a few minutes or seconds from the videos and repeat them several times for their students. Moreover, they use learning apps for general education students to teach their students numbers and letters. Another way of providing the required AT for their students is to print and use photos with words and numbers, with some adaptations, from books designed for students at different levels. One of the teachers explained why she had to adapt resources designed for general education students:

When I look around me I do not find what my students need to use in order to learn, you know that not everything is provided in our classrooms. Sometimes they only need a few simple things. I felt that it was my responsibilities as a teacher to think of free resources and try, only try. I said to myself that I would not lose anything if I gave it a try.

The other teacher described how she started using general education resources to teach her own students with severe disabilities:

I remember that day when I was teaching my daughter at home, she is a first grade student in a general education school, and I found in the app she used some words and beautiful pictures. I though that my students may benefit if I use the words and pictures in my daughter’s apps. I decided to take my iPad to the classroom and try that. Although I could use only a few words and
pictures from a couple of apps, my students loved that. I did not stop, I used more and more from my daughters’ books with adaptation because of the severity of the disabilities my students have. Now I am using YouTube to show my students some videos. Most of the Arabic videos for children, if not all, are designed for students without disabilities, so I downloaded the videos, I did some edits and cut only seconds or minutes and use them.

Another teacher also explained that he used the environment and other resources around him to create low-tech for his students. He said; “I do not have sensory toys or learning toys in my classrooms, so I go outside the institute and bring leaves and sticks sometimes I used them to teach colors, numbers, words, and other lessons.” He indicated that this was his new way of using low-tech, which he had learned in a training course on how to use the environment to create low-tech for students.

**Personal Devices.** During the interviews, all the teachers were asked whether they used their own devices or not and what motivated them to do so. All the female participants indicated that they had used their own devices – including all types of low-tech, mid-tech, and high-tech AT in the classrooms. Not surprisingly, all the teachers who stated in the open-ended question in the online survey that they had used their own devices worked at the Intellectual Education Institute for Girls in either eastern or western Riyadh. In other words, all of them were female teachers. One of the female teachers stated “The laptop I am using in the classroom is mine, and I sometimes use my iPhone to teach my students in different ways to make them more active.” Another
female teacher indicated, “In the last ten years, I have paid a lot of money, I have paid for pens, learning toys, markers, gifts for students, cards, snacks, and other things.”

Unlike female teachers, male participants indicated that they had never used their own devices in the classrooms. However, one of the male teachers said that he had occasionally paid for gifts for his students. Another male teacher stated “I often use my printer at home, if I need to, and print some papers for my students, but no, I do not use my devices and I never paid for any AT.”

This raised a significant question: Why is it only female teachers that pay for AT devices or use their own devices in the classrooms? First, when asked why they did not choose to use their own devices if they did not have any high-tech in the classroom, the male teachers replied that they did not have to. One teacher indicated “well, I don’t think they would benefit from my device, and I think I would need a lot of them not only one device.”

Furthermore, when I asked them why they did not pay for AT if they did not have sufficient AT devices in the classrooms, they said there were two reasons. All three male teachers indicated that providing the necessary classroom equipment and supplies, including all types of AT, was the responsibility of the Ministry of Education, schools, and the institutes concerned. Another reason was that “my salary barely covers the basic needs of me and my whole family” male teacher said. Furthermore, another teacher claimed, “that will cost me a lot of money, I can’t.”

On the other hand, when the two female teachers were asked why they preferred to use their own devices in the classrooms, they indicated that there was no high-tech in
their classrooms and their students always want to play and learn by using smartphones. One of them acknowledged that her students become excited when they use her iPad, which means a lot to her. When I asked them why they chose to pay for classroom supplies and AT, one of the teachers replied, “if I do not get what my students and I need in the classroom, they will never learn.” The other teacher indicated “I feel like they are my daughters, so I will still buy them what they need.”

However, both female teachers indicated there were negative aspects attached to bringing personal devices into the classroom. These negative aspects related to the following: (a) health issues, (b) maintenance costs, and (c) effectiveness. One of the female teachers said “I have to carry all my books, stories, laptop, and boxes to the institute everyday, that is annoying, it hurts my back and my shoulder.”

Both teachers said that they had to pay for maintenance of their own devices. Moreover, one teacher said that when she brought her own devices, she could not let her students use such devices for the length of time they needed, which could minimize the benefits of using high-tech devices.

*Sensory learning tools.* During the interviews, teachers talked about the various types of AT they used with their students, especially the low-tech type. Almost all the teachers relied more on pictures, papers, and cards. However, some of them indicated that there was a shortage of sensory learning tools. Teachers acknowledged that their students and other students with severe developmental disabilities needed to touch, hold, and play with tools in order to learn.
Considerations

*Sub-question 1.c.* What elements do teachers report considering when selecting AT for their students? Selecting the appropriate AT for students with disabilities is a critical step. First, I asked teachers what factors they usually took into consideration when selecting AT for their students. I also asked them about their use of IEP to plan for AT use, and how they worked with IEP team members. The teachers identified several points regarding their selection of AT, and the following sub-themes emerged during the interviews: students’ preferences, lack of planning, and shortage of IEP team collaboration.

*Students’ preferences.* Almost all teachers indicated that they started working with their students and observed what made them more active and learn more quickly. Moreover, they stated that sometimes it depended not only on the availability of AT in the classroom, but also on their own skills and ability to use certain types of AT.

*Lack of planning.* When I asked teachers about planning for the use of AT in the IEP, they indicated that they usually included the use of AT in the IEP. However, when asked how they incorporated AT in the IEP, all of them stated that they only write whether they had used it or not. One teacher stated, “The use of AT is not a priority in the IEP, at the beginning of the semester, we only have to write that we will use AT, we do not write what type of AT we will use. At the end of the semester, we check the box of AT if we really used it.”

Another participant stated, “We have to use a certain IEP form, and that form does not require us to plan or explain how or why we use AT with our students.” They
reported that the use of AT was left to teachers to think about, plan, and implement, and that they would not be asked for further details.

*Shortage of IEP team collaboration.* All the teachers indicated that they did not collaborate with their colleagues with regard to planning and implementing AT in the classroom. When I asked teachers specifically about the IEP team meetings and discussion of students’ AT needs, they stated that they usually did not discuss AT in detail at these meetings; generally focusing on long and short-term goals, which were not related to AT use. Moreover, they stated that not all IEP team members attended the meetings.

Teachers do everything. I write the whole IEP by myself for each student, and no one else is involved. Another thing is that when we meet, we only talk about general points, we do not discuss every point, we do not discuss teaching strategies using AT, and we only meet once at the end of each semester.

However, notwithstanding the above, some teachers indicated that they sometimes shared their experiences of AT use with other teachers and benefited from each other’s experiences.

**Barriers**

**Research Question 2.** How do teachers perceive the barriers to the use of AT with students with severe intellectual and developmental disabilities?
Exploring teachers’ perspectives of the barriers to the use of AT with students with severe intellectual and developmental disabilities was an essential aim of this study. Twelve items under the barriers section were given in the online survey questionnaire. Moreover, teachers had additional comments to say about barriers in the open-ended question. However, the quantitative results indicated that there was a significant lack of high-tech use, thus necessitating further explanation regarding the factors that specifically limited the teachers’ use of high-tech with their students. Teachers were asked to talk about the barriers to the use of all AT types in general and then about specific factors that limited their use of high-tech. The following two sub-themes relating to barriers emerged during the interviews: curriculum and lack of funding.

Curriculum. The teachers indicated that the curriculum was one of the barriers that limited their use of AT with their students. They indicated that they had been given a certain curriculum, whose goals and teaching strategies they had to follow. One of the teachers stated, “We have been given a curriculum without the AT we need in order to deliver the curriculum and teach its’ lessons”, the teacher further explained “I cannot use the traditional teaching strategy, I mean the lecture, with my students, they will never learn that way, there should be AT, especially for the group of students I teach.”

As the teachers acknowledged, all students with severe intellectual and developmental disabilities in Saudi Arabia were given the same curriculum for each grade level. In fact, all students in general education were given the same curriculum for each grade level. As a result, the teachers indicated that they started adapting the curriculum and adding the necessary goals, strategies, and tools in order to be able to
teach their students in an appropriate manner. One teacher said “There is no way with
the current curriculum provided to us to use AT and to be creative unless we change
and adapt what it needed to be adapted.” Another teacher claimed that the current
curriculum needed a tremendous amount of work to be suitable for the use of high-
tech, and that he did not have the time or the skills to do so.

*Lack of funding.* The teachers also indicated that there were funding issues that
limited their use of AT. They claimed it was very difficult, if not impossible, to obtain
high-tech. One of the teacher with approximately 21 years’ experience in teaching
students with disabilities stated, “the lack of money issue is not related to only high-
tech, it is about all basic tools that should be available in classrooms.” Other teachers
said that they had requested different types of AT, including high-tech, but the funding
they received only permitted them to purchase a few mid-tech and low-tech tools. They
indicated that the reason for this was that the Ministry of Education did not provide
their institutes with sufficient funds to purchase all the necessary AT devices.

**Professional Development Needs**

**Research Question 3.** What resources and support do teachers of students with
severe intellectual and developmental disabilities believe needed to effectively use AT
in special education institutes?

Although funding was regarded as the most important resource for special
education teachers to provide their students with the necessary tools, the primary focus
was on their professional development needs. They mentioned various aspects and
issues related to their experiences in professional development and what they needed
as part of their professional development in the use of AT. The following two sub-themes emerged under professional development: limited accessibility and creativity.

**Limited Accessibility.** The quantitative results revealed that only 53% of the participants had had at least one opportunity to attend a training program on the use of AT with students with disabilities. Furthermore, some of the teachers who had attended AT training programs or courses indicated in the open-ended question that there was a shortage of AT training programs. It was therefore important to ask about the accessibility of AT training programs or courses, and why there was a lack of AT training.

The teachers indicated that all the AT training courses were offered outside their institutes. Moreover, these training courses were usually held during the school day. One of the teachers stated, “In the last year, all training programs on the use of AT with students with disabilities were located too far from my institute, unfortunately I could not attend.”

Other teachers claimed that it was not easy to register for such courses due to considerations relating to time, cost, and location. Moreover, teachers stated that they sometimes received a list of training courses to be provided by the Ministry of Education during the year, and that they could choose from the topics on the list. One teacher indicated that he could choose only a limited number of training courses, and moreover that in the past two years he had not seen any training course on the use of AT.
Another issue regarding accessibility related to the administrations of the institutes. Teachers claimed that there was a lack of assistance from the institutes' administrations in regard to professional development in the use of AT. They acknowledged that sometimes the administrations could not assist them to attend training courses outside their institutes.

One teacher stated “I am not always allowed by the administration to attend the training programs in other centers during the school day.” It was mentioned that teachers always have to leave their classes to attend training programs outside their institutes, and that if the administration did not support them, they could not attend.

*Creativity.* I asked teachers about the training they had received on the use of AT, and what they still needed from training courses in order to improve and increase their use of AT. With regard to the content of their previous training courses, they indicated that most of them had been lectures or presentations rather than training as such. Some teachers claimed that these courses did not usually focus on overcoming the barriers they faced, such as lack of skills or lack of devices. Also, three teachers stated that the training courses usually focused more on the use of low-tech or mid-tech, whereas they need to know more about high-tech use.

In response to a question on what they still needed in terms of professional development with regard to the use of AT, they indicated that they still needed to learn how to design apps, videos, and games for their students. They ascribed their need for AT training in high-tech to the fact that some of their students preferred devices such as iPads and iPhones. One teacher stated “I need to learn about different apps for students
with disabilities in iPad, because some of my students love to use my iPads in classroom.”

Moreover, some teachers believed that training courses could be a great resource for learning new teaching strategies using AT. They also indicated that they needed to learn something new and creative in the training courses. For example, one teacher said, “training programs should promote the creativity in teachers.”

**Qualitative Interpretations of the Quantitative Data**

As explained at the beginning of this chapter, the aim of conducting a second, qualitative, phase was to gain an in-depth understanding of the teachers’ use of AT with students with severe intellectual and developmental disabilities, and other issues relating to the use of AT. In the first phase, data collected from the participants was used to answer the main research questions of this study. However, after collecting and analyzing the data from the first, quantitative, phase, certain statistical results needed to be further clarified. To more fully understand and clarify those results, the second, qualitative, phase was conducted on the basis of interviews with five participants. After conducting the interviews and analyzing the qualitative data, it was possible to elaborate on and interpret the statistical results more effectively, and the picture became much clearer as a result.

The results indicated that there were statistical differences in the use of AT between the four special education institutes. Moreover, they indicated that female teachers in both girls’ institutes had reported higher use of AT than male teachers in the
two boys’ institutes. The qualitative data interpreted those differences and indicated that female teachers tended to purchase devices or use their own devices in the classrooms. Male teachers, on the other hand, preferred to use the AT devices already available in their classrooms, although there was a lack of AT in those classrooms.

Moreover, the statistical results demonstrated that the important aspects were not adequately taken into consideration before selecting AT – for example, when planning for AT in the IEP and collaborating with teachers. However, the qualitative data could explain why there was a lack of IEP planning. Teachers indicated they had had a certain format for the IEP that they had to follow, and that format allowed teachers only to indicate whether they had used AT or not. Moreover, teachers stated that they only meet once – at the end of the semester – and that not all IEP team members attend that meeting. This explains why there was a lack of collaboration with teachers with regard to selecting and using AT.

Furthermore, as far as barriers to the use of AT were concerned, the majority of the participants agreed and strongly agreed with most of the statements given in the online survey questionnaire, and they provided additional barriers at the end of the survey. The statistical results demonstrated that there was a lack of AT use in general, and a severe lack of the use of high-tech. During the interviews, the participants were asked questions about the barriers they usually faced when using AT in general and high-tech in particular. The participants referred to additional barriers such as curriculum and funding, and explained how such barriers could severely limit their use of AT.
Finally, nearly half of the participants indicated in the first, quantitative, phase that they had not attended any training courses in the use of AT. Moreover, approximately 98% of participants either strongly agreed or agreed that they were in need of training courses in the use of AT. Several questions were asked during the interviews with a view to identifying the reason behind the lack of training, and why teachers who had attended training courses still needed further training. The teachers explained that there were issues with accessibility to the training programs provided by the Ministry of Education, and that most of the training courses they had attended lacked creativity.

Summary

The aim of this mixed methods sequential explanatory design was to investigate teachers’ perspectives on their use of AT with their students with severe intellectual and developmental disabilities in four special education institutes in Riyadh, Saudi Arabia. Moreover, this study aimed to provide a better understanding of issues relating to the use of AT, such as the effectiveness of AT, considerations, barriers, and resources needed from the standpoint of special education teachers.

This study consisted of two phases - a quantitative phase followed by a qualitative one. In the first, quantitative, phase the results demonstrated that there was a lack of AT use, with teachers reporting higher use of low-tech than mid-tech and high-tech. The results also demonstrated that there were statistical differences in the use of AT between the four special education institutes. Teachers at the girls’ institutes reported higher use of AT than teachers at the boys’ institutes. Other statistical
differences in the use of AT were found between teachers who had attended training courses on the use of AT and those who had not. Moreover, teachers who had attended training courses reported fewer barriers than those who had not. With regard to familiarity with AT, teachers who were familiar with both theoretical and practical aspects, as well as those who reported they were more familiar with practical than theoretical aspects, reported higher use of AT than teachers who were not familiar with either and those who were familiar with only the theoretical aspect of AT.

In the second, qualitative, phase, interviews were conducted with five teachers. The interviews were aimed at gaining a deeper understanding of the issue and elaborating on the statistical results analyzed in the first phase. Four major themes emerged from the interviews, as well as several sub-themes. The four themes were (a) the use of AT, (b) considerations, (c) barriers, and (d) professional development. These themes and sub-themes made it possible to interpret and elaborate on the data collected in the first, quantitative, phase. In the next chapter the outcomes of both phases are discussed in further detail and in relation to both the relevant literature and the theoretical and conceptual frameworks of this study.
CHAPTER FIVE:
DISCUSSION, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Introduction

The purpose of this study was to explore the perspectives of special education teachers regarding their use of AT with students who experience severe intellectual and developmental disabilities in four special education institutes in Riyadh, Saudi Arabia. This study, moreover, aimed to gather information about how these teachers perceived the effectiveness, elements they take into consideration, and barriers of AT as well as about what resources are needed for the effective use of AT. I conducted the study in two phases, a quantitative and a qualitative phase, in order to get a better understanding of the issue studied. In the quantitative phase, an online survey questionnaire was employed to obtain data, and then interviews were conducted with five participants in order to elaborate and to interpret the outcomes of the first phase.

In this chapter, I discuss the main findings of the study and the relationship of the study to the current literature on the use of AT and related concepts. The discussion includes the results of both quantitative and qualitative phases. In the first phase, major findings such as lack of AT use, barriers, resources, and significant differences between teachers’ use of AT and training, familiarity with AT, and special education institutes are discussed. Major results of the second phase such as reasons of AT lack, different
AT barriers, and professional development issues are discussed in details. Moreover, I explain the relationship between the findings of this study and the conceptual frameworks chosen for this study. Furthermore, I discuss the implications of the results ascertained in this study and conclude with some recommendations for further research.

The use of AT

1- How do teachers of students with severe intellectual and developmental disabilities perceive their implementation of assistive technology in special education institutes? In order to understand how special education teachers implement AT with their students, the following three sub-questions were asked:

1.a. What types of AT do teachers report using with their students and how frequently?
1.b. How do teachers perceive the effectiveness of the use of AT with students with severe intellectual and developmental disabilities?
1.c. What elements do teachers report considering when selecting AT for their students?

With regard to the first sub-question, the findings revealed that most of the teachers (64%) reported that they use low-tech devices almost every day. This result was considered positive. However, one concern was that 28% of teachers indicated that they use mid-tech devices only 2–3 days a week, while 47% of teachers reported that they never use high-tech devices with their students. Only 4% of the participants
indicated they use high-tech with their students. These outcomes, however, clearly revealed there is a lack of AT usage in these four special education institutes.

This shortage of AT use is consistent with other findings in Saudi Arabia and other countries. Most recently, Alharbi (2018) has explored the knowledge and usage of AT among special education teachers in Saudi inclusive schools, and among other findings the study revealed that most of the special education teachers reported that they do not often use AT with their students. Moreover, the results showed that their students rarely even had access to AT devices in their schools. Another study in Saudi Arabia has been conducted by Alkahtani (2013), who has surveyed 127 general and special education teachers and interviewed three of them in order to gather in-depth information regarding their knowledge, skills, and use of AT, and she has found that there is a shortage of AT use.

Notably, teachers’ use of high-tech with students seems to be lacking. Not surprisingly, other studies have also shown that high-tech is the type of AT used least often by special education teachers. Flanagan, Bouck, and Richardson (2013) have found that high-tech is used less frequently than low-tech. In the qualitative phase of this research, the teachers (interviewees) indicated that there is a severe shortage of high-tech usage among their students because of a lack of funding, which, in turn, leads to a paucity of high-tech devices. The literature has also shown that one reason for using high-tech devices less frequently than low-tech devices might be a lack of financial support (Johnson, Beard, & Carpenter, 2007).
The participants were asked in the second sub-question how they perceived the effectiveness of the use of AT with students who experience severe intellectual and developmental disabilities. Although teachers reported a shortage of AT usage, most of them indicated that all three types of AT (low-tech, mid-tech, and high-tech) are highly effective with students. Flanagan et al. (2013) have revealed similar findings; teachers were asked to report the effectiveness of low-tech and high-tech, and they indicated most of the devices were effective.

In the third sub-question, teachers were asked about what elements they usually took into consideration when selecting AT for their students. According to Zabala (1995), there are four essential elements that teachers should consider when selecting AT for their students: students, the environment, tasks, and tools (SETT). Zabala (1995) has indicated that the main idea of the SETT framework is to provide a detailed set of guidelines for the IEP team members to assist them in selecting AT devices to suit students with disabilities in classrooms. Thus, SETT framework was designed based on the IEP team members’ collaboration; in short, IEP team members should make their decisions regarding selecting and using AT with their students based on these four essential elements (SETT).

Hence, it is important to ask teachers how often they work with the IEP team members in order to select and plan for AT employment. In the survey questionnaire, teachers were asked how often they meet with the IEP team members to discuss and select the appropriate AT devices for their students. Thirty-seven percent of teachers reported never meeting, 29% of teachers reported rarely meeting, and surprisingly only
3% of teachers reported always meeting. To understand more how teachers consider AT in their students’ IEPs and why they do not meet with the IEP team members, I asked the interviewees certain questions, and they gave multiple explanations. First, they said that they do not write details about what AT devices they would or had used. Second, they indicated that the reason for not writing the necessary details regarding AT in the IEP is that they have a certain format they have to use and that this format does not include more information about the use of AT. Third, they said that they usually meet with their IEP team members at the end of the semester and that they only tell each other whether or not they have ever used AT. This shows, first, that teachers lack preparation and planning for AT use in their students’ IEPs and, second, that there is a lack of collaboration with the IEP team members. This mirrors previous findings. Alkahtani (2013) has indicated that among 127 Saudi special and general education teachers, about 94% of the participants do not consider the use of AT in their students’ IEPs. Chambers et al. (2018) have found that 33% of teachers and other professionals included the use of iPad in their students’ IEPs.

With regard to the first element of SETT, students, teachers were given an item in the survey questionnaire asking them how often they took into consideration each of their students’ abilities before selecting AT. A total of 44 teachers (47%) indicated they always take into consideration the ability of each student, while 37 teachers (40%) reported doing this often. This was the most reported element that teachers take into consideration. Although there were some teachers who reported they only sometimes, rarely, or never consider their students’ abilities before selecting AT, taking into
consideration this first element, students, is considered a good indicator due to the high number of teachers who are aware of the importance of this element. Furthermore, one of the sub-categories identified in the open-ended question was students’ needs and wants. This sub-category shows how teachers strongly consider this aspect by choosing to bring and to use their own devices with their students because they believed that their students are specifically in need of these devices on account of their abilities. Moreover, during the interviews, I asked teachers what elements they usually take into consideration when selecting AT for their students. The teachers insisted on the importance of this first element, students, by describing how they sometimes buy new devices for their students or, otherwise, use their own devices, especially for those students with severe intellectual and developmental disabilities. For instance, one of the teachers stated: “If I do not get what my students and I need in the classroom, they will never learn.” Furthermore, when they were asked about the first aspect that they consider before using AT, they answered “students.”

Zabala (1995), in his model, has argued how significant it is to consider the environment before selecting AT for students, and he has discussed some questions that the IEP team members should ask before making a decision regarding AT. One major question that he has discussed in this model is: “What materials and equipment are currently available in the environment?” Hence, it is important to ask teachers if they consider the availability of materials in their institutes. In the online survey questionnaire, teachers were asked how often they took into consideration the availability of the AT in the environment. About 39% of teachers reported that they
often consider this element before deciding what AT would best suit their students, and 30% of teachers reported always considering this. The findings revealed that female teachers take additional measures when they do not find the appropriate AT in the environment. As explained previously, they first consider the availability of AT in their classrooms, and if there is no AT, they tend to buy or bring their own AT in order to meet students’ needs.

With regard to the tools and tasks elements of SETT, these should be planned in the students’ IEP and should be discussed with the team members of the IEP. These two elements focus more on the activities and teaching strategies for using AT; hence, there is less focus on them in this study. However, I did ask teachers what they usually consider before selecting and using AT for their students, and the responses indicated they do not usually consider them as priorities in selecting AT devices for their students. They mostly consider the needs and wants of their students.

The Barriers to the Use of AT

One of the major aims of the current study was to explore the factors that limit teachers’ use of AT with their students who experience severe intellectual and developmental disabilities. To identify those factors and understand how they play a role in limiting teachers’ use of AT, I focused on this issue in the quantitative and qualitative phases. Furthermore, the technology acceptance model (TAM) framework was utilized as a guide to understand how external variables could influence the actual use of AT.
In the first phase, teachers were given 12 items pertaining to the barriers to AT usage. These 12 barriers were mentioned throughout the literature as the most-reported barriers among special education teachers (Ajuwon & Chitiyo, 2016; Alkahtani, 2013; Al-Moghyrah, 2017; Davis, Barnard-Brak, & Arredondo, 2013; Flanagan et al., 2013). In the current study, teachers’ responses revealed that the most frequently reported barrier is a lack of funding. This barrier was also found in the open-ended question and emerged during the interviews. The deficiency of funding has been one of the major barriers to the use of AT for decades (Constantinescu, 2015; Derer et al., 1996; Gustafson, 2006; Hourcade, Brimer, & Parette, 1996; Jacobsen, 2012; Parette & Murdick, 1998; Todis, 1996). Although teachers lack funding, the results indicated that they still use some AT devices, especially low-tech devices. The deficiency of funding along with the high cost of AT devices could significantly limit teachers’ employment of high-tech and mid-tech.

Moreover, one of the more frequently reported barriers was the shortage of support regarding how to use AT in the classroom, and this was followed by the barrier pertaining to deficiency of training. This result mirrors other findings that have shown that special education teachers experience a shortage in professional development with respect to the use of AT (Ajuwon & Chitiyo, 2016; Al-Moghyrah, 2017; Constantinescu, 2015; Flanagan et al., 2013; Gustafson, 2006; Jacobsen, 2012). In the current study, about 43 teachers (46.7%) indicated they have never had training on the use of AT. Thus, this shortage of professional development could influence teachers’ use of AT with their students.
Moreover, in the open-ended question and during the interviews, teachers claimed that there are more barriers that usually hinder their use of AT with their students. In the open-ended question, they reported that families and classrooms sometimes play certain roles in limiting teachers’ use of AT. With regard to families, they said that some families do not use AT devices at home with their children and that this limits their children’s abilities and skills. Some classrooms, teachers claimed, are too small to accommodate all students and the different types of AT devices.

Teachers’ deficiency of knowledge has been one of the most frequently reported barriers in recent studies (Ajuwon & Chitiyo, 2016; Alharbi, 2018; Alkahtani, 2013; Al-Moghyrah, 2017; Bausch & Hasselbring, 2004; Hawsawi, 2007). In the current study, almost 56% of the participants either agreed or strongly agreed that the deficiency of knowledge is a barrier in the employment of AT. Michaels and McDermott (2003) have stated that “almost universally in agreement that the success of students with disabilities with AT is related directly to the AT knowledge, skills, and dispositions of special education teachers” (p. 29). This shows the importance of teachers’ familiarity with AT and how the deficiency of knowledge among teachers influence the use of AT. However, further details regarding teachers’ familiarity with AT and its usage are discussed later in this chapter under the heading Familiarity and AT Use.

One of the most frequent barriers to emerge during the interviews was the curriculum. In Saudi Arabia, there is one curriculum for each subject per grade school level in special education. For instance, all students with intellectual disabilities in the first grade in Saudi Arabia have the same curriculum. Teachers indicated the way that
the curriculum is designed and its goals do not serve the use of AT. This barrier has not been evident in the current literature; there might be several reasons for this. First, generally, there is a lack of studies on the use of AT and its associated barriers in Saudi Arabia. Second, most of the studies on AT in Saudi Arabia have aimed to examine teachers’ knowledge and skills. Although there have been some studies that have explored the barriers to the use of AT, these studies have been primarily quantitative. Using a survey questionnaire could either prove or disprove the barriers found in the literature. Furthermore, interviews enable researchers to gather information and to interpret what teachers actually experience in their classrooms. Another possible reason that might explain why this, curriculum, barrier has not been evident in the literature is that no study has been conducted on the use of AT for students with severe intellectual and developmental disabilities and so examined the barriers that teachers and students face. The barrier of the curriculum might be more evident among students with severe disabilities due to the severity of the disability of this group of students (Lancioni, Sigafous, O’Reilly, & Singh, 2012) and the great challenges faced by teachers when teaching students with severe disabilities (Jones et al., 2015).

The barriers found in this study, as Davis (1985) has stated in the TAM framework, could influence how teachers consider and then use AT in their classrooms. As the outcomes have revealed, the most-reported barriers to the use of AT (the lack of funding and the high cost of AT) have been associated with the lack of AT usage, particularly with high-tech devices. Moreover, teachers themselves have stated that with those barriers they cannot successfully use AT with their students. That exactly
supports what Davis (1985) has claimed, that the external variables might affect the use of technology in the classrooms.

Resources Needed

Exploring teachers’ needs with regard to the use of AT with their students was one of the major purposes of the current study. With all the barriers that previous studies have found, it was important to ask teachers what resources they need for successful use of AT. In the first phase, they were given a total of four resources that have been found in the literature to be required by teachers. The most frequently reported resource was adequate financial support. One hundred percent of the participants either agreed or strongly agreed with the statement “Adequate financial support should be provided to institutes to enable them to provide teachers with more assistive technology devices.”

The second most frequently reported resource was training in AT usage. According to the data obtained in this study, nearly half of the participants have not had previous training in AT usage. Moreover, almost 98% of teachers agreed or strongly agreed with the following statement: “Teachers should be provided with the needed training on the use of AT.” The high number of teachers who agreed with the previous statement implies that all teachers are in need of ongoing professional development regardless of whether or not they have had previous training in AT usage.

Moreover, in the open-ended question, several sub-categories regarding teachers’ needs for professional development emerged; the teachers explained what they needed, in particular, from the professional development programs. First, they would prefer AT
training that focuses on the practical use of AT instead of being presented with information about the use of AT. Teachers also indicated that professional development for AT usage should be provided regularly. The last sub-category was that the focus of the AT training should be more on high-tech devices. Furthermore, enhancing teachers’ creativity through professional development on AT was indicated by the interviewees as an important aspect.

Recently, other studies have found that special education teachers have reported similar resources needed for the successful use of AT with their students. Most recently, Al-Moghyrah (2017) has found that AT training at the pre-service level is the most frequently reported resource needed by teachers of students with Down syndrome in Riyadh. In addition, Chambers et al. (2018) have found that about 70% of teachers of students with disabilities reported a great need for training on the use of iPad. Other findings from the same study have shown that teachers reported funding as a much-needed factor for developing AT use with their students. Another study conducted by Ajuwon and Chitiyo (2016) has shown that there is a significant need for teachers’ professional development in AT usage and also for funding in order to promote the successful use of AT.

Training and AT Use

It was certainly disappointing to discover that only 53% of teachers who participated in this study had received previous training on the use of AT. However, this study aimed to investigate the significant differences, if any, in teachers’ perspectives about their use of AT, its barriers, and the resources needed, based on
previous AT training experiences. First, I examined the significant difference between AT use and previous training. The results showed that there is a difference between teachers who have had previous training on AT use (M = 10.18) and teachers who reported to have never had AT training before (M = 8.83). The difference was statistically significant p = 0.005. This is commensurate with the teachers’ insistence on reporting the significant need for professional development for AT usage. As I have previously described, almost half of participants indicated they have not had a chance to train in AT usage; thus, these significant differences between AT use and AT training show that there is a great need to increase professional development programs for teachers in the four special education institutes.

I also examined if there was a significant difference between teachers’ previous training and the barriers that limit AT use with their students. The findings indicated that teachers with previous AT training (M = 39) face fewer barriers than teachers without the training (M = 42). The difference was also statistically significant p = 0.017.

Furthermore, about 77% of teachers indicated that the shortage of AT training is a barrier, 57% reported that deficiency of knowledge is a barrier, and 98% said there is a high need for AT. The results of the statistical tests revealed that there is a statistical difference in the use of AT and the reported barriers between teachers who have had AT training and who have not. This implies that providing teachers with the needed professional development may increase the use of AT and may, moreover, decrease the barriers faced when they implement AT. However, as I have previously discussed,
through the open-ended questions and during the interviews, teachers described in
detail the AT training they still need to increase and to improve their use of AT.

Similarly, in the literature, professional development for AT usage has been
linked to teachers’ use of AT. One study has shown the importance and the influence of
the AT training on teachers’ use of AT (Flanagan et al., 2013). A relationship between
teachers’ previous training and AT use has been found. Flanagan et al. (2013) have
stated: “This may suggest that as training and/or coursework increase, overall feeling
of preparation and the actual ability to choose and then implement AT may increase;
and, vice versa” (p. 28).

**Familiarity and AT Use**

Teachers’ deficiency of knowledge with AT has been shown as a limitation of AT
among special education teachers (Ajuwon & Chitiyo, 2016; Alkahtani, 2013; Bausch &
Hasselbring, 2004). In this study, teachers were asked about their familiarity with AT
use, including their knowledge (theoretical aspect) and their skills (practical aspect) in
using AT. The results of this question showed that there is a relationship between the
use of AT and teachers’ familiarity with AT, on the one hand, and their professional
development needs and the use of AT, on the other hand.

The results indicated teachers who are familiar with both the theoretical and
practical aspect of AT reported a higher use of AT, and this was followed by teachers
who are familiar with only the practical aspect of AT. Teachers who are only familiar
with the theoretical aspect or who are not familiar with both aspects reported a lower
use of AT. These finding seem to imply that teachers should learn more about both aspects or at least the practical aspects for increasing AT use with students.

There are two points that support this assumption. First, in the quantitative phase, about 98% of teachers reported that they either agreed or strongly agreed that there is an extremely high need for training on AT use. Second, teachers in the open-ended questions acknowledged the importance of focusing on the practical aspect of the training programs. In addition, during the interviews, teachers noted that the professional development on AT use should always focus on teachers’ skills and how to use AT with students instead of focusing on theories and other information related to AT.

**AT Use and Special Education Institutes**

Examining the differences among special education teachers from the four special education institutes with regard to AT use was one of the major aims of this study. These institutes are, first, divided according to gender: two institutes for boys and two for girls. Second, one of the boys’ institutes and one of the girls’ institutes are located in eastern Riyadh, under two different school districts (male and female school districts). The two other institutes are located in western Riyadh, under different school districts. In short, all four institutes are governed under different administrations/school districts.

In the quantitative phase of this research, the results showed that teachers in both institutes for girls reported a higher AT use than in the institutes for boys. In the
qualitative phase, interpretations and explanations were provided by teachers as to why there were differences and how these differences manifested. In other words, the interviews revealed further factors that influenced their use of AT. According to Rogers (2003) in the Diffusion of Innovations, the use of AT can be influenced by one or all of the following four elements: (a) innovations, (b) communication channels, (c) time, and (d) social systems. During the interviews, teachers indicated that innovations and the social system could influence AT usage and could explain the difference in AT usage between the four special education institutes, particularly between institutes for boys and girls.

The innovation and the social system are two factors that could positively influence teachers’ AT usage in special education institutes. As previously explained, there was a severe deficiency of AT devices, particularly high-tech devices in the four special education institutes. Thus, the social system in the girls’ institutes positively influenced the innovation and could increase the use of AT at the girls’ institutes.

An innovation, according to Rogers (2003), entails “an idea, practice, or object that is perceived as new by an individual or another unit of adoption.” With regard to the social system, Rogers (2013) believed that it could play an important role in AT use among teachers: “the structure of the social system can facilitate or impede the diffusion of innovations.” Special education teachers in the four institutes, in this case, are considered members in the social system, and their role is significant.

During the interviews and through the open-ended answers obtained from the survey, female teachers indicated that they either bought or used their own devices
with their students. Male teachers, in contrast, tended to only use the AT devices provided by their institutes. Hence, assistive technology, which is considered an innovation, according to Rogers (2003), because it provides new alternatives for teachers to solve problems, was positively influenced by female teachers, who are part of the social system in this case. Figure 8 shows how the social system influences the innovation and how both of the two elements can influence the use of AT.

![Diagram](image)

*Figure 8: The influence of social systems and innovations on the use of AT*

Furthermore, female teachers acknowledged that they have purchased new ATs for their students, have used their own devices in the classrooms, and have also paid a substantial amount of money for the maintenance of these devices. In contrast, male teachers did not indicate that they had ever used their own devices for teaching purposes with their students in the classrooms. This is possibly due to the fact that in Saudi Arabia, men, unlike women, are responsible for the households of their families.
Women, based on the law, religion, and culture, are not required to pay for their living costs, regardless of their income. This implies that Saudi male teachers have more financial responsibilities. This might allow female teachers to be more generous in providing AT devices for their students and in paying for maintenance costs.

**Implications**

The outcomes of this study could have multiple implications for positive change with regard to teachers’ use of AT with students who experience severe intellectual and developmental disabilities; these outcomes could be realized on the level of the teaching, administration, and research. At the teachers’ level, the findings of this study suggest several ways for improving AT use among teachers. First, the findings of the current study show the significance of professional development in teachers’ use of AT and how it could increase the level of use among teachers who have had previous training on AT use. Thus, it is highly recommended that teachers attend more training programs/courses on AT use, especially those teachers who have not had a chance to attend any training program before. Another way for increasing the level of AT use and its effectiveness entails collaboration and IEP planning. Zabala (1995) has suggested that teachers should always plan and consider the students’ use of AT in their IEPs. The outcomes of the current study revealed a shortage of AT planning in students’ IEP; thus, it is important that teachers include more details on the use of AT in students’ IEP and that they collaborate with each other in order to increase the level and the effectiveness of AT use.
At the administration level, the outcomes of this study may inform the decision-makers in the Ministry of Education, school districts, and special education institutes that teachers of students who experience severe intellectual and developmental disabilities need AT training programs/courses. Teachers have acknowledged that there are three important focus areas that training programs should all incorporate: (1) practical knowledge, (2) sustainability, and (3) high-tech. Hence, providing teachers with such training programs may increase and improve the use of AT among teachers. Another way to increase the level of AT use is through providing various AT devices in classrooms. Funding has been considered a major barrier that limits teachers’ use of AT with students; therefore, it is important that decision-makers in the Ministry of Education increase the financial support for AT in institutes and schools.

The outcomes of the current study indicate that approaching the problem of the current study through utilizing a sequential, explanatory, mixed methods approach is beneficial for addressing the issue studied. The interpretations of the quantitative results justify the significant differences in teachers’ use of AT and further explain the barriers encountered by teachers and the resources needed by teachers.

Another implication of this research relates to the theoretical and conceptual frameworks chosen for this study. Through the interpretive paradigm, I could find interpretations and explanations for the significant issues related to the research questions of the study. Moreover, the diffusion of innovations, technology acceptance model, and the SETT framework guided this study in understanding major aspects of
AT use among teachers, and they helped to provide a clear picture on how teachers currently use AT and how they should use it.

**Recommendations for Future Research**

According to the outcomes of this study, the recommendations for future research on AT use among teachers of students with severe intellectual and developmental disabilities in Saudi Arabia are as follows.

**Professional Development.** The outcomes of this study highly recommend an ongoing professional development for AT usage for all teachers in the special education institutes. The findings of this study revealed a shortage of professional development among special education teachers regarding the use of AT. Moreover, the literature on professional development on using AT in Saudi Arabia is lacking; hence, either quantitative or qualitative research studies could be conducted to further explore the reasons for the shortage of this professional development. Furthermore, the current professional development on AT provided for special education teachers in Saudi Arabia, especially in special education schools/institutes, could be explored.

**Administrators.** In this study, teachers indicated various barriers that limit AT use, including barriers related to either the special education institutes’ administrations or to the Ministry of Education, such as a deficiency in funding, a shortage of professional development, and curriculum-based problems. Hence, exploring administrators’ perspectives regarding these barriers is imperative in furthering our understanding of the issue and in examining these barriers from other perspectives.
Teacher Collaboration. The shortage of collaboration among teachers was one of the major barriers that limited teachers’ planning for AT use in students’ IEP. Thus, other studies could investigate the factors behind this lack of collaboration in terms of planning for AT use with students.

Curriculum. In the second phase of the study, teachers acknowledged that the curriculum they had been given for students with disabilities is not appropriate for AT use. Further research should be conducted to interview teachers and to provide a better understanding of the relationship between the curriculum and the use of AT with students with disabilities in Saudi Arabia.

Qualitative Research. Although this study utilized a mixed methods approach for exploring teachers’ perspectives in AT usage, conducting qualitative research using interviews, focus groups, and observations on how teachers implement AT with their students might provide more details regarding the issues related to AT use in special education institutes.

Special Education Institutes. This study explored teachers’ perspectives on their AT use, the barriers limiting their use, and the resources needed for effective AT use in four special education institutes in Riyadh. However, similar studies could be conducted on teachers from other institutes, cities, or regions in order to determine whether there are similarities or differences in their perspectives regarding the use, considerations, effectiveness, barriers, and resources needed.
Conclusion

Although the relatively low response rate in this study, which did not represent every teacher in the four special education institutes, I believe that the quantitative and qualitative data gathered in the two phases were sufficient to describe, interpret, and understand teachers' perspectives of AT use with students with severe intellectual and developmental disabilities.

The purpose of this sequential explanatory mixed methods design was to explore and interpret teachers' perspectives of their use of AT with students with severe intellectual and developmental disabilities in four special education institutes in Riyadh, Saudi Arabia. Furthermore, this study aimed to better understand other aspects related to the use of AT such as the effectiveness of AT, teachers' considerations when selecting AT devices, barriers, and resources needed for effective use of AT. Moreover, examining the differences between teachers' use of AT and their previous training, familiarity with AT, and the institute they work for was one of the major aims of this study. The study was guided by the interpretive paradigm. Also, the Diffusion of Innovations, the Technology Acceptance Model, and the SETT framework guided the study to better understand the issue being studied.

This study consisted of two phases, quantitative followed by qualitative interviews. A total of 92 special education teachers from four special education institutes were surveyed, and five teachers in the second phase were interviewed to provide interpretations for the data gathered from the first phase. The findings from the first phase provided baseline data on how teachers use, select, and perceive AT. The
results showed that there was a lack of AT use, particularly high-tech devices. The outcomes also showed that there were statistical differences in the use of AT between the four special education institutes. Other statistical differences in the use of AT were found between teachers who had had professional development and those who had not. In regard to the familiarity with AT, teachers who reported familiar with both theory and practical, and familiar with practical more than theory, reported higher use of AT than other teachers. In the second phase, I collected data from interviews with five teachers. Four major themes were emerged from the data with several sub-themes. The four themes were (a) the use of AT, (b) considerations, (c) barriers, and (d) professional development. Those themes and sub-themes elaborated and interpreted the quantitative data. Finally, the outcomes of both phases show the need for training on the use of AT, increasing financial support, and overcoming other barriers that limit teachers' use of AT.


Alkahtani, K. D. (2013). Teachers knowledge and use of assistive technology for
students with special needs. Journal of Studies in Education, 3(2). Doi:
orrg/10.5296/jse. V3i2.3424.

Almalki, N. (2013). Professional development needs of early intervention providers of
preschoolers with moderate and severe disabilities in Saudi Arabia (Doctoral
dissertation, Ball State University).

Mainstream Schools in Riyadh, Saudi Arabia: Teachers’ Perspectives. Journal of
Education and Practice. Vol.8, No.33, 2017

Centennial Anniversary for Founding the Kingdom of Saudi Arabia. Riyadh, Saudi
Arabia: Ministry of Education.

to Integration. Dubai, United Arab Emirates: Dar Al-Kalam.

Alquraini, T. A. (2011). Teachers' perspectives of inclusion of the students with severe
disabilities in elementary schools in Saudi Arabia (Doctoral dissertation, Ohio
University).

Alquraini, T. A. (2012). Factors related to teachers' attitudes towards the inclusive
education of students with severe intellectual disabilities in Riyadh, Saudi.


doi:10.1177/0741932511401037


Division for Learning Disabilities & Division for Research of The Council for Exceptional


Hawsawi, A. (2007). Obstacles in using educational technology in teaching mental retarded students as perceived by teachers of intellectual education. (King Saud University).


Taşkm, N., & Kandemir, B. (2010). The affect of computer supported simulation applications on the academic achievements and attainments of the seventh grade students on teaching of science. Procedia-Social and Behavioral Sciences, 9, 1379-1384.


World Health Organization (2017). Global priority research agenda for improving access to high-quality affordable assistive technology. Retrieved from:


APPENDICES
Appendix A: Interview protocol

Interview Guide

1- Please describe your use of AT with your students?
   a. How do you use AT?
   b. What types of AT do you usually use?
   c. Do you use your own devices? Why/Why not?

2- Please tell me about the elements you take into consideration when you select AT for your students?
   a. Please tell me how you plan for AT use in the IEP?
   b. Do you discuss your use of AT with IEP team members?
   c. Please tell me about your collaboration with colleagues in terms of selecting and using AT?

3- Please tell me about the barriers that limit your use of AT in general with your students?
   a. Please tell me about the barriers that limit your use of high-tech?

4- What resources do you think you need for effective AT use with your students?
   a. Please tell me about the accessibility of professional development on the use of AT?
   b. Please tell me about your experience with AT professional development?

What do you think you still need in terms of professional development regarding AT use?
Appendix B: Instrument

Section One

Q1. What is your age?
   - □ 30 and younger
   - □ 31 - 35
   - □ 36 – 40
   - □ More than 50

Q2. What is your gender?
   - □ Male
   - □ Female

Q3. How many years of special education teaching experience do you have?
   - □ 1- 5
   - □ 6-10
   - □ 10- 15
   - □ More than 15 years

Q4. What is the highest level of education you have completed?
   - □ Bachelor’s degree
   - □ Master’s degree
   - □ Doctorate degree
Appendix B: Continued

☐ Other: _______________

Q5. What is your special education institute?

☐ The Intellectual Education Institute for Boys in western Riyadh
☐ The Intellectual Education Institute for Girls in western Riyadh
☐ The Intellectual Education Institute for Boys in eastern Riyadh
☐ The Intellectual Education Institute for Girls in eastern Riyadh

Q6. Have you ever attended any training courses/programs on the use of assistive technology?

☐ Yes
☐ No

A- Were your training courses/programs part of the professional development programs provided by the Ministry of Education?

☐ Yes
☐ No

B- Were your training courses/programs during college?

☐ Yes
☐ No
Appendix B: Continued

C- Were your training courses/programs part of self-learning?

☐ Yes

☐ No

D- Others. Please indicate: ..............................................

Q7. How many training courses/programs have you attended so far?

☐ 1- 2

☐ 3-5

☐ More than 5

Q8. Which of the statements below best characterizes your familiarity with AT? For the purpose of this question, theoretical knowledge refers to knowing, in theory, how the AT can be used and for which purposes; the practical use refers to your actual use and level of comfort when using the AT as it is intended or for any other instructional uses.

Please select only one.

☐ Familiar with both theoretical knowledge and practical use of AT.

☐ Familiar with theoretical knowledge more than the practical use of AT.

☐ Familiar with practical use of AT more than the theoretical knowledge.

☐ Not familiar with either theoretical knowledge or practical use of AT.
Appendix B: Continued

Section Two

*Part I: Use of AT*

Q1. Which of the following AT types do you usually use with your students and how frequently?

<table>
<thead>
<tr>
<th>AT Type</th>
<th>Frequency of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Tech (e.g. non-computer technology, communication boards, flashcards, pen or pencil grip, etc.)</td>
<td></td>
</tr>
<tr>
<td>Mid-Tech (e.g. computer, projector, audiobook, electronic speller, voice amplification etc.)</td>
<td></td>
</tr>
<tr>
<td>High-Tech (e.g. advanced technology, electronic tablet such as iPad, iPod or other advanced devices or Apps, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Continued

**Part II: The effectiveness of AT**

Q1: To what extent do you think the following types of AT use are effective with students with severe intellectual and developmental disabilities?

<table>
<thead>
<tr>
<th>AT Type</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Tech (e.g. non-computer technology, communication boards, flashcards, pen or pencil grip, etc.)</td>
<td>Not effective at all</td>
</tr>
<tr>
<td>Mid-Tech (e.g. computer, projector, audiobook, electronic speller, voice amplification etc.)</td>
<td></td>
</tr>
<tr>
<td>High-Tech (e.g. advanced technology, electronic tablet such as iPad, iPod or other advanced devices or Apps, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Continued

*Part III: Considerations*

Q1: Which of the following elements do you usually consider when you select AT devices for your students?

<table>
<thead>
<tr>
<th>Elements for considerations</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I take into consideration each student's ability before selecting the AT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I take into consideration each student's preferences before selecting the AT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I take into consideration the availability of the AT in my institute before I decide what AT best suit my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I meet with the Individualized Education Program (IEP) team members to discusses and select the appropriate AT for my students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I decide myself what AT devices best suit my students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Continued

Section Three

The barriers to the use of AT

Q1: How do you perceive the following AT barriers in your institute?

<table>
<thead>
<tr>
<th>AT Barriers</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The high cost of some AT devices prevents me from using AT with my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack of funding on purchasing the needed AT devices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack of AT devices that I need to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack of teachers’ knowledge of using AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack of training in AT use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack of support for teachers in how to deal with AT devices in the classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some of AT devices are</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Some of AT devices are too difficult and complex for my students to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do not think that my students make an improvement by using AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My students sometimes do not prefer to use AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a lack or no maintenance services for the AT devices in my institute.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using AT in the classroom requires additional time and effort, which makes it difficult sometimes to use AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Resources needed

Q1: What resources and support do you believe are needed for successful use of AT?

<table>
<thead>
<tr>
<th>Resources Needed</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers should be provided with the needed training on using AT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate financial support should be provided to institutes to enable them to provide teachers with more AT devices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers need AT expert in the institute to provide technical assistance and support.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance services should be provided to help teachers repair devices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Continued

Section Five

Please, provide any comments or suggestions regarding your use of AT with your students, AT effectiveness, elements you take into consideration when selecting AT, barriers, and/or resources needed.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________


Appendix C: Institutional Review Board approval to conduct research study

Study ID: Pro00038052 Date Approved: 12/31/2018

Informed Consent to Participate in Research Involving Minimal Risk
Pro00038052

You are being asked to take part in a research study. Research studies include only people who choose to take part. This document is called an informed consent form. Please read this information carefully and take your time making your decision. Ask the researcher or study staff to discuss this consent form with you, please ask him/her to explain any words or information you do not clearly understand. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

We are asking you to take part in a research study called:

Teachers’ Use of Assistive Technology in Special Education Institutes in Riyadh, Saudi Arabia.

The person who is in charge of this research study is Khalid Abu Alghayth, a doctoral student at USF. This person is called the Principal Investigator. However, other research staff may be involved and can act on behalf of the person in charge. He is being guided in this research by Dr. Phyllis Jones, professor, USF.

The research will be conducted at [Special Education Institutes in Riyadh].

Why are you being asked to take part?

We are asking you to take part in this research study because you are a special education teacher who teaches students with severe disabilities in special education institute in Riyadh.

Study Procedures:

If you take part in this study, you will be asked to:

• Participate in an interview up to 45 minutes.
• The interviews will be conducted online through FaceTime, Zoom or a similar platform.
• Interviews will be audio recorded. You shall be notified and your approval will be sought before the recording. You can deny being recorded if you change your mind. Only the researchers will have access to these tapes.
Appendix C: Continued

Study ID: Pro00038052 Date Approved: 12/31/2018

- Recordings will remain in electronic format and be deleted after the final report is presented to the IRB or 5 years later. After 5 years, images, recordings and transcripts will be deleted.

**Total Number of Participants**
A total of 10 individuals will participate in the study at all sites.

**Alternatives / Voluntary Participation / Withdrawal**
You have the alternative to choose not to participate in this research study.

You should only take part in this study if you want to volunteer; you are free to participate in this research or withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study. *Your decision to participate or not to participate will not affect your student status, course grade, recommendations, or access to future courses or training opportunities.*

**Benefits**
We are unsure if you will receive any benefits by taking part in this research study.

**Risks or Discomfort**
This research is considered to be minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

**Compensation**
You will receive no payment or other compensation for taking part in this study.

**Costs**
It will not cost you anything to take part in the study.

**Conflict of Interest Statement**
There is no conflict of interest.

**Privacy and Confidentiality**
We will do our best to keep your records private and confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Certain people may need to see your study records. These individuals include:

- The research team, including the Principal Investigator, study coordinator, research nurses, and all other research staff.
Appendix C: Continued

Study ID: Pro00038052 Date Approved: 12/31/2018

• Certain government and university people who need to know more about the study, and individuals who provide oversight to ensure that we are doing the study in the right way.
• Any agency of the federal, state, or local government that regulates this research.
• The USF Institutional Review Board (IRB) and related staff who have oversight responsibilities for this study, including staff in USF Research Integrity and Compliance.

We may publish what we learn from this study. If we do, we will not include your name. We will not publish anything that would let people know who you are.

You can get the answers to your questions, concerns, or complaints

If you have any questions, concerns or complaints about this study, or experience an unanticipated problem, call Khalid Abu Alghayth at 813 382 6227.

If you have questions about your rights as a participant in this study, or have complaints, concerns or issues you want to discuss with someone outside the research, call the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu.

Consent to Take Part in this Research Study

I freely give my consent to take part in this study. I understand that by signing this form I am agreeing to take part in research. I have received a copy of this form to take with me.

Signature of Person Taking Part in Study ______________________________ Date ____________

Printed Name of Person Taking Part in Study ______________________________

Statement of Person Obtaining Informed Consent

I have carefully explained to the person taking part in the study what he or she can expect from their participation. I confirm that this research subject speaks the language that was used to explain this research and is receiving an informed consent form in their primary language. This research subject has provided legally effective informed consent.

Signature of Person obtaining Informed Consent ______________________________ Date ____________

Printed Name of Person Obtaining Informed Consent ______________________________
Appendix D: Approval Letter from Ministry of Education to Conduct Research Study

<table>
<thead>
<tr>
<th>اسم</th>
<th>خالد بن محمد أبو الغيث</th>
</tr>
</thead>
<tbody>
<tr>
<td>الجامعة</td>
<td>جنوب فلوريدا / أمريكا</td>
</tr>
<tr>
<td>العام الدراسي</td>
<td>1440 هـ</td>
</tr>
<tr>
<td>الدرجة العلمية</td>
<td>الدكتوراه</td>
</tr>
</tbody>
</table>

عنوان الدراسة: استخدام التكنولوجيا المساعدة في معالجات التربوية الفكرية

عميد الدراسة: معلم / التربية الفكرية

المحكرمة: قائد / المدرسة

السلام عليكم ورحمة الله وبركاته،

إشارة إلى قرار ملكي وزيرة التعليم رقم 288/80 و تاريخ 5/12/1428 هـ بشأن تقنيات الإصلاحات لتدريب التعليم، وبناءً على قرار سعادة مدير عام التعليم بمنطقة الرياض رقم 289/80 و تاريخ 1428/6/23 هـ بشأن تقنيات الإصلاحات لقيادة التخطيط والمعلومات لتسهيل مهمة الباحثين والباحثات،

وجيث تقدم إلينا الباحث (الموثقة ببياناتها أعلاه) بطلب إجراء دراسته، ونظرًا لاحتمال الأوراق المطلوبة

نأمل تسهيل مهمته.

مع ملاحظة أن الباحث يتولى مكالمة المسؤولية المتعلقة بمختلف جوانب البحث، ولا يعني سماع الإدارة العامة للتعليم موافقتها بالضرورة على مشكلة البحث أو على الطرق والأساليب المستخدمة في دراستها وتحليتها.

والمعنوي فإن طلب (إناء المهمة) يطلب الرغب لنا من الجهات المعنية بتطبيق البحث.

بأن الباحث قد باشر تنفيذ أدوات البحث حضورياً.

شاكرين لكم تفهمكم وتقديركم.

مدير إدارة التخطيط والمعلومات

سعود بن راشد آل عبد العزيز
Appendix E: IRB approval letter

1/2/2019

Khalid Abu Alghayth
Teaching and Learning

RE: Expedited Approval for Initial Review
IRB#: Pro00038052
Title: Teachers' Use of Assistive Technology in Special Education Institutes
Study Approval Period: 12/31/2018 to 12/31/2019

Dear Mr. Abu Alghayth:

On 12/31/2018, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol Document(s):
Protocol Version #1 10/29/2018

Consent/Assent Document(s)*:
Arabic Informed Consent (interview).pdf
IC Interview.pdf
English Informed Consent Survey **
Arabic Informed Consent (survey) **

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent documents are valid until the consent document is amended and approved. **Online survey coversheets are not stamped.

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review
Appendix E: Continued

category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your study qualifies for a waiver of the requirements for the documentation of informed consent for this online survey as outlined in the federal regulations at 45CFR46.117(c) which states that an IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: (1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) business days.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

Kristen Salomon, Ph.D., Chairperson
USF Institutional Review Board