

The Challenges and Benefits of Assistive Technology and Educational Programs for Educators, Caregivers, and Youth with Multiple Exceptionalities/Special Needs

by

Paula M. Ivan

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Dr. William J. Hunter

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Review Committee:

Research Supervisor

Dr. William J. Hunter

Second Reader

Dr. Diana Petrarca

The above review committee determined that the Project/Major Paper is acceptable in form and content and that a satisfactory knowledge of the field was covered by the work submitted. A copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

ABSTRACT

Assistive technology (AT) is a process that provides opportunities for youth with multiple exceptionalities/special needs to learn, grow, and discover meaningful avenues in order to navigate through an evolving digital world. A growing body of research literature suggests that when assistive technology is introduced into the educational curriculum by teachers, included in the educational system by stakeholders, and made accessible in the learning community; it has the potential to enhance digital literacy, language, and numeracy skills for youth with multiple exceptionalities/special needs. Assistive technology also has the potential to augment cognitive development, language development, social development, and physical development, while improving the overall well-being of youth with multiple exceptionalities/special needs. This systematic literature review is qualitative by nature and seeks to explore the broad question, “what are the challenges and benefits of assistive technology and educational programs for educators and families of youth with multiple exceptionalities/special needs in the educational system?”

Keywords: Assistive technology (AT); Augmentative and Alternative Communication (AAC) devices; *Autcraft*; do-it-yourself (DIY); Edmark Reading Program (ERP); Community-based Education Programs (CBEs); adapted physical education (APE); System of Augmented Language (SAL); Human-Computer Interaction (HCI); Assessment of Written Expression Adaptivity for Assistive technology (AWE ADAPT for AT); Autism Spectrum Disorder (ASD); Attention-Deficit/Hyperactivity Disorder (ADHD); Down Syndrome (DS)

AUTHOR'S DECLARATION

I hereby declare this M.Ed. project consists of original work that I have authored. This is a true copy of the work, including any required final revisions, as accepted by my committee.

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Paula M. Ivan

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STATEMENT OF CONTRIBUTIONS

I hereby certify that I am the sole author of this work and that no part of this work has been published or submitted for publication. I have used standard referencing practices to acknowledge ideas, research techniques, or other materials that belong to others. Furthermore, I hereby certify that I am the sole source of the creative works and inventive knowledge described in this document.

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LIST OF ABBREVIATIONS AND SYMBOLS

SLR	Systematic Literature Review
AT	Assistive technology
ASD	Autism Spectrum Disorder
ADHD	Attention-Deficit Hyperactivity Disorder
DS	Down Syndrome
DIY	Do-it-yourself
ERP	Edmark Reading Program
DIY-AT	Do-it-yourself Assistive Technology
APE	Adapted physical education
CBEs	Community-based education programs
MI	Motivational Interviewing
AAC	Augmentative and Alternative Communication
SAL	System of Augmented Language
HCI	Human-Computer Interaction
AWE ADAPT for AT	Assessment of Written Expression Adaptivity for Assistive Technology
VSD	Visual scene display
AR	Augmented Reality
OT	Occupational Therapy
IEP	Individualized Education Plans
IDEA	Individuals with Disabilities Education ACT
ADA	American Disabilities ACT

KEY TERMS

Assistive technology- a flexible and exploratory process that allows communities to develop, grow, learn, and use creativity vis-à-vis categories that are ill-defined, static, or pre-defined (Ringland & Wolf, 2021).

Autism Spectrum Disorder- is categorized under neurodevelopmental disabilities, impacting social, communication, and social interaction, followed by restricted and repetitive patterns of behaviour (Deng & Rattadilok, 2022).

Attention-Deficit Hyperactivity Disorder- is a functional problem that includes inattention, hyperactivity, and impulsivity (Husain, 2020).

Down Syndrome- is a condition caused by an extra copy of chromosome 21.

Autcraft- is part of an ethnographic engagement. It is focused on how a virtual community includes organizing activities to transform a Minecraft game into a collection of assistive technologies to support youth with ASD (Ringland & Wolf, 2021).

Edmark Reading Program- is designed for youth with ASD in order to support and enhance students' literacy, language, and phonetics. The purpose of the ERP program is to develop sight-word reading skills for students and youth with ASD (Bruni & Hixson, 2017).

Adapted physical education- it includes educators who are trained and understand youth with ASD, and can improve digital access to services, resources, and programs, while also assist youth to use AT in education (McIntire, 2018).

Community-based Education Programs- programs that enhance youth's lived experiences, provides an opportunity for students to become critical thinkers and change-makers within the society and community, upholds community-based approaches while also connecting to civic engagement and volunteerism (Lardier et al., 2020).

Augmentative and Alternative Communication- is a device that includes voice output, picture symbols, and speech-generating devices. It could also be used to support youth with ADHD and ASD by enhancing language development (e.g., reading and writing) and attention span (Pontikas et al., 2022).

System of Augmented Language- is a tool that is part of the AAC device family. The SAL tool can support youth with ADHD to navigate through online applications, familiarize themselves with the digital world, improve intellectual functioning (e.g., memory, learning, problem-solving, and judgement), and enhance adaptive functioning, which is connected with communication skills (e.g., speech), developing virtual friendships, social judgement, and interactive online activities (Pontikas et al., 2022).

Assessment of Written Expression Adaptivity for Assistive Technology- is beneficial with respect to understanding the effectiveness, efficiency, satisfaction, and helpfulness of resources and strategies used for the assessment of youth with ASD (Lemmon & Grajo, 2022).

The Challenges and Benefits of Assistive Technology and Educational Programs for Educators, Caregivers, and Youth with Multiple Exceptionalities/Special Needs

Introduction

This systematic literature review (SLR) is focused on the challenges and benefits of assistive technology and educational programs for youth with multiple exceptionalities/special needs, which include Autism Spectrum Disorder (ASD), Attention-Deficit Hyperactivity Disorder (ADHD), and Down Syndrome (DS).

Assistive technology (AT) is a process that provides opportunities for youth with multiple exceptionalities/special needs to learn, grow, and discover meaningful avenues in order to navigate through an evolving digital world (Pontikas et al., 2022). One of the many functions of AT is to support youth with various disabilities to perform higher levels of functionality, build various skills, enhance developmental domains, and improve learning within the field of education (Deng & Rattadilok, 2022). Furthermore, AT can foster academic and digital skills within the classroom environment, and can also be utilized outside of the classroom (e.g., home environment) in order to meet diverse learning objectives (Ghanouni et al., 2020). This raises the question as to what kind of assistive technologies are exemplars?

Computer-AT is used to support youth with Autism Spectrum Disorder (ASD) within two domains. These two domains include communication and social skills (Deng & Rattadilok, 2022). Furthermore, text-to-speech assistive technology allows youth with Attention-Deficit Hyperactivity Disorder (ADHD) to enhance reading, spelling, intonation, and word affirmations (Herawati et al., 2022). Similarly, Augmentative and Alternative Communication (AAC), which include voice output, picture symbols, and speech-generating devices, could be used to support youth with ADHD and ASD by

enhancing language development (e.g., reading and writing) and attention span (Pontikas et al., 2022). Assistive technology (AT) is also beneficial for youth with ADHD and ASD with respect to improving self-help skills and providing meaningful social interactions (Pontikas et al., 2022). Subsequently, AT could also be used within the home environment, by exploring the Human-Computer Interaction (HCI) to support youth with ADHD (Husain, 2020). The HCI supports youth with ADHD within the home environment by enhancing self-monitoring skills, engagement levels, self-awareness, and accountability (Husain, 2020). All of these assistive technologies are valuable and add to the body of pertinent knowledge with respect to analyzing the challenges and benefits of AT within the educational environment.

Previous research reviews have analyzed the general impact of assistive technology on youth with disabilities (Deng & Rattadilok, 2022). Thus, the general finding include how AT was used within the medical field and clinical practice to support individuals with ASD (Deng & Rattadilok, 2022). According to Deng & Rattadilok (2022), AT was presented in various forms, which include sensory devices, software, robots, and telehealth applications (Deng & Rattadilok, 2022). Conversely, these general findings are not consistent with respect to the main function of AT within the field of education because of the limitation it presents with respect to the general use of AT within the medical field and clinical practice. However, there is a need to further explore the gaps in the literature with respect to the benefits and challenges of AT for youth with multiple exceptionalities/special needs. The primary focus of this paper is to develop a systematic literature review that specifically explores the challenges and benefits of

assistive technology and educational programs for educators, caregivers, and youth with multiple exceptionalities/special needs within the educational system.

Research Purpose Statement

This SLR will encapsulate the effectiveness of assistive technology and educational programs with an emphasis on accessibility, equity, and inclusion processes for their integration (youth with multiple exceptionalities/special needs) into the community.

The overall purpose of this study is to gain an understanding of youth, educators, and caregivers' lived experiences while using assistive technology and educational programs. The aim of this study is to explore the effectiveness of assistive technology, accessibility, and inclusion processes, with an emphasis on digital technology programs to support youth development and their integration into the community.

Statement of the Primary Research Question

The research is centered around educators, caregivers, youth perspectives, and their lived experiences within the realm of the educational system. In order to investigate whether gaps within the literature address the accessibility, inclusion, and equal distribution of assistive technologies among diverse educational programs for families of youth with multiple exceptionalities/special needs (e.g., ASD, ADHD, and DS), I conducted a systematic literature review guided by the following research question, “what are the challenges and benefits of assistive technology and educational programs for educators and families of youth with multiple exceptionalities/special needs in the educational system?” In order to further explore whether different assistive technologies can enhance social, cognitive, physical, and language development for youth with

multiple exceptionalities/special needs, this systematic literature review looks at this secondary research question, “how can assistive technology (AT) provide youth with multiple exceptionalities/special needs an alternative format to communicate in a virtual-based learning environment?”

Justification/Rationale for the Study Based on Systematic Literature Review

Due to the existing systematic literature reviews that deals with the general impact of assistive technology, this review will examine the possibility of specific aspects of the impact of assistive technology. This SLR is needed because it looks more at the current literature and what it reveals regarding the perspectives of youth with multiple exceptionalities/special needs, educators, and caregivers. Thus, gathering more in-depth information regarding the effectiveness of assistive technology, accessibility, and inclusion processes, that are *de facto* available for caregivers and educators to explore in order to support the development of youth with multiple exceptionalities/special needs.

This SLR is also needed because it provides one with the opportunity to review the studies specific to the ones that already exist in order to analyze and critique them. Thus, it can contribute to the body of pertinent knowledge to support educators, stakeholders (e.g., educational leaders), and professionals working in various agencies. Similarly, it can foster collaborative groups to come together as a collective in order to develop a network where co-operative teams learn to understand, support, and create equitable, inclusive, diverse, accessible, and balanced educational programs for youth with multiple exceptionalities/special needs.

Previous Literature

Previous literature included international studies from various countries (e.g., Syria, Canada, United Kingdom, Germany, Kenya, Saudi Arabia, and Northern Ireland) in order to explore the challenges and benefits of assistive technology. The studies provide an insight into various educational approaches, practices, services, programs, that add to the body of knowledge, while also contributing to the expansion for a diverse array of strategies and solutions within the field of education with respect to using AT to support youth with multiple exceptionalities/special needs not only in education but also within the home environment. This leads to further questions regarding how AT can support youth with Autism Spectrum Disorder (ASD), Attention-Deficit Hyperactivity Disorder (ADHD), and Down Syndrome (DS).

According to O'Neill et al., (2020), assistive technology is beneficial in improving functioning, building various skills, and supporting the development and overall well-being of youth with Autism Spectrum Disorder (ASD). Autism Spectrum Disorder is categorized under neurodevelopmental disabilities, impacting communication, and social interaction, followed by restricted and repetitive patterns of behaviour (Deng & Rattadilok, 2022). Assistive technology is beneficial for youth with ASD because it allows youth to learn how to sight word and read, enhances mathematical skills (e.g., iPad) and social skills, improves time management skills (e.g., tablet devices), and supports with completing daily tasks (O'Neill et al., 2020). Similarly, the main function of assistive technology is to support youth with ASD and other disabilities (e.g., ADHD and DS), to perform higher levels of functionality within daily routines, and to improve

the quality of life (Deng & Rattadilok, 2022). This leads to further questions regarding the use of AT within the education environment and family unit.

The Impact of AT in Education and Family Unit

In Syria parental involvement is beneficial with respect to choosing the necessary therapy services and AT for youth diagnosed with ASD in relation to supporting youth with decision-making, communication, and intervention process by providing special education programs (Mounzer & Stenhoff, 2022). According to Mounzer & Stenhoff (2022), 65 non-government organizations offer various services for youth with ASD in Syria. These services include speech therapy, occupational therapy, behavioural therapy, physical therapy, parent training, medical services, and family counselling. Parental involvement and training are important elements that supports youth with ASD to overcome barriers within the educational system. Thus, allowing for a smooth transition toward special education programs. Studies also highlight that in Canada, professionals (e.g., social workers and mental health practitioners) who are trained in the field of Attention-Deficit Hyperactivity Disorder (ADHD) can provide specific resources and services within the educational environment, outside of the educational environment, and within the family unit (McMenemy & Nicholas, 2022). A resilience framework can support youth with ADHD to experience positive outcomes amidst stress and adversity (McMenemy & Nicholas, 2022). Resilience is defined as the capacity to respond positively when faced with adversity (McMenemy & Nicholas, 2022). Furthermore, resilience acts as a buffer to a disorder or dysfunction, which may directly or indirectly affect the mediation between adversity and negative outcomes (McMenemy & Nicholas, 2022). Thus, strong parental support, the implementation of diverse parental strategies,

mindful parenting, and cohesive family environments can promote resiliency and provide protective factors that may lower severe ADHD symptoms in youth (McMenemy & Nicholas, 2022).

This SLR presents the findings from thirty-two peer-reviewed articles which specifically explore the lived experiences of caregivers of youth with ASD while also being concerned with the following topics: challenges and benefits of assistive technology for youth with ASD and ADHD; educational programs for youth with Autism Spectrum Disorder; Attention-Deficit Hyperactivity Disorder; Down Syndrome, accessibility of assistive technology for youth in educational environments and home environments; the improvement of resilience within the family environment for youth with ASD and ADHD; factors that influence social, cognitive, and physical development within the educational environment; and the relationship between services and therapies with AT for the social integration of youth with ASD, ADHD, and DS into the community.

Method

Narrated Description of Research Method

In designing this study, I was guided by the PRISMA systematic review principles. The PRISMA systematic review principles include: identification, screening, and studies that are included in the review (Page et al., 2021). Thus, the PRISMA approach provides general guidance in order to conduct and report high quality systematic reviews. According to Sheaf (2023), the PRISMA systematic review methodology provides a “structured approach with respect to reporting systemic reviews”

(p.1). This systematic literature review will examine qualitative studies in order to collect detailed information from a small sample size, with a narrow focus (Mukherji & Albon, 2018) on the youth who have been diagnosed with ASD, ADHD, and DS. This method has been selected because it seeks to understand the perspectives and lived experiences of educators and caregivers of youth with multiple exceptionalities/special needs. According to Check & Schutt (2012), a qualitative method relies on “written or spoken words or observation that do not have a direct numerical interpretation” (p. 394). This method typically involves exploratory research questions and inductive reasoning, which provides an orientation to the educational context and human subjectivity, while also considering the meanings attached by participants to events and their lives (Check & Schutt, 2012).

Databases

Sources were collected from December 2022 to February 2023. Searches were conducted from each of the following databases: EBSCOhost Education, Google Scholar, PubMed Central, ACM Digital Library, ProQuest: Sociology Collection Database, Canadian Research Knowledge Network SpringerLink, University of St. Augustine for Health Sciences, ERIC, Library of Congress, Scopus, Web of Science, MEDLINE via OVID, PsycINFO, and PsycARTICLES, Taylor & Francis CRKN Social Science and Humanities, SciTech Premium Collection, Taylor & Francis CRKN Science and Technology, and Index Medicus.

Search Process

In order to address the research questions, I conducted the following searches in each of the databases mentioned above:

Search 1

(“Assistive Technology” OR “Youth/Student”) AND (“Special Needs” OR “Augmented Communication”) AND (“Autism Spectrum Disorder”)

Search 2

(“Education” OR “Education Programs” OR “Teacher”) AND (“Youth” OR “Adolescent” OR “Student”) AND (“Down Syndrome”)

Search 3

(“Assistive Technology”) AND (“Autism Spectrum Disorder”) AND (“Special Education Programs”)

Search 4

(“Assistive Technology”) AND (“Attention-Deficit Hyperactivity Disorder”)

Inclusion Criteria

The articles (including a meta-analysis) in these searches focused on:

- The benefits and challenges of assistive technology and educational programs for educators, caregivers and youth with multiple exceptionalities/special needs were included.
- Researchers who included diverse therapies (e.g., speech and language, cognitive behaviour therapy, occupational therapy) were included.
- Various occupations (e.g., education, social work, mental health, and psychology) were included.
- Diverse perspectives (e.g., family relations and special education) were included.

The Focus of the Chosen Articles

The selection process of articles was developed in order to meet the requirements for the sources used in the study. Following the analysis of titles, abstracts, introductions,

and discussions, sources were selected and examined in order to meet the following requirements:

- This study is focused on the benefits and challenges of assistive technology and educational programs.
- This study is focused on educators and/or families/caregivers of youth with ASD, ADHD, and DS.
- This study makes references to established principles such as accessibility, inclusion, and equity.
- This study explores whether different assistive technologies can enhance social, cognitive, physical, and language development for youth with multiple exceptionalities/special needs.
- This study explores how assistive technology can support youth with multiple exceptionalities/special needs to enhance academic and digital skills (with an emphasis on fostering academic and digital skills within the classroom and outside of the classroom to meet diverse learning objectives).
- This study explores educators, stakeholders (e.g., educational leaders), and professionals working within the field of ASD, ADHD, and DS.

Article Selection

From 200 publications found in the original searches, thirty-six remained after application of the inclusion criteria. Figure 1 summarises the selection results.

Database	Number of Sources Selection	Reason for Selection
EBSCOhost Education	n= 10 sources selected	<ul style="list-style-type: none"> • For educational programs
Google Scholar	n= 10 sources selected	<ul style="list-style-type: none"> • For assistive technology, ASD, ADHD, and DS
PubMed Central	n= 7 sources selected	<ul style="list-style-type: none"> • For DS
ACM Digital Library	n= 3 sources selected	<ul style="list-style-type: none"> • For ASD and ADHD
ProQuest: Sociology Collection Database	n= 1 sources selected	<ul style="list-style-type: none"> • For DS
Canadian Research Knowledge Network SpringerLink	n= 3 sources selected	<ul style="list-style-type: none"> • For ASD and ADHD
University of St. Augustine for Health Sciences, and PsycINFO	n= 2 sources selected	<ul style="list-style-type: none"> • For DS
Total	n= 36 sources	<ul style="list-style-type: none"> • Searches were conducted for ASD, ADHD, and DS

Figure 1: Summary of Articles Selected

Four of these studies were eliminated because they did not meet the exclusion criteria.

The Exclusion Criteria

Of the 36 articles selected, four studies were excluded for the purpose of this systematic literature review. Two studies focused on children and adults with disabilities with no emphasis on assistive technology. Conversely, the other two studies mentioned

the benefits of AT with respect to travelling purposes and the importance of using AT within the medical field and clinical practices of nurses in hospitals. Therefore, these four studies were excluded on the basis of the exclusion criteria, leaving 32 studies for analysis.

The abstracts found within the 32 studies were examined for relevance and included within the SLR. Studies with an explicit reference to or those that focused on the benefits and challenges of assistive technology and educational programs were retained. Studies that did not convey the benefits and challenges of using assistive technology for youth with multiple exceptionalities/special needs as units of analysis within the abstract, introduction, and discussions were omitted for further investigation. For example, Khan et al., (2021) examined designing mobile apps for young adults with Down Syndrome for independent travel; Robb et al., (2018) studied parental intention to support cognitive training for children with genetic neurodevelopmental disorders; Bennett et al., (2018) explored the interdependence used as a frame for assistive technology research and design; and Manolov & Onghena (2018), who examined the use of single-case sporadic treatment designs. These four studies were not taken into consideration for the purpose of this systematic literature review, thus resulting in their removal. Therefore, these four studies were excluded on the basis of the exclusion criteria, leaving 32 studies for analysis. Two of these studies focused on children and adults with disabilities, but there was no focus on AT. The other two studies mentioned the benefits of AT with respect to travelling purposes and the importance of nurses in hospitals.

Guided by the PRISMA checklist (Page et al., 2021) the exclusion process was fulfilled because it omitted articles that were outside the scope of assistive technology

and educational programs, and not focused specifically on youth with multiple exceptionalities/special needs. Consequently, the focus is on the benefits and challenges of assistive technology and educational programs for educators, caregivers, and youth with multiple exceptionalities/special needs. However, the results within this SLR will be further investigated.

Results

Thirty-two collected studies were carefully analyzed in order to meet the inclusion criteria in this process (see Appendix A). First, the inclusion criteria did specify that studies need to report how assistive technology can support educators and caregivers of youth with ASD, ADHD, and DS. My review led me to identify four themes.

The first theme is specifically looking at the impact of assistive technology on student learning. Studies in this theme explore how AT enhances academic and digital skills, AT enhances social and cognitive development, and the impact of therapies with AT on physical development, while also understanding the functions of special education programs.

The second theme explores the impact of assistive technology on educational settings. From this second theme, various sub-themes emerged which analyze the benefits of AT in special needs classrooms, and building resilience in support of educational and family environments.

The third theme analyses the impact of assistive technology on family dynamics. From this third theme, various sub-themes emerge which explore AT in home environments, and the benefits of AT on youth with ASD, ADHD, and DS.

The fourth theme analyses the impact of assistive technology on community involvement. From this fourth theme, various sub-themes emerge which explore the benefits of AT to support cognitive development, assistive technology and social integration, the impact of cognitive and motor interventions on social integration, and the benefits of occupational therapy with AT in education.

Each of these themes is discussed in detail below.

The Impact of Assistive Technology on Student Learning

Assistive technology (AT) is a flexible and exploratory process that allows communities to develop, grow, learn, and use creativity vis-à-vis categories that are ill-defined, static, or pre-defined (Ringland & Wolf, 2021). Autism Spectrum Disorder is categorized under neurodevelopmental disabilities, which impact youths' communication, social interaction, followed by restricted and repetitive patterns of behaviour (Deng & Rattadilok, 2022). Youth with Autism Spectrum Disorder (ASD) present a developmental delay with respect to social communication, interaction, repetitive and restrictive behaviours, activities, and interests (O'Neill et al., 2020). This leads to further questions regarding how can assistive technology (AT) support youth with multiple exceptionalities/special needs to enhance academic and digital skills?

Exploring How AT Enhances Academic and Digital Skills

According to O'Neill et al., (2020), assistive technology is beneficial for youth with ASD because it provides the opportunity to learn how to sight word and read, enhances mathematical skills (e.g., iPad) and social skills, improves time management (e.g., tablet devices), and supports with the completion of daily tasks. This continues to

build and add to the idea of developing ethnographic engagement to create a community for autistic youth named *Autcraft* in Germany (Ringland & Wolf, 2021). This community includes organizing activities to transform a Minecraft game into a collection of assistive technologies to support youth with ASD. The purpose of this ethnographic engagement is to allow youth with ASD to adapt, adopt, and engage with assistive technologies (Ringland & Wolf, 2021). Similarly, youth and students with ASD who adapted, adopted, and engaged with the *Autcraft* community and do-it-yourself (DIY), were able to create simulations, develop creativity and identity, strategic configurations, decision-making skills, leadership skills, and create virtual learning spaces within a digital world, while also engage in literacy and language skills (Ringland & Wolf, 2021). The DIY is a simulation that promotes and develops the identity and creativity of youth with ASD; while also fostering strategic configurations that meet the individual needs of all members within the *Autcraft* community (Ringland & Wolf, 2021). Moreover, ethnographic engagement also enhances, mediates, and alters activities and interactions within the *Autcraft* community (Ringland & Wolf, 2021) allowing members to form virtual networks, and develop reading and writing skills from peer-to-peer interactions for youth with ASD (Ringland & Wolf, 2021). Furthermore, the DIY can also bring youth with ASD to the centre of the *Autcraft* community, in order to build experiences and allow them to become the experts of their own simulations. This also fosters creativity and allows youth with ASD to explore virtual spaces (Ringland & Wolf, 2021) and develop “problem-based learning” (van Oostveen; Barber, & Childs, 2019). This continues to build and add to the idea that an Edmark Reading Program is beneficial to support youth with ASD to improve language skills.

The Edmark Reading Program (ERP) is designed in the United Kingdom for youth with ASD in order to support and enhance students' literacy, language, and phonetics. The purpose of the ERP program is to develop sight-word reading skills for students and youth with ASD (Bruni & Hixson, 2017). Furthermore, the benefit of the ERP program is to provide teaching strategies for youth with ASD and allow an instructional framework for educators (Bruni & Hixson, 2017). The ERP also includes a story activity that is comprised of 86 illustrated stories that focus on the "word taught from the word-recognition activity" (Bruni & Hixson, 2017, p. 250). Similarly, assistive technology can improve reading, listening, organization, writing skills, and learning independence in youth with ASD (Ahmed, 2018). AT software also includes text-to-speech, speech-to-text, word prediction, spell checkers, and graphic organizers (Young, 2012). Results indicate that youth with ASD who use AT demonstrate increased levels of self-confidence, self-concept, self-esteem, social transitions, motivation for learning, and become independent learners (Young, 2012). It was also found that assistive technologies are beneficial for students and youth with ASD with respect to enhancing learning experiences and increasing academic performance in school (Ahmed, 2018). Specifically, results indicate that assistive technology can enhance various elements within multiple domains, namely, language, literacy, and numeracy (Ahmed, 2018). Furthermore, results also indicate that AT could be used as a word processing software that can assist students with ASD in developing digital creations and organizational skills to facilitate proper spelling and grammar (Alghamdi, 2022). The limitations of the ERP while using AT for youth with ASD are further explored.

Limitations with Respect to The Edmark Reading Program. The limitations presented by the ERP when compared to other programs (e.g., Early Literacy Skills Builder, Early Intervention and Reading Program) are the following: it places caregivers and youth with ASD on waiting lists, various prerequisites are required in order for the youth with ASD to be included, skills are measured infrequently, instruction in phonetics is poor, and there is “little evidence to indicate the effectiveness of the ERP with respect to the participants who completed the program” (Bruni & Hixson, 2017, p. 250). On the contrary, the barriers that educators face when using AT within the educational system derive from the lack of educational funding, poor professional training, and inadequate assessments (Ahmed, 2018). Furthermore, there is limited training available to support pre-service special education teachers with respect to using AT effectively to care for youth with ASD (Alghamdi, 2022). Moreover, there is a lack of courses offered within the domain of special education as well as a lack of knowledge and understanding on the part of educators with respect to implementing AT in special education classrooms (Alghamdi, 2022). However, the question could be raised to understand how AT can enhance social and cognitive development.

Exploring How Assistive Technology Enhances Social and Cognitive Development

Assistive technology could improve oral communication and math skills, enhance reading and writing skills, motor development, and the use of digital technology (Alghamdi, 2022). Similarly, the literacy learning program enhances language skills and confidence levels in youth with ASD and intellectual disability (Moni et al., 2018). A study in Kenya indicated that an open DIY-AT through a TalkBox is beneficial in

enhancing language skills, in-class participation, and engagement level for youth with ASD (Hamidi, 2018). The limitations of using AT to support social and cognitive development in youth with ASD are further explored.

Limitations with Respect to Using AT. There needs to be more research with respect to youth with ASD using AT within the classroom (Alghamdi, 2022). There is also limited research regarding the accessibility of evidence-based practice (Moni et al., 2018). According to Hamidi (2018), TalkBox is not made equally accessible to all families and youth with disabilities, resulting in poor sociocultural and technological factors that are affecting the daily lives of youth with disabilities (ASD) within the home, school, and environment in Kenya (Hamidi, 2018). This raises the question as to why there is a need for an increase in services, resources, and therapies with AT in order to support youth with ASD to enhance physical development.

The Impact of Therapies with AT on Physical Development

This SLR indicates that poor health care services, economic situations, dishonour, and lack of education services are the elements resulting in the barriers related to accessing various supports for youth with ASD in China (Deng & Rattadilok, 2022). One explanation for this could be that due to a lack of trained professionals, poor healthcare services, and a shortage of educators, the systems are unable to provide proper education, healthcare services, and therapies, which are crucial in supporting the cognitive and physical development of youth with ASD (Deng & Rattadilok, 2022). However, it was also found that by allowing stakeholders who are willing to provide the necessary resources, explore interventions and services, and identify the essential technologies; it

could lead to enhancing not only the learning environment but also the cognitive, physical development, and overall well-being of youth with ASD (Ghanouni et al., 2020). Conversely, in Syria, there are 65 non-government or non-profit organizations that offer various services for youth with ASD (Mounzer & Stenhoff, 2022). These services include: speech therapy, occupational therapy, behavioural therapy, physical therapy, parent training, medical services, and family counselling (Mounzer & Stenhoff, 2022). The diverse array of services and therapies are important because it benefits youth with ASD in China who do not have access to resources. Though it is quite possible that adapted physical education (APE) teachers who are trained and understand youth with ASD can improve digital access to services, resources, and programs, and also assist youth to use AT in education (McIntire, 2018). Subsequently, the APE teacher's prior knowledge can contribute to developing more relevant practices for practitioners working with youth with ASD (McIntire, 2018). The limitations of youth with ASD who do not have equal access to services, resources, and therapies within the educational community to support physical development are explored.

Limitations with Respect to Therapies with AT. According to Deng & Rattadilok (2022), Chinese youth with ASD need healthcare and educational professionals and therapists to enhance physical development. Furthermore, different therapeutic areas need to be made available for youth with ASD within the education system (Ghanouni et al., 2020). Consequently, there is a need for an increase in the professional development of adapted physical education teachers who are trained to work with youth with ASD (McIntire, 2018). Research findings also reveal a lack of higher

education training within the domain of ASD (McIntire, 2018). However, this leads to further questions regarding the functions of special education programs and AT.

Understanding the Functions of Special Education Programs and AT

Special Education programs are designed to meet the individual needs of youth with ASD. For example, in Saudi Arabia, there are numerous special education programs (e.g., public and private) that are built to enhance language skills (Sulaimani & Bagadood, 2022). Furthermore, there are different digital assistive technologies that have been adopted within the Saudi educational system. Some of these assistive technologies include Voiceover Apps, cognitive and hearing aids, and the braille sense notetaker (Sulaimani & Bagadood, 2022). Similarly, these assistive technologies support youth with ASD and DS to enhance their notetaking abilities and improve access to resources within the Saudi educational system (Sulaimani & Bagadood, 2022). Specifically, results also indicate that parental involvement allows for a smooth transition with respect to decision-making, communication, and intervention process in providing special education programs that also includes therapies with AT for youth with ASD (Mounzer & Stenhoff 2022). Conversely, community-based education programs (CBEs) are also beneficial for youth with ASD (Lardier et al., 2020). Research findings reveal that CBE programs enhance youth's lived experiences, provide an opportunity for students to become critical thinkers, change-makers within the society and community, and uphold community-based approaches while also connect to civic engagement and volunteerism (Lardier et al., 2020). The limitations regarding the functions of special education programs are explored.

Limitations with Respect to Special Education Programs. Advanced special education programs that include assistive technologies need to be provided for youth with ASD in order to strengthen the lack of parent-professional partnerships in Syria (Mounzer & Stenhoff, 2022). Furthermore, researchers need to understand the complexities and tensions that may arise when implementing or developing CBEs (Lardier et al., 2020). This leads to further questions about the findings in this SLR regarding the second theme which analyses the impact of assistive technology on educational settings.

Impact of Assistive Technology on Educational Settings

Professional training within the educational field is needed in order to support educators in facilitating educational programs for youth with ASD. Thus, enhancing reading intervention and knowledge comprehension of youth with ASD in educational settings (Atanga, 2017). Within educational settings, assistive technology is useful in order to enhance social skills and peer relationships for youth with ASD (Vantura, 2020). Specifically, the benefits and limitations should be analyzed to learn what is often overlooked and may be deemed important in improving special needs classrooms.

Analyzing the Benefits of AT in Special Needs Classrooms

Special needs classrooms could benefit from educators introducing assistive technologies to support youth with ASD. Technology usage stems primarily from three domains: making the right choice, apprehension and concern about uptake, and external obstacles to implementation (Ghanouni et al., 2020). These three domains (e.g., making the right choice, apprehension, and concern about uptake) are interconnected, resulting in enhancing the decision-making process of educators with regard to the adoption,

extension, and accessibility of assistive technology within the area of ASD (Ghanouni et al., 2020). Similarly, stakeholders who are willing to provide the necessary resources, explore, and identify the essential technologies can inherently support the learning environment for youth with ASD (Ghanouni et al., 2020). In this light, assistive technology could be used as a word processing software within the special needs classrooms to assist students with ASD in developing digital creations and organizational skills to facilitate proper spelling and grammar (Alghamdi, 2022). AT could also be used as an audio recording device that provides youth with ASD the opportunity to access class materials (Alghamdi, 2022). Moreover, AT could be used as a screen-reading software (e.g., JAWS, NVDA, and Voiceover) which is beneficial for youth with ASD because it allows students the ability to pronounce words, letters, and numbers within the written documents (Alghamdi, 2022). According to Young (2012), AT has a positive effect on the language development of youth with ASD. Though it is quite possible that special education classrooms could benefit from implementing AT and developing residency programs designed to facilitate youth's language, communication, social development, life skills, and independence (Young, 2012). The limitations with respect to special needs classrooms are further explored.

Limitations with Respect to Special Needs Classrooms. Results indicate that there needs to be consistent growth in the areas that are concerned with the development of technology-based programs for youth with ASD (Ghanouni et al., 2020). Furthermore, there is a lack of empirical evidence to support the implementation of AT within the educational curriculum (Alghamdi, 2022). There is also limited training with respect to pre-service special education teachers using AT effectively to support youth with ASD in

special needs classrooms (Alghamdi, 2022). There is also a lack of courses offered within the domain of special education, and poor knowledge and understanding on the part of educators with respect to implementing AT in special education classrooms (Alghamdi, 2022). This raises the question as to whether building resilience skills could support educational and family environments.

Building Resilience Skills in Support of Educational and Family Environments

Youth diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD) are at risk of developing functional problems (Schoenfelder et al., 2020). Some of the functional problems include inattention, hyperactivity, and impulsivity (Husain, 2020). Resilience is defined as the capacity to respond positively when faced with adversity (McMenemy & Nicholas, 2022). This continues to build on the idea that a resilience framework from Northern Ireland can support youth with ADHD to experience positive outcomes amidst stress and adversity (McMenemy & Nicholas, 2022). Furthermore, strong parental support, the implementation of diverse parental strategies, mindful parenting, and cohesive family environments can promote resilience and provide protective factors that may lower severe ADHD symptoms (McMenemy & Nicholas, 2022). According to Schoenfelder et al., (2020), psychoeducation used in Northern Ireland enhances the attitudes and behaviours of youth with ADHD, which include providing various treatments to enhance motivation strategies. Furthermore, the psychoeducational, family-based prevention, and MI intervention models are feasible, equitable and provide inclusive ways to increase parental, professional, and educational knowledge, while also providing evidence-based treatment options for youth with ADHD (Schoenfelder et al., 2020). This raises the question of whether youth with ADHD could

benefit from Motivational Interviewing (MI) techniques to elevate motivational levels (Schoenfelder et al., 2020). In this light, MI is described as an intervention model that allows practitioners to understand the effects of the treatment options, and gain a better understanding with respect to the attitudes and behaviours of youth with ADHD (Schoenfelder et al., 2020). This leads to further questions regarding the findings from the third theme within this SLR, which analyses the impact of assistive technology on family dynamics.

The Impact of Assistive Technology on Family Dynamics

Family-based preventative interventions are beneficial in improving the behaviours of youth with ADHD and also lowering the risk of unhealthy behaviours which could result from family adversity and socioeconomic status (Schoenfelder et al., 2020). Similarly, psychoeducational alongside family-based prevention could enhance parental, professional, and educational knowledge regarding ADHD evidence-based treatment options (Schoenfelder et al., 2020). In connection with assistive technology; Augmentative and Alternative Communication (AAC), which include voice output, picture symbols, and speech-generating devices could be used to support youth with ADHD and ASD by enhancing language development (e.g., reading and writing) and attention span (Pontikas et al., 2022). Furthermore, assistive technology (AT) is beneficial for youth with ADHD and ASD with respect to improving self-help skills and providing meaningful social interactions (Pontikas et al., 2022). Conversely, results indicate that family dynamics could improve when using AT with respect to supporting youth with ADHD who have various core symptomatology, which is related to lower speech, language development, motor skills, memory, learning, and behaviour (Pontikas

et al., 2022). This raises the question of whether AT could be beneficial within home environments.

Exploring AT in Home Environments. Families who explore and encourage youth with ADHD to use AT demonstrate an improvement with respect to the social, emotional, and cognitive domains (Pontikas et al., 2022). Furthermore, educational settings that are associated with offering therapy strategies with AT could also support family dynamics and improve home environments because it offers direct support to youth with ADHD by enhancing self-management and expressive communication skills (Pontikas et al., 2022). Conversely, caregivers who allow youth with ADHD to explore and use the System of Augmented Language (SAL) tool, which is an AAC, have the ability to connect this tool to an iPhone and iPad (Pontikas et al., 2022). Moreover, the SAL tool could also support youth with ADHD to navigate through online applications, familiarize themselves with the digital world, improve intellectual functioning (e.g., memory, learning, problem-solving, and judgement), and enhance adaptive functioning, which is connected with communication skills (e.g., speech), developing virtual friendships, social judgement, and interactive online activities (Pontikas et al., 2022). Assistive technology could also be used within the home environment, by exploring the Human-Computer Interaction (HCI) to support youth with ADHD (Husain, 2020). Results indicate that HCI supports youth with ADHD within the home environment by enhancing self-monitoring skills, engagement levels, self-awareness, and accountability (Husain, 2020). Nevertheless, this aspect of assistive technology speaks volumes. This leads to further questions about the challenges and benefits of AT.

The Benefits of AT on Youth with ASD, ADHD, DS

The examination of the validity of the Assessment of Written Expression Adaptivity for assistive technology (AWE ADAPT for AT) is beneficial in supporting youth with ASD (Lemmon & Grajo, 2022). Furthermore, the AWE ADAPT for AT is beneficial with respect to understanding the effectiveness, efficiency, satisfaction, and helpfulness of resources and strategies used for the assessment of youth with ASD (Lemmon & Grajo, 2022). The results indicate that AWE ADAPT for AT is beneficial in enhancing written expression for youth with ASD and ADHD (Lemmon & Grajo, 2022). This raises the question of whether AT could be beneficial for youth with ADHD in enhancing reading skills by using text-to-speech assistive technology.

Understanding the impact of text-to-speech assistive technology on youth with ADHD during e-learning is an important element. Text-to-speech assistive technology can enhance reading levels with respect to word affirmations in youth with ADHD (Herawati et al., 2022). The benefit of text-to-speech assistive technology allows youth with ADHD to enhance reading, spelling, voice intonation, and word affirmations (Herawati et al., 2022). Furthermore, results indicate that reading assistive technology improves students' language ability and also increases grammar, leading toward an increase in vocabulary, reading words and sentences, decoding, and reading comprehension in youth with ADHD (Herawati et al., 2022). Similarly, reading assistive technology is also beneficial with respect to increasing the reading ability of youth with ADHD by combining visual skills (e.g., looking at the text-screen during e-learning) and listening to audio books (Herawati et al., 2022). Conversely, exploring the benefits of visual scene displays (VSD) used within a virtual world can support youth with Down

Syndrome (DS) in enhancing communication skills (Babb, 2020). The VSD is an app that highlights areas of a scene and produces a speech output that allows a word or a phrase to be recorded (Babb et al., 2020). Furthermore, the VSD incorporates an integrated approach to support youth with DS to participate in a learning community (Babb et al., 2020). Results indicate that youth with DS who use VSD as an assistive technology can enhance language development, learn how to communicate with community members, and also participate in various community-oriented activities (Babb et al., 2020). This raises the question of whether the VSD app is also connected to the AAC.

This continues to build on the idea that a correlation is formed between the VSD app and AAC because both are developed to support educational settings and enhance expressive communication levels in youth with DS (Babb et al., 2020). However, it was also found that Augmentative and Alternative Communication (AAC) technologies enhance self-help skills, academic skills, and social connection/interaction with other youth with ASD, ADHD, and Down Syndrome (Pontikas et al., 2022). The limitations of AWE ADAPT for AT are further explored.

Limitations with Respect to AWE ADAPT for AT. According to Lemmon & Grajo (2022), an interview-based assessment should be used to administer the AWE ADAPT for AT. Thus, Occupational Therapists should be the ones to carry out the assessments by facilitating and providing tools, strategies, and resources (Lemmon & Grajo, 2022). In addition, a clinical utility should be provided in order to enhance future research and provide the foundations needed in order to examine the validity and reliability of the assessments for youth with ASD (Lemmon & Grajo, 2022). Conversely,

some of the challenges that can arise when using reading assistive technology could be ineffective signals resulting in delays in vocabulary in youth with ADHD (Herawati et al., 2022). The findings within this SLR, with respect to the fourth theme regarding the impact of assistive technology on community involvement is further explored.

The Impact of Assistive Technology on Community Involvement

Two studies (Krasniqi et al., 2022; Babb et al., 2020) have demonstrated that AT could be used to enhance community involvement and participation for youth with DS in various community-based activities. Down Syndrome (DS) is a condition caused by the presence of an extra copy of chromosome 21. According to Krasniqi et al., (2022), assistive technology can support youth with DS in solving real-life problems within the home and community and promote independence in life. Furthermore, results indicate that AT enhances problem-solving skills, orientation, eye-hand coordination, self-esteem, and self-efficacy, and also improves daily activities (Krasniqi et al., 2022). AT can also enhance communication, interaction, and mobility, while also providing ample amount of time in order to allow youth with DS to complete daily activities within the school and home environment (Krasniqi et al., 2022). Similarly, there are various assistive technologies that can support youth with DS. One example of an AT is Augmented and Alternative Communication (AAC) which enhances non-verbal communication (Krasniqi et al., 2022). Similarly, the use of AAC within educational settings also enhances expressive communication levels in youth with DS (Babb et al.,2020). Conversely, another AT is Augmented Reality (AR) which supports in the development of online environments (e.g., virtual spaces) for youth with DS (Krasniqi et al., 2022). Moreover, educational video games are also beneficial because it introduces youth with DS to

gamification (Krasniqi et al., 2022). One explanation for this could be that youth with DS have various assistive technologies to choose from. This leads to further questions regarding the benefits of AT in developing an educational community.

The Benefits of AT to Support Cognitive Development

Neuropsychologists who work with youth with DS could benefit from using eye-tracking technologies. According to Vianello & Lanfranchi, (2022), eye-tracking technologies allow neuropsychologists to understand the cognitive development of youth with DS. Similarly, eye-tracking technologies could enhance social communication skills, reciprocity, and behavioural rigidity in youth with DS (Vianello & Lanfranchi, 2022). Furthermore, eye-tracking technologies also allow neuropsychologists to understand the nature of imitative learning, which includes: joint attention, and gaze by following, reading, and mimicking others' actions (Warmerdam Wolter et al., 2018). Similar to AT, eye-tracking technologies are a device that analyzes the reduced attention span and social stimuli in youth with DS (Warmerdam Wolter et al., 2018). The results indicate that youth with DS are less inclined to focus on the neuropsychologists during the observation phase and the performance of the task at hand (Warmerdam Wolter et al., 2018). Conversely, youth with DS who have acquired visual attention skills when looking at the neuropsychologist's facial expression results in higher imitative behaviour (Warmerdam Wolter et al., 2018). The limitations of using eye-tracking technologies are further explored.

Limitations with Respect to Using Eye-tracking Technologies. The eye-tracking technologies need to include and discuss the clinical practice regarding the neurocognitive mechanisms and how they are connected to social learning in youth with

DS (Warmerdam Wolter et al., 2018). Furthermore, parental behaviours need to be further investigated. Conversely, further research needs to include gaze-pattern analysis to support youth with DS with attention span, and focus control (Vianello & Lanfranchi, 2022). This leads to further questions regarding AT and social integration.

Assistive Technology and Social Integration

The etymological roots of the basic terms inclusion and integration are explored. Integration stems from the Latin word, “*integer*,” meaning “untouched” or “honest” (Reich-Limbach, 2015, p. 359). Furthermore, the word integration also depicts a process that focuses on “the recovery of intact, healthy conditions” (Reich-Limbach, 2015, p. 359). Conversely, the word inclusion, stems from the Latin “*includere*” (*includo*), which translates to “being within” (Reich-Limbach, 2015, p. 359). According to Reich-Limbach (2015), inclusion is a dynamic process which results in incorporating groups or individuals into a social system (e.g., groups and individuals who have contributed to the operative system by acquiring various skills). Similarly, the inclusion or exclusion concepts are correlated to how well or poorly the function is maintained by the subsystems (e.g., economy, education, and law) and the ability to demonstrate a synergy and collaboration among the subsystems to form a functioning system (Reich-Limbach, 2015). This raises the question of how AT is included or excluded within the educational system.

An eight-domain model was used to analyze emotional well-being, physical well-being, material well-being, personal development, rights, self-determination, social inclusion, and interpersonal relationships to support youth with DS (Gómez et al., 2020).

The eight-domain model adapted to using the KidsLife-Down Scale in order to select various items for youth with DS (Gómez et al., 2020). Results indicate that KidsLife-Down Scale demonstrated accurate psychometric properties where social inclusion was elevated (Gómez et al., 2020). Conversely, results also demonstrated that physical well-being and self-determination were scored lower vis-à-vis the other domains (Gómez et al., 2020). Specifically, the idea of how AT can support youth with DS to access materials online while also participate in the digital world and engage in interactive games and interact in online activities should be further explored in order to learn what is often overlooked and may be deemed significant. According to Sulaimani & Bagadood, (2022), assistive technology has the capacity to nurture the psychological and cognitive process while enhancing students' attention levels and information retention skills. Results indicate that AT enhances communication, reading, and writing skills, while also raising engagement levels to allow youth with DS the opportunity to participate in various sensory activities (Sulaimani & Bagadood, 2022). Furthermore, AT fosters confidence levels which result in a higher level of academic attainment (Sulaimani & Bagadood, 2022). The benefit of AT stems from offering support to youth with DS who could benefit from accessing online materials, participate in online activities, promote motivation, and allow them to complete tasks using text-to-speech software (Sulaimani & Bagadood, 2022). The text-to-speech software supports youth with DS to decode, comprehend, and read online materials fluently (Sulaimani & Bagadood, 2022). The limitations of the eight-domain model alongside the KidsLife-Down Scale are further explored.

Limitations with Respect to the Eight-Domain Model. The KidsLife-Down Scale does not investigate inter-rater reliability (Gómez et al., 2020). Furthermore, research needs to include more specific measurements (Gómez et al., 2020). Future research also needs to take into consideration the lived experiences of the caregivers/families of youth with DS and incorporate a holistic approach to the KidsLife-Down Scale (Gómez et al., 2020). This raises further questions regarding the impact of cognitive and motor interventions on social integration.

The Impact of Cognitive and Motor Interventions on Social Integration

The process of including Occupational Therapy (OT) and AT within the educational curriculum is beneficial in supporting with pre-employment for youth with DS (Ventura, 2020). Results indicate that OTs could support youth with DS in the transitioning stage of life. One example could be to assist youth with DS in the educational system (e.g., college or university) and support them to move toward obtaining a job within society (Vantura, 2020). Similarly, it is also valuable to address therapy treatments that are used by primary caregivers for youth with DS within the home environment (Neil et al., 2018). Nonetheless, this aspect of therapy treatments speaks volumes. Thus, various treatments are used by caregivers who have youth with DS, namely, applied behaviour analysis, reading, and phenological awareness treatments (Neil et al., 2018). Results indicate that all therapy treatments support youth with DS by enhancing communication, reading, and mathematical skills (Neil et al., 2018). This leads to further questions regarding the benefits of introducing OTs with AT in education, to support youth with DS.

The Benefits of Occupational Therapy with AT in Education

The benefits of introducing OTs into the educational system could be to develop an OT-based curriculum, that would build pre-employment skills and foster self-efficacy and also develop confidence levels for both youth with DS and their employers (Vantura, 2020). As demonstrated in Vantura (2020), youth under the Individuals with Disabilities Education ACT (IDEA) are provided with a diverse array of resources. This leads to youth being provided with Individualized Education Plans (IEP), which also incorporate OT sessions within the educational system and are also included in the special education classes. Similarly, results also indicate that an IEP plan offers both caregivers of youth with DS, and youth with DS a transitioning plan to college and the workplace (Vantura, 2020). Conversely, few educational departments in Canada include Occupational Therapists within the educational curriculum to support youth with DS in the transitional process when moving from the IDEA toward the American Disabilities ACT (ADA). The limitations with respect to Occupational Therapy and AT are further explored.

Limitations with Respect to Occupational Therapy and AT. There are limited resources offered to youth with DS with respect to the transitioning process when youth move from the IDEA to the ADA. The results from Vantura's study indicate that when youth with DS move out of the IDEA at the age of 21, they need to advocate for themselves, which at times results in lower and unequal access to resources within the educational community (Vantura, 2020). Conversely, caregivers of youth with DS who used various therapy treatments may not always be able to identify the developmental milestones in order to connect the specific treatments. This could potentially lead to poor

knowledge regarding the accessible treatment options and specific therapies offered for youth with DS (Neil et al., 2018).

Summary and Discussion

Assistive technology is beneficial to support youth with ASD, ADHD, and DS. The results of this systematic literature review (SLR) demonstrated that AT and AAC, which include voice output, picture symbols, and speech-generating devices (Pontikas et al., 2022), can enhance digital literacy, language development, cognitive development, social development, physical development, and improve the overall well-being of youth with ASD, ADHD, and DS. The sub-themes are consistent with findings from previous peer-reviewed scholarly articles, which also support the theoretical and practical ways AT could be introduced, accessed, used, and implemented within the educational system, educational curriculum, special education classrooms, and within the home environment. The findings of Deng & Rattadilok, 2022; Ahmed, 2018; Herawati et al., 2022; Pontikas et al., 2022; Sulaimani, & Bagadood, 2022) were similar to this review which indicated that AT is at the core with respect to supporting youth with ASD, ADHD, and DS, to increase levels of functionality, improve overall well-being, enhance learning experiences, increase academic achievement, develop language, literacy, and numeracy skills, increase reading levels, enhance self-management (e.g., promotes motivation) and expressive communication skills. Consequently, the findings support the conclusion that AT is effective with respect to nurturing the psychological state and cognitive development to enhance attention and memory levels (Sulaimani & Bagadood, 2022). This SLR is distinct from others because it analyzes the effectiveness of assistive technology on youth with ASD, ADHD, and DS while also exploring the accessibility

and inclusion processes, with an emphasis on digital technology programs to support youth development and their integration in the community. This SLR serves as an indicator for future research to explore the ways in which AT could be used to support youth with ASD, ADHD, and DS within the educational system, educational curriculum, special education classrooms, and home environment.

The most common keyword used was AT throughout the literature. This resulted from one's own focus on assistive technology during the retrieval process and inclusion of international studies. Furthermore, the assistive technologies used internationally, could be taken into consideration. It can be a good starting point that can transcend into a meaningful unit for future analysis where there is an in-depth understanding of the various functions and ways assistive technologies could be integrated into the educational system, educational curriculum, special education classrooms, and within the home environment. This leads to the conclusions.

Conclusions

This systematic literature review (SLR) focuses on the challenges and benefits of assistive technology and educational programs for youth with multiple exceptionalities/special needs, which include Autism Spectrum Disorder (ASD), Attention-Deficit Hyperactivity Disorder (ADHD), and Down Syndrome (DS).

The broad question guiding this study was: "What are the challenges and benefits of assistive technology and educational programs for educators and families of youth with multiple exceptionalities/special needs in the educational system?"

Four themes were identified in this SLR using the guiding research questions to organize the findings, while also focusing on the impact of assistive technology on student learning, educational settings, family dynamics, and community involvement. This was done through a systematic process that involved retrieving studies from various databases. Furthermore, the collective findings contribute to the conclusions that result from the thematic analysis. Therefore, the benefits of AT on student learning are further discussed.

Benefits of AT on Student Learning

Assistive technology is beneficial within the educational system with respect to improving student learning by enhancing academic and digital skills, increasing mathematical and social skills, language development, oral communication, and daily tasks (O'Neill et al., 2020). Findings also revealed that an ethnographic engagement allows youth with ASD to adapt, adopt, and engage with assistive technologies (Ringland & Wolf, 2021). Similarly, youth with ASD who adapted, adopted, and engaged in the *Autcraft* community and do-it-yourself (DIY) were able to create simulations, develop creativity and identity, strategic configurations, decision-making skills, leadership skills, and create virtual learning spaces within a digital world, while also engage in literacy and language skills (Ringland & Wolf, 2021). This leads to further questions regarding the benefits of AT on educational settings.

Benefits of AT in Educational Settings

AT is beneficial when used within educational classrooms because it enhances digital literacy, language development, cognitive development, social development, and physical development, while also improving the overall well-being of youth with ASD,

ADHD, and DS. According to Alghamdi (2022), AT fosters oral communication and math skills, enhances reading and writing skills, and increases motor development, and the use of digital technology (Alghamdi, 2022). Similarly, AT also supports youth with ASD, ADHD, and DS, to increase levels of functionality, improve overall well-being, enhance learning experiences, increase academic achievement, enhance language, literacy, and numeracy skills, and enhance self-management (e.g., promote motivation) and expressive communication skills (Deng & Rattadilok, 2022). This leads to further questions with respect to the benefits of AT on family dynamics.

Benefits of AT on Family Dynamics

Family-based preventative interventions are beneficial in improving the behaviours of youth with ADHD and also lowering the risk of unhealthy behaviours which could result from family adversity and socioeconomic status (Schoenfelder et al., 2020). Similarly, psychoeducational, and family-based prevention could enhance parental, professional, and educational knowledge regarding ADHD evidence-based treatment options (Schoenfelder et al., 2020). In a similar vein, AAC can support youth with ADHD and ASD by enhancing language development (e.g., reading and writing) and attention span (Pontikas et al., 2022). Furthermore, AT is beneficial for youth with ADHD and ASD with respect to improving self-help skills and providing meaningful social interactions (Pontikas et al., 2022). Conversely, results also indicate that family dynamics could improve when using AT with respect to supporting youth with ADHD who have various core symptomatology, which is related to lower speech, language development, motor skills, memory, learning, and behaviour (Pontikas et al., 2022). This leads to further questions regarding the benefits of AT on community involvement.

Benefits of AT on Community Involvement

Families who explore and encourage youth with ADHD to use AT can increase youths' social, emotional, and cognitive domains (Pontikas et al., 2022). Furthermore, educational settings that are associated with offering therapy strategies could also support family dynamics and improve home environments because it offers direct support to youth with ADHD by enhancing self-management and expressive communication skills (Pontikas et al., 2022). Nonetheless, the challenges of AT should be explored with respect to including and integrating AT within the educational system.

Challenges of AT

Based on the findings of this SLR, one would recommend for stakeholders, educators, professionals, therapists, and caregivers to consider including and integrating AT not only within the educational systems but also within the home environments.

To conclude, youth with ASD, ADHD, and DS could benefit from having equal opportunities to access inclusive services, resources, and educational programs. Furthermore, an expansion of resources, services, therapies, and equal access to assistive technologies could support not only the youth with multiple exceptionalities/special needs, but also educators, and families who continue to support, learn, and understand the educational system, educational curriculum, special education classrooms, and navigate the home environment. This leads one to further explore the final limitations of the SLR.

Limitations of the Review

Two limitations impacted this review. First, the holistic approaches to implementing equitable and accessible resources and services for families of youth with ASD, ADHD, and DS in the community were not included. This resulted from a small

sample size and limited peer-reviewed articles that did not focus on resources and interventions. Second, the higher education training within the multiple exceptionality/special needs category was not included. This builds on the idea of including recommendations for future research.

Recommendations for Future Research

Youth with ASD, ADHD, and DS could benefit from having equal opportunities to access inclusive services, resources, and educational programs. Furthermore, an expansion of resources, services, therapies, and equal access to assistive technologies could support not only the youth with multiple exceptionalities/special needs, but also their respective families who continue to support, learn, and understand the educational system, educational curriculum, special education classrooms, and navigate the home environment. Similarly, academic experiences and resilience skills could be enriched for youth with multiple exceptionalities/special needs when there is the presence of a deeper analysis with respect to how assistive technologies could be integrated into the educational system, educational curriculum, special education classrooms, and home environment. Consequently, future research could also explore this research question, “what is the role of transformational leadership in deconstructing and reconstructing an equitable, inclusive, accessible, and diverse education curriculum for youth with multiple exceptionalities/special needs within the educational system?”

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APPENDIX A

The Results Chart

Study	Target Group	Research Method	Key Results	Challenges/ Benefits	Limitations
O'Neill et al., (2020)	Youth with ASD	Qualitative The study evaluates the demographic information with a focus on individuals with ASD with respect to the types of services accessed, the level of supports individuals with ASD received, how AT is used in connection with life experience, and the future role of AT within the community.	The research findings reveal a positive correlation between AT devices and apps available for youth with ASD. Furthermore, 32% of respondents reported accessing AT using tablet devices, 9% of responders reported using a computer to access AT, and 8% of responders reported accessing AT using smartphones (O'Neill et al., 2020).	According to O'Neill et al., (2020), assistive technology is beneficial for youth with ASD because it allows youth to learn how to sight word, and read, it enhances mathematical skills (e.g., iPad) and social skills, improves time management (e.g., tablet devices), and supports with completing daily tasks. The benefits of using AT are crucial with respect to the impact it has on youth's ability to learn, interact with other youth members, and develop independence within the educational setting (O'Neill et al., 2020).	The researchers used a qualitative method followed by survey questionnaires. The survey questionnaires used a snowballing sampling technique for distribution purposes.

Deng & Rattadilok (2022)	Youth with ASD	<p>Qualitative</p> <p>The focus of the research is on obtaining a deeper understanding of the many ways assistive technology (AT) can benefit youth with ASD, with respect to the needs and barriers of Chinese youth while using AT.</p>	<p>According to Deng & Rattadilok (2022), Assistive technologies main function is to support individuals with ASD and other disabilities (e.g., ADHD and DS), by performing higher levels of functionality within the daily routine and also improve better life quality.</p> <p>The research findings reveal that poor health care services, economic situations, dishonour, and lack of education services are the elements resulting in the barriers related to accessing various supports for youth with ASD (Deng & Rattadilok, 2022).</p>	<p>Chinese youth with ASD need healthcare and educational professionals (Deng & Rattadilok, 2022).</p> <p>China could also benefit from informatics technologies to support in creating an evidence-based tool for youth with ASD (Deng & Rattadilok, 2022).</p>	<p>Professionals must be trained and provide accessible healthcare and educational services for youth with ASD.</p>
Ghanouni et al., (2020)	Youth with ASD	<p>Qualitative</p> <p>The purpose of this study is to understand the characteristics and</p>	<p>According to Ghanouni et al., (2020), these three domains (e.g., making the right choice, apprehension, and concern about uptake) are</p>	<p>Technology usage stems primarily from three domains: making the right choice, apprehension and concern about uptake,</p>	<p>There needs to be more development of technology-based programs for youth with ASD.</p>

		viewpoints with respect to implementing technology-based tools, and interventions by stakeholders who are in the field of ASD (Ghanouni et al., 2020).	interconnected, resulting in the decision-making process with regard to the adoption, extension, accessibility, or removal of technology within the area of ASD. Stakeholders who are willing to provide the necessary resources, explore, and identify the essential technologies can inherently support the learning environment for youth with ASD (Ghanouni et al., 2020).	and external obstacles to implementation.	More therapeutic areas need to be made available for youth with ASD within the education system.
Mounzer & Stenhoff (2022)	Youth with ASD	Qualitative Exploring parental involvement with respect to choosing the necessary therapy services for youth with ASD.	The list of therapies include: educational, behavioural, medical, and pharmacological treatments (Mounzer & Stenhoff, 2022). Parental involvement allows for a smooth transition with respect to decision-making, communication,	According to Mounzer & Stenhoff (2022), there are 65 non-government or non-profit organizations that offer various services for children and youth with ASD in Syria which include: speech therapy, occupational therapy,	Lack of parent-professional partnership in Syria.

			and intervention process in providing special education programs for youth with ASD (Mounzer & Stenhoff 2022).	behavioural therapy, physical therapy, parent training, medical services, and family counselling.	
McIntire, B. (2018).	Youth with ASD	<p>Qualitative</p> <p>The study analyzes educators' prior knowledge and training practices with respect to assistive technology, students with ASD, and implementing various standards for physical educators (McIntire, 2018).</p> <p>The aim of the study is to analyze adapted physical educators' views of using assistive technology when working with students with ASD.</p>	<p>Research findings reveal a lack of higher education training within the exceptionality category of ASD (McIntire, 2018).</p> <p>Educators need to demonstrate patience when working with youth with ASD.</p>	<p>The study is geared toward adapted physical education (APE) teachers. It focuses on how APE teachers understand youth with ASD, use assistive technology, and how their prior knowledge can contribute to developing more relevant practices for practitioners working in the field of ASD (McIntire, 2018).</p>	<p>The is a need for trained professionals to specialize in the development of adapted physical education to support APE teachers.</p>

<p>Ringland & Wolf (2021)</p>	<p>Youth with ASD</p>	<p>Developing ethnographic engagement to develop a community for autistic youth named “<i>Autcraft</i>” (Ringland & Wolf, 2021, p. 1).</p> <p>This includes organizing activities to transform a Minecraft game into a collection of assistive technologies to support youth with Autism Spectrum Disorder (ASD) (Ringland & Wolf, 2021).</p>	<p>The results of the study indicated that youth with ASD and students who adapted, adopted, and engaged in the <i>Autcraft</i> community and with the DIY, were able to: create simulations, develop creativity, foster a sense of identity, form strategic configurations, develop decision-making skills, leadership skills, and create virtual learning spaces within a digital world, while also enhance in literacy and language skills (Ringland & Wolf, 2021).</p>	<p>The purpose of this ethnographic engagement is to allow youth with ASD to adapt, adopt, and engage with assistive technologies (Ringland & Wolf, 2021).</p> <p>The first goal allows members of the <i>Autcraft</i> community who also engage in do-it-yourself (Ringland & Wolf, 2021, p. 1). This allows and builds towards the creation of community spaces by changing the virtual spaces (e.g., social spaces designed for sensory breaks within the virtual world).</p> <p>This do-it-yourself (DIY) is a simulation that also promotes and develops youth with ASD in forming their identity, creativity, and</p>	<p>Not mentioned.</p>
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				<p>strategic configurations that meet the individual needs of all members within the “<i>Autcraft</i>” community.</p> <p>These simulations also allow youth with ASD to develop decision-making skills, leadership skills, and create various designs within the virtual space. Thus, allowing youth with ASD to take leadership roles and invite other members within the community to join (Ringland & Wolf, 2021).</p> <p>The second goal is to expand and enhance the definition of assistive technology in order to enhance, mediate, and alter activities and interactions within the <i>Autcraft</i></p>	
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				<p>community. Thus, allowing members to form virtual networks, and develop reading and writing skills from peer-to-peer interactions for youth with ASD (Ringland & Wolf, 2021).</p> <p>The third goal is to bring youth with ASD to the centre of the <i>Autcraft</i> community in order to build experiences and become the experts in their own simulations, creativity, and virtual spaces.</p>	
Bruni & Hixson (2017)	Youth with ASD	<p>Qualitative</p> <p>The development of the Edmark Reading Program (ERP) was designed for youth with ASD in the United Kingdom. The program is designed to support and enhance</p>	<p>The results of the study indicate that ERP is a good model because it is grounded in phonetics and phonetic awareness, and allows educators and Speech and Language Pathologists to teach sight-word reading skills, decoding skills, literacy skills,</p>	<p>The benefit of the ERP program is to enhance teaching strategies for youth with ASD by providing an instructional framework. The ERP also includes a story activity that is comprised of 86 illustrated stories. The</p>	<p>Little evidence to indicate the effectiveness of the ERP for participants who completed the program (Bruni & Hixson, 2017).</p>

		<p>students' literacy, language, and phonetics.</p> <p>The purpose of the ERP program is to develop sight-word reading skills for students and youth with ASD.</p>	<p>and language skills (Bruni & Hixson, 2017).</p>	<p>focus is on the word taught from the word-recognition activity (Bruni & Hixson, 2017, p. 250).</p> <p>The challenges that are presented by the ERP, when compared to other programs (e.g., Early Literacy Skills Builder, Early Intervention and Reading Program), are the following: families of youth with ASD placed on waiting lists, various prerequisites are required in order for the youth with ASD to be included, and skills-measured infrequently, instruction in phonetics (Bruni & Hixson, 2017).</p>	
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Results Chart (Cont.)

Study	Target Group	Research Method	Key Results	Challenges/ Benefits	Limitations
Ahmed, (2018).	Youth with ASD	Qualitative Analyzing the benefits of assistive technology in the classroom and within the educational field by using an online survey and questionnaire.	The research findings reveal that assistive technologies are beneficial for students (e.g., youth) with ASD with respect to enhancing learning experiences and increasing academic performance in school. Furthermore, assistive technology can enhance various elements within multiple domains, namely, language, literacy, and numeracy (Ahmed, 2018).	According to Ahmed (2018), assistive technology can improve reading, listening, organization, writing skills, and learning independence in youth with ASD. Some of the barriers that educators face when using ATs within the educational system derive from the lack of educational funding, poor professional training, and inadequate assessments (Ahmed, 2018).	There is limited evidence to suggest that preservice teachers receive basic training with respect to using assistive technology to support youth with ASD (Ahmed, 2018). There is a lack of support provided to educators with respect to understanding how to evaluate the needs of youth with ASD with respect to receiving ATs while also adding it to the Individualized Educational Program (Ahmed, 2018).
Atanga, (2017).	Youth with ASD	Qualitative Research is focused on how educators	The research findings reveal that educational knowledge and professional training	Educators need to acquire the necessary training and attend professional	Educators must be trained to use assistive technology and implement it into the

		<p>in Texas can enhance student learning by using ATs.</p>	<p>regarding the use of assistive technology within the educational field could be enhanced by educational programs for youth with ASD. This can result in enhancing professional training to support educators with intervention and comprehension (Ataga, 2017).</p>	<p>programs in order to understand the benefits of AT for youth with ASD (Atanga, 2017).</p> <p>The educational system in Texas could benefit from analyzing the knowledge and understanding that educators may have with respect to supporting students with ASD (Ataga, 2017).</p> <p>According to Ataga (2017), educators could start by implementing AT competencies within the curriculum to support youth with ASD.</p>	<p>educational curriculum.</p> <p>Self-efficacy levels could be increased based on the use of assistive technologies.</p>
<p>Alghamdi, (2022).</p>	<p>Youth with ASD</p>	<p>Qualitative</p> <p>The purpose of this study is to examine the insights of pre-service special education in the US with respect to using AT effectively to</p>	<p>According to Alghamdi (2022), assistive technology could improve oral communication and math skills, enhance reading and writing skills, motor development,</p>	<p>Assistive technology could be used as word processing software that can assist students with ASD in developing digital creations and</p>	<p>More research needs to be conducted with respect to analyzing youth with ASD who are using AT within the classroom</p>

		<p>support youth with ASD.</p>	<p>and the use of digital technology.</p> <p>AT also enhances the participation of youth with ASD in the classroom, heightens engagement levels, and improves peer-to-peer interactions (Alghamdi, 2022).</p>	<p>organizational skills to facilitate proper spelling and grammar (Alghamdi, 2022).</p> <p>AT could also be used as an audio recording device that provides youth with ASD the opportunity to access class materials (Alghamdi, 2022).</p> <p>The benefit of using assistive technology for educators are the following: to present class materials in a more engaging manner by using various technologies such as voice-to-text software, digital books, interactive web programs, and transcribe written text into an electronic form (Alghamdi, 2022).</p> <p>AT could also be used as a</p>	<p>(Alghamdi, 2022).</p> <p>There is a lack of empirical evidence to support the implementation of AT within the educational curriculum (Alghamdi, 2022).</p> <p>More courses need to be added to address how educators could use AT and implement it in the classrooms (Alghamdi, 2022).</p>
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				<p>screen-reading software (e.g., JAWS, NVDA, and Voiceover) which is beneficial for youth with ASD because it allows students the ability to pronounce words, letters, and numbers within the written documents (Alghamdi, 2022).</p> <p>The limitations are the following: youth with ASD demonstrate a lack of self-confidence, there is limited training with respect to pre-service special education teachers using AT effectively to support youth with ASD in the classrooms, lack of courses offered within the domain of special education, and lack of knowledge and understanding</p>	
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				on the part of educators with respect to implementing AT in special education classrooms (Alghamdi, 2022).	
Young, (2012).	Youth with ASD	<p>Mixed-methods through quantitative survey data and interview.</p> <p>The study explored how learning strategies and supports offered in school could enhance academic self-concept and school motivation in youth with ASD.</p> <p>The purpose of the study is to investigate the school environment and the impact of AT on youth with ASD with respect to self-concept and motivation for learning.</p>	<p>The results indicate that youth with ASD who use AT demonstrate increased levels of self-confidence, self-concept, self-esteem, social transitions, motivation for learning, and more independent learners (Young, 2012).</p> <p>Furthermore, youth with ASD who use AT also demonstrate positive educational experiences, the ability to complete academic tasks, improve competence levels, and increase student perception and belonging within a learning community (Young, 2012).</p>	<p>According to Young (2012), AT has a positive effect on writing, language, and grammar for youth with ASD.</p> <p>AT software also includes text-to-speech, speech-to-text, word prediction, spell checkers, and graphic organizers (Young, 2012).</p> <p>The benefits of AT could also stem from implementing residency programs designed to facilitate youth's language, communication, social development, life skills, and independence (Young, 2012).</p>	According to Young (2012), a small sample size was used to collect data.

Lardier et al., (2020).	Youth with ASD	<p>Qualitative</p> <p>The study analyzed the lived experiences of youth with ASD in the US who have chosen to resume their education within the CBE programs that offer high school equivalency instruction.</p> <p>The aim of the study is to explore the correlations between the experiences of youth and students' willingness to attend community-based education programs (CBEs) due to the community environment.</p>	<p>Research findings reveal that CBE programs enhance youth's lived experiences, and students can become critical thinkers, change-makers within the society and community, uphold community-based approaches, and connect to civic engagement and volunteerism (Lardier et al., 2020).</p> <p>The onus is on youth with ASD to become responsible students and citizens within society and become autonomous youth (Lardier et al., 2020).</p>	<p>According to Lardier et al., (2020) youth with ASD who obtain access to social services-based programs could become self-sufficient, develop self-determination, foster growth, and embrace the potential for education, build an ontological vocation for participation in society, and provide a foundation for critical pedagogy (Lardier et al., 2020).</p>	<p>In-depth research into the complexities and tensions that exist within the work of the developing CBEs needs to be further explored in future studies.</p>
Moni et al., (2018).	Youth with ASD	<p>Quantitative analysis</p> <p>The study analyzes the impact of literacy learning from an evidence-based school</p>	<p>The results of the study indicated that long-term PSE programs could enhance language development and literacy skills for youth</p>	<p>The literacy learning program enhances language skills and confidence levels in youth with ASD and</p>	<p>There is limited research regarding the accessibility of evidence-based practice.</p>

		<p>literacy and teaching program (Latch-On) designed to support youth with ASD.</p> <p>The purpose of the study is to support youth with ASD and intellectual disability (ID) to enhance literacy skills, self-confidence, and provide opportunities for employment.</p>	with ASD (Moni et al., 2018).	ID (Moni et al., 2018).	<p>Youth with ID are under-represented in PSE programs.</p> <p>There was a small control group for the quantitative analysis.</p>
Lemmon & Grajo, (2022)	Youth with ASD	<p>Qualitative</p> <p>The aim of the study is to examine the validity of the Assessment of Written Expression Adaptivity for Assistive Technology (AWE ADAPT for AT) to support youth with ASD.</p>	The results of the study indicate that AWE ADAPT for AT is beneficial for enhancing written expression for youth with ASD and ADHD (Lemmon & Grajo, 2022).	The benefit of the AWE ADAPT for AT is interconnected with the Occupational Adaptation (OA) model, which is useful with respect to understanding the effectiveness, efficiency, satisfaction, and helpfulness of resources and strategies used for the assessment (Lemmon & Grajo, 2022).	<p>According to Lemmon & Grajo (2022), an interview-based assessment should be used to administer the AWE ADAPT for AT.</p> <p>Occupational Therapists should be the ones to carry out the assessments by facilitating and providing tools, strategies, and resources.</p>

					According to Lemmon & Grajo (2022), the argument is in favour of using a clinical utility in future research to provide the foundation for examining the validity and reliability of the assessment.
Hamidi at al., (2018).	Youth with ASD	<p>Qualitative</p> <p>The study is focused on understanding the potential role of implementing DIY-ATs to address problems regarding the inclusion and accessibility of youth with disabilities (ASD) in Kenya.</p> <p>The study also explored how stakeholders could provide various opportunities for youth with disabilities to have access to an open-tool DIY-AT by using a TalkBox.</p>	The results indicate that an open DIY-AT through a TalkBox is beneficial in enhancing language skills (Hamidi, 2018).	The DIY is beneficial with respect to elevating in-class participation and engagement levels for youth with ASD (Hamidi, 2018).	<p>According to Hamidi (2018), TalkBox is not made equally accessible to all families and youth with disabilities.</p> <p>There is inadequate access to services and resource facilities in Kenya.</p> <p>Poor sociocultural and technological factors are affecting the daily lives of youth with disabilities in the home, school, and environment in Kenya (Hamidi, 2018).</p>

<p>Reich-Limbach (2015).</p>	<p>Youth with ASD</p>	<p>Qualitative</p> <p>The study aims to understand educators' knowledge and comprehension with respect to inclusion studies and practices.</p> <p>The purpose of the study is to explore the ethical principles, the change in educational policies, and the etymological roots of the basic terms of inclusion and integration.</p>	<p>The results indicate that inclusion practices are beneficial for educators who are in the field of ASD. Thus, inclusion practices can offer reasonable accommodations to youth with ASD in order to fulfill the performance levels in education (Reich-Limbach, 2015).</p> <p>According to Reich-Limbach (2015), inclusive education adapts to the needs of youth with disabilities (ASD).</p>	<p>The integration process allows students and youth with disabilities to participate equally, develop, adapt, and become accepted into the educational system (Reich-Limbach, 2015).</p>	<p>According to Reich-Limbach (2015), the educational inclusive system needs to be investigated thoroughly with empirical evidence.</p> <p>The human rights and ethical dimensions with respect to implementing inclusive education need to be researched thoroughly (Reich-Limbach, 2015).</p>
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Results Chart (Cont.)

Study	Target Group	Research Method	Key Results	Challenges/ Benefits	Limitations
McMenemy & Nicholas (2022)	Youth with ADHD	Qualitative The study explores the many ways in which the resilience framework is understood and experienced by families of youth with ADHD.	Holistic interventions are beneficial versus deficit-related ones (McMenemy & Nicholas, 2022). A resilience framework can support youth with ADHD to experience positive outcomes amidst stress and adversity (McMenemy & Nicholas, 2022).	Strong parental support, the implementation of diverse parental strategies, mindful parenting, and cohesive family environments can promote resilience and provide protective factors that may lower severe ADHD symptoms (McMenemy & Nicholas, 2022).	Not mentioned.
Schoenfelder et al., (2020)	Youth with ADHD	Qualitative The study explores the interventions needed for youth diagnosed with ADHD and who are at risk of developing functional problems that may mitigate the treatment and reduce health risks.	According to Schoenfelder et al., (2020), psychoeducation enhances attitudes and behaviors regarding ADHD treatments and includes motivation. For example, it enhances strategies using Motivational Interviewing	The family-based preventative interventions improve behaviours in youth by lowering the risk of unhealthy behaviours which could stem from family adversity and socioeconomic status (Schoenfelder et al., 2020).	Not mentioned.

		<p>The study also explores various interventions (e.g., psychoeducation/health literacy programs and family-based preventative interventions, and psychosocial treatment) that are also designed for families who have youth with ADHD in order to increase treatment options and motivation.</p>	<p>therapeutic techniques.</p> <p>The Motivational interviewing (MI) technique is used to enhance and increase drive in youth diagnosed with ADHD. The MI clinicians use open-ended questions to analyze youth with ADHD and their level of ambivalence (Schoenfelder et al., 2020).</p> <p>Thus, results indicate that MI improves treatment engagement outcomes, increases psychiatric medication obedience, and reduces youth risk behaviors (Schoenfelder et al., 2020).</p>	<p>MI intervention models allow practitioners to understand the effects of the treatment options, and gain insights with respect to the attitudes and behaviours of youth with ADHD (Schoenfelder et al., 2020).</p> <p>The benefits of the psychoeducational, family-based prevention and MI intervention models are that they are feasible and provide inclusive ways to increase parental, professional, and educational knowledge regarding ADHD evidence-based treatment options (Schoenfelder et al., 2020).</p>	
Husain, (2020)	Youth with ADHD	Participatory Design and User-Centred Design provide insight into the requirements and evaluation.	Self-monitoring engagement levels, alongside self-awareness, increase personal accountability in youth with	The benefits of procedural rhetoric strategies result in promoting a collective understanding of the symptoms	Not mentioned.

		The study explores the state of the art regarding assistive technologies for youth with ADHD and Human-Computer Interaction (HCI).	ADHD (Husain, 2020). The Continuous Performance Test resulted in positive effects on students' attention levels (Husain, 2020).	and the difficulties youth with ADHD face versus non-ADHD youth.	
Herawati et al., (2022)	Youth with ADHD	Qualitative The study is focused on understanding the impact of text-to-speech assistive technology on youth with ADHD during e-learning.	Text-to-speech assistive technology enhances reading levels with respect to word affirmations (Herawati et al., 2022). According to Herawati et al., (2022), "Students who have difficulty with reading can use assistive technology in the form of a spell-checking software to support students in evaluating grammar" (p. 172). Reading assistive technology improves students' reading ability and vocabulary.	The benefit of text-to-speech assistive technology is to allow youth with ADHD to enhance reading, spelling, voice intonation, and word affirmations (Herawati et al., 2022). Reading assistive technology is beneficial for increasing reading ability in youth with ADHD by combining visual skills (e.g., looking at the text-screen during e-learning) and listening to audio books (Herawati et al., 2022).	Not mentioned.

			It also supports youth with reading comprehension, decoding, and reading words and sentences (Herawati et al., 2022).	Some of the challenges that can arise when using reading assistive technology are ineffective signals resulting in delays when reading and confusing youth with ADHD (Herawati et al., 2022).	
Pontikas et al., (2022)	Youth with ADHD	Qualitative The study explores how technological applications could be used as an educational instrument to support youth with ASD and ADHD.	Augmentative and Alternative Communication (AAC), which includes voice output, picture symbols, and speech-generating devices, can support youth with ASD and ADHD with language development, reading, writing, and attention span (Pontikas et al., 2022). System of Augmented Language (SAL) can support youth with online applications, and familiarize them with the digital world, improve	Assistive technology (AT) is beneficial for youth with ASD and ADHD with self-help skills and provide meaningful social interactions (Pontikas et al., 2022). AT could also support youth with various core symptomatology, which is related to lower speech, language development, motor skills, memory, learning, and behaviour (Pontikas et al., 2022).	Not mentioned.

			<p>intellectual functioning.</p> <p>Intellectual functioning includes memory, learning, and problem-solving skills.</p> <p>Thus, the SAL could enhance adaptive functioning, which is connected with communication skills, developing virtual friendships, social judgement, and interactive online activities, and enhancing speech (Pontikas et al., 2022).</p> <p>Information and Communication Technologies (ICT's) are designed to support students with special needs in the following areas: self-control, self-awareness, motivation, and attention (Pontikas et al., 2022).</p>	<p>AT is beneficial to support youth with ASD and ADHD in social, emotional, and cognitive domains, while also offering therapy strategies, self-management skills, and expressive communication skills (Pontikas et al., 2022).</p>	
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			<p>The results of the study found that AAC technologies enhance self-help skills, academic skills, and social connection/interaction with other youth with ASD, ADHD, and Down Syndrome (Pontikas et al., 2022).</p>		
<p>Kumaresan (2022)</p>	<p>Youth with ADHD</p>	<p>Qualitative</p> <p>The study explores the use of a modern web-based recommendation system known as “Buddy” (Kumaresan et al., 2022, p. 54) that enhances AT levels.</p>	<p>The web-based recommendation system provides inclusion for all youth with ADHD by providing accessibility with respect to education, work, leisure, and participation in society (Kumaresan et al., 2022).</p> <p>The results stem from a user study on assistive technology usage in Sweden and Austria.</p> <p>Results indicate that 15% of users found AT to be useful in supporting individual needs</p>	<p>The challenges presented with respect to the accessibility of AT’s include: mainstream technologies using touch interactions and well-established website manipulation techniques to support youth with ADHD who have a cognitive impairment (Kumaresan et al., 2022).</p>	<p>There is a gap associated with the AT provision process with respect to a lack of training, support, and maintenance (Kumaresan et al., 2022).</p> <p>Therefore, a barrier to using AT provision process results in users (e.g., youth with ADHD) not being able to find a suitable AT for their individual needs</p>

			<p>(Kumaresan et al., 2022).</p> <p>Conversely, over 60% of AT users needed external support to find suitable technology designed for their individual needs (Kumaresan et al., 2022).</p>		<p>(Kumaresan et al., 2022).</p>
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Results Chart (Cont.)

Study	Target Group	Research Method	Key Results	Challenges/ Benefits	Limitations
Sulaimani & Bagadood, (2022)	Youth with DS	<p>Qualitative</p> <p>The study explores educators' understanding of various special education programs for youth with Down Syndrome (DS) in Saudi Arabia (Sulaimani, & Bagadood, 2022).</p>	<p>Results indicate that AT supports youth with DS with communication, reading and writing skills, attention, and engagement in various sensory activities, and social and emotional competency (Sulaimani, & Bagadood, 2022).</p> <p>It also fosters confidence levels resulting in a higher level of academic attainment (Sulaimani, & Bagadood, 2022).</p> <p>According to Sulaimani and Bagadood (2022), "assistive technology could nurture psychological and mental preparation, supporting students' attention and enhancing their</p>	<p>Assistive technology can support youth with DS to access materials online, participate within an online activity, complete tasks using text-to-speech software, and promotes motivation (Sulaimani, & Bagadood, 2022).</p> <p>The text-to-speech software also allows youth with DS to decode and support with comprehension of reading materials (Sulaimani, & Bagadood, 2022).</p> <p>Various devices have been adopted within the Saudi educational system, which includes: Voiceover Apps, cognitive and hearing aids,</p>	Educators could potentially lose the physical contact with students with DS if AT takes over and becomes a model for learning.

			information retention capacity” (p. 5).	electrical assistive devices, and the braille sense notetaker (Sulaimani, & Bagadood, 2022). All of these assistive technologies allow students with DS to synchronize resources and take notes in educational settings (Sulaimani, & Bagadood, 2022).	
Krasniqi et al., (2022)	Youth with DS	Qualitative The focus of this study is on the impact of assistive technology on youth with DS and how AT could support in solving real-life problems within one’s home and community.	Assistive technology can support youth with DS in solving real-life problems within one’s home and community, while also promoting independence in life (Krasniqi et al., 2022). AT enhances problem-solving skills, orientation, eye-hand coordination, self-esteem, self-efficacy, and improves daily activities (Krasniqi et al., 2022).	Various assistive technologies can support youth with DS namely, Augmented and Alternative Communication (AAC) that enhances non-verbal communication. Augmented Reality (AR) supports in building online environments (e.g., virtual spaces), and Educational Video Games introduce youth with DS to gamification	Not mentioned.

				(Krasniqi et al., 2022). Assistive technology can enhance communication, interaction, mobility, and completing of daily activities within the school and at home (Krasniqi et al., 2022).	
Neil et al., (2018)	Youth with DS	Qualitative The study addresses the therapy treatments used by primary caregivers for youth with DS within the home environment.	Results indicate that caregivers of youth with DS mainly use the following treatment options: speech therapy, occupational therapy, physical therapy, applied behaviour analysis, and evidence-based treatments to support with speech, language, motor skills, communication, and behaviour (Neil et al., 2018).	Various treatments are used by caregiver who have youth with DS namely, applied behaviour analysis, reading, and phenological awareness treatments to support with communication, reading, and mathematical skills (Neil et al., 2018).	Caregivers of youth with DS may not be able to identify the developmental milestones in order to connect the specific treatment(s). Lack of knowledge regarding the accessible treatment options and specific therapies offered for youth with DS.
Gómez et al., (2020)	Youth with DS	Mixed Methods An eight-domain	KidsLife-Down Scale demonstrates accurate psychometric properties where social inclusion	An eight-domain model is used for emotional well-being, physical well-being, material well-	The Eight-domain model does not investigate reliability.

		<p>model is used.</p> <p>The study focuses on adapting the KidsLife-Down Scale to select various items for youth with DS.</p>	<p>was elevated (Gómez et al., 2020).</p> <p>On the other hand, physical wellbeing and self-determination were scored lower vis-à-vis the other domains (Gómez et al., 2020).</p>	<p>being, personal development, rights, self-determination, social inclusion, and interpersonal relationships to support youth with DS (Gómez et al., 2020).</p>	<p>Future research needs to include those specific measurements (Gómez et al., 2020).</p> <p>Future research also needs to take into consideration the lived experiences of the caregivers/families of youth with DS and incorporate a holistic approach to the eight-domain model (Gómez et al., 2020).</p>
Ventura, (2020)	Youth with DS	<p>Qualitative</p> <p>The study focuses on the benefits of Occupational Therapy (OT) for youth with DS.</p> <p>The purpose of the study is to demonstrate the goal and the process of including OT in the educational curriculum</p>	<p>Occupational therapists are needed to support youth with DS with respect to providing assessments to support youth with the transition stage from adolescence stage into adulthood (Ventura, 2020).</p>	<p>Individuals under the Disabilities Education Act (IDEA) supports early intervention programs for youth with DS by providing a diverse array of resources (Ventura, 2020).</p> <p>Under the IDEA, youth with DS are provided with individualized education plans (IEP) which also</p>	<p>Youth with DS must advocate for themselves in order to have access to resources after the age of 21.</p> <p>More resources need to be in place for youth after the age of 21 within the educational system.</p>

		and pre-employment to support youth with DS (Ventura, 2020).	OT's can also assist by providing support to youth with DS in the educational system (e.g., college or university) toward a working life (Vantura, 2020). Occupational therapists are also needed in order to introduce an OT-based curriculum and include it within a pre-employment class to enhance self-efficacy levels and confidence for both individuals with DS and employers (Vantura, 2020).	incorporated OT sessions within the education system and special education classes (Vantura, 2020). The IEP plan offers both caregivers with youth with DS a transitioning plan to college and the workplace. Conversely, few educational departments in Canada include occupational therapists within the transitional process when the youth move from the IDEA to the Americans with Disabilities ACT (ADA).	
Babb et al., (2020)	Youth with DS	Qualitative The study explores the benefits of providing video models as a method of instruction. This is done by understanding the impact of VSD in real-	The use of AAC within educational settings enhances expressive communication levels in youth with DS (Babb et al., 2020). Youth with DS who use VSD as an assistive	Visual scene displays (VSD) use a photograph tool that is programmed on a tablet computer to enhance communication for youth with DS (Babb et al., 2020).	Not mentioned.

		world contexts to support youth with DS in enhancing communication skills (Babb et al., 2020).	technology, demonstrate an increase in how to communicate with community members within a volunteer role and participate in various activities (Babb et al., 2020).	<p>The VSD is an app that also highlights areas of a scene and produces speech output which allows a word or a phrase to be recorded (Babb et al., 2020).</p> <p>Volunteer settings can act as an intervention plan to increase levels of communication, independence, and completion of daily activities (Babb et al., 2020).</p> <p>The VSD incorporates an integrated approach to support youth with DS to participate in the volunteering community (Babb et al., 2020).</p>	
Warmerdam-Wolter et al., (2018)	Youth with DS	<p>Qualitative</p> <p>The study explores the identified parental behaviors and the behaviors of the youth with DS.</p>	Eye-tracking technologies also allow one to understand the nature of imitative learning, which includes joint attention, gaze by following and reading, and	The eye-tracking data indicates that youth with ASD and DS are directly looking at the demonstrations but not at the demonstrators performing the	Further studies need to discuss the importance of clinical practice with respect to how neurocognitive mechanisms are connected to social

			<p>mimicking others' actions (Warmerdam Wolter et al., 2018).</p>	<p>task (Warmerdam Wolter et al., 2018).</p> <p>Youth with DS are less inclined to focus on the demonstrator during the observation phase and the performance of the task at hand (Warmerdam Wolter et al., 2018).</p> <p>Conversely, youth with DS who have acquired visual attention skills with respect to the demonstrator's facial expression results in higher imitative behaviours (Warmerdam Wolter et al., 2018).</p> <p>Youth with ASD and DS show reduced attention span to social stimuli (Warmerdam Wolter et al., 2018).</p>	<p>learning in youth with DS.</p> <p>Thus, parental behaviours need to be further investigated.</p>
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<p>Vianello & Lanfranchi, (2011)</p>	<p>Youth with DS</p>	<p>Qualitative</p> <p>The study explores the impact of the social cognitive development of youth with DS within the educational environment.</p>	<p>Eye-tracking technologies enhance social communication skills, reciprocity, and behavioural rigidity (Vianello & Lanfranchi, 2022).</p> <p>The eye-tracking device also allows neuropsychologists to understand the cognitive development of youth with DS (Vianello & Lanfranchi, 2022).</p>	<p>The eye-tracking technologies can support youth with DS to enhance goal-directed movement, social cues, and cognitive development (Vianello & Lanfranchi, 2022).</p>	<p>Further research needs to include gaze-pattern analysis to support youth with DS with attention span, and focus control.</p>
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