Media Literacy and Assistive Technologies for Empowerment in Autism

Edited by Carla Sousa and Alan H. Tkaczyk

Edições Universitárias Lusófonas

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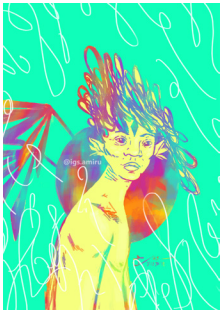
ABOUT THE BOOK COVER



// ENG
Artist: Igor Amirú Paz Cordeiro (he/him)
From Curitiba, Paraná, Brazil.
Instagram: @igs.amiru
Email: igor.paz.cordeiro@gmail.com
https://linktr.ee/igs.amiru

Image description: Digital painting over a traditional pencil drawing. Made in Krita.
Author character: Sô, neurodiverse spirit.

Artist's note
Hi, I'm Igor Amirú, a transgender autistic artist, watercolor painter, plant lover and aspiring botanist.
I paint plants and diverse bodies in the hope that one day society will respect both and live better with the beings around it.

// PT
Artista: Igor Amirú Paz Cordeiro (ele/dele)
De Curitiba, Paraná, Brasil.
Instagram: @igs.amiru
Email: igor.paz.cordeiro@gmail.com
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Descrição da imagem: Pintura digital sob desenho a lápis tradicional. Feita no Krita.
Personagem autoral: Sô, espírito neurodiverso.

Nota do Artista
Olá. Eu sou Igor Amirú, um artista autista transgênero, pintor de aquarelas, apaixonado por plantas e aspirante a botânico.
Pinto plantas e corpos diversos na esperança que um dia a sociedade respeite ambos e conviva melhor com os seres ao seu redor.

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Foreword

One billion people, or 15% of the world's population, experience forms of disabilities. Among those, one-fifth of the estimated global total, or between 110 million and 190 million people, experience significant disabilities. Disability prevalence is even higher for developing countries and those with disabilities are more likely to experience adverse socio-economic outcomes such as less education, poorer health and employment outcomes, and higher poverty rates.

The European Commission's European Disability Strategy has identified social exclusion as one of the grand challenges that people with disabilities in Europe are facing. People with disabilities are the most disadvantaged in society exacerbating many inequity issues. For instance, people with disabilities may have limited access to basic education, which can largely reduce their chances to obtain meaningful and gainful employment as adults. Globally, the employment rates of people with disabilities is significantly lower than their peers without disabilities. In addition to the socio-economic implications, social exclusion impacts negatively on self-esteem, mental health and quality of life. Thus, social inclusion is an important element of well-being for people with disabilities and a key component of the United Nations Convention on the Rights of Persons with Disabilities. Research has highlighted that social inclusion can be promoted through access to education and employment.

Research has also demonstrated that Assistive Technology (AT) can be a meaningful way to improve access to education, employment, and community participation among people with disabilities. AT, include both high-end and low-end devices, are products, equipment, and systems that enhance learning, working and daily living for persons with disabilities. While AT can be useful in improving the life of people with disabilities, the World Health Organization have identified that only 10% of the population in need of AT products have access to them.

Social Inclusion maybe even more challenging for those who experience difficulties with social communication as is characteristic of Autism Spectrum Conditions (ASC). Advancing Social Inclusion through Technology and EmPowerment (a-STEP) is an European Union funded COST Action comprising of an interdisciplinary consortium of researchers, practitioners, service providers, educators, developers and people with disability from 35 countries. a-STEP is dedicated to making accessible and sustainable AT available to those that need it especially those with ASC. Members of a-STEP have demonstrated in this book how AT can be powerfully deployed across education, higher education and in the workplace to increase social inclusion and empowerment. They joined a group of scholars that also approached, in a broad manner, how media literacy fosters an active and engaged citizenship in an increasing digitized society. The book will be of interest to parents, educators, researchers, service providers and the autism community.

Prof. Geraldine Leader (a-STEP, Chair)
Dr. Zeynep Sahin Timar (a-STEP, Vice-Chair)

PART I

AUTISM, DIVERSITY, AND MEDIA LITERACY

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Introduction

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In a world defined by growing global interconnectedness and technological reliance, the significance of media and information should not be overlooked. We engage with many forms of digital media, such as news stories and videos, which have a significant impact on shaping our views, beliefs, and behaviors. Nevertheless, persons who are on the autism spectrum face unique challenges as well as possibilities when it comes to navigating the complex realm of media. Considering the contemporary context, the **ASDigital Project** (2020-1-PT01-KA226-SCH-094961) and the **a-STEP**[1] COST action (19104) have brought together a group of academics, professionals and people on the autism spectrum to develop short, user-friendly approaches that reflect on the existing evidence about the challenges and promises that emerge from this relationship.

The primary objective of this book titled "**Media Literacy and Assistive Technologies for Empowerment in Autism**" is to examine and shed light on the aforementioned dynamics. It aims to provide valuable perspectives on the ways in which media literacy and assistive technology can enhance the capabilities of individuals with autism, enabling them to flourish in the era of digital advancements.

Promoting more media literacy initiatives including individuals in the autism spectrum could provide them the tools to navigate an ever-evolving digital landscape with confidence and competence (Ressa, 2022). Therefore, in the first part of this book, called "**Autism, Diversity, and Media Literacy**", six chapters are presented, to explore the different intersections between the fields of media literacy, media education, diversity, and autism.

1 https://www.a-step-action.eu/

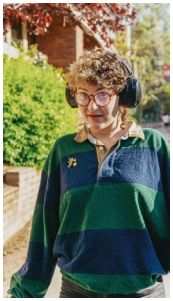

Photo by Hiki App at Unsplash

The chapter "**Decoding the Digital Landscape: Media Literacy for Autism Spectrum Disorder**" seeks to outline key directions for research and intervention concerning the relationship between individuals on the autism spectrum and media literacy. It emphasizes the importance of authentic representation, empathic media literacy, neurodiverse talent, and social advocacy in the media, as inclusivity strategies. By proposing the collective approach of the potential challenges, and how this would include researchers, media professionals, advocacy organizations, and a more neuro-diversity-driven media education, the chapter intends to refine the current state of the art and contribute to evidence-based interventions that empower individuals with autism in the realm of media literacy.

In the following chapter, an experienced teacher, working in the field of autism – **Ewa Litwinczuk** – was supported by a more academic perspective to provide the readers with an overview of implementing pedagogical strategies based on TEACCH (Treatment and Education of Autistic and Related Communication-Hazardous Children) and PECS (Picture Exchange Communication System). In a more innovative approach, the authors provide an evidence-based reflection on the potential of these strategies in the promotion of literacy, through their visual supports.
A digital game specifically developed to foster digital security-driven competencies in youth in the autism spectrum is the starting point of the next chapter – **"Desktop Adventure": a Tool for the Development of Digital Competencies in Students with Autism Spectrum Disorder** – by **Conceição Costa** and **Vera Pradiante**. Here, the authors provide insights on how diversity was included in the game design and development process, while presenting the game's intervention proposal and expected outcomes.

In the following chapter, **Sara Rye** continues to explore the broad potential of gaming as a pedagogical tool, this time as a path to foster a more equitable higher education system. According to the author, a variety of analogue games promotes cooperative learning, facilitating the development of communication skills, group problem-solving abilities, and conceptual understanding through collaborative effort. Furthermore, these games foster a sense of community, enhancing the educational environment in educational settings through the provision of multimodal engagement, collaborative opportunities, critical thinking exercises, and experiential learning activities that enhance traditional instructional approaches.

In the next chapter, **Didi** takes on the challenge of thinking about the potential of a media franchise in their identity construction as an autistic and non-binary person. "**Bringing Hues to the Spectrum: A Journey with Autism, Gender Identity, and Pokémon**" is an in-depth description of a personal journey, which can support more and less academic reflections on diagnosis, human relationships, development, gender identity and the mediating role of fantasy worlds. As it was originally written in Portuguese, this chapter is published in both languages (Portuguese and English).

By way of conclusion, in the last chapter of this part, **Ana F. Oliveira** issues challenges the readers – can media education be, instead of a barrier, a bridge to connect generations? In "**Minding the Gap: Building Bridges through Intergenerational Media and Information**", the author transcends the neurotypical - neurodiverse debate, bringing us the issue of generationality in media education, as a new source of opportunities, guided by a set of possibilities to be explored, which include: access; knowledge; competencies; connections; interests and motivations.

Through these chapters, we embark on a journey that includes developing digital competencies, examining identity within media franchises, interpreting the digital landscape, and implementing innovative pedagogies. By doing this, this first part intends to advance knowledge while also sparking a coordinated effort between academics, media professionals, advocacy groups, and educational institutions that genuinely reflect neurodiversity. In the end, this compilation aims to improve the current state of the art by fostering evidence-based methods that empower people

on the autism spectrum in the area of media literacy.

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Decoding the Digital Landscape: Media Literacy for Autism Spectrum Disorder

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Abstract

In the present-day context, media literacy assumes significant importance due to the growing integration of digital media into our everyday existence. Given the inherent vulnerabilities of certain audiences, it is imperative to emphasise the significance of taking action to address their specific accessibility requirements and literacy needs. The objective of this chapter was to provide a conceptual framework that delineates the primary needs and characteristics of individuals in the autism spectrum and establish connections between these attributes and the contemporary notion of "media literacy". Through this mapping, it was possible to identify and critically explore a set of opportunities for neurodiversity-driven media education, including: (1) promoting authentic representations; (2) enhancing empathic media literacy; (3) foster neurodivergent talent in media production; and (4) advancing social advocacy through media. These pillars also intend to emphasize priorities for the forthcoming research endeavours in the topic.

Keywords: Media Literacy; Autism Spectrum Disorder; Neurodiversity; Accessibility; Empathic Media Education.

Introduction

In contemporary society, digital literacy holds immense relevance as technology becomes increasingly intertwined with our daily lives. This includes all forms of communication and participation, even the ability to foster institutional and non institutional forms of engagement in civic and political life (Polizzi, 2020) – to this extent considered as fundamental precursors of social inclusion (Simplican et al., 2015).

Considering their vulnerabilities, the need for action is particularly significant when it comes to audiences with specific accessibility needs. It is important to note that in the face of the great contradictions generated by the current "liquid world", where we experience the best and worst of times, the digital society provokes such intense inequalities and cultural crises that we all reveal ourselves as fragile and vulnerable beings. This is of utmost importance and certainly justifies the mobilisation of political decision-makers and all those in civil society who can contribute to raising the levels of this literacy among society in general and, in particular, among various audiences with specific needs (Gomes da Silva, 2015). This need to focus on the media literacy needs of people with disabilities is emphasised by their significant representation on the research panorama in this field, including individuals with Autism Spectrum Disorder (ASD; Sousa & Costa, 2022).

This chapter aims to conceptually map some of the main needs and characteristics of people on the autism spectrum and relate them to the current concept of "media literacy". Hence, it intends to discuss some of the opportunities emerging from this theoretical relationship, opening paths for research and intervention.

Autism and Neurodiversity

In contemporary society, autism can be seen through different lenses, from the most medical or biological to the most socially constructed, emphasising the role of self-determination of people with these characteristics (Morán et al., 2021).

In the first group of conceptualizations, the most widely accepted definitions of autism come from established diagnostic criteria, primarily the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association[APA], 2013) and the International Classification of Diseases (ICD; World Health Organization [WHO], 2019).

According to the DSM-5 (APA, 2013), ASD is distinguished by two fundamental domains of characteristics. The initial domain pertains to deficits in social communication and interaction, encompassing enduring challenges in social-emotional reciprocity. These difficulties are evident in the context of engaging in reciprocal dialogues, expressing emotions, and demonstrating empathy towards others. Individuals diagnosed with ASD may encounter challenges in the realm of nonverbal communication, including the comprehension and utilisation of gestures, facial expressions, and body language as means of expressing emotions or intentions. Moreover, individuals frequently encounter challenges in establishing and sustaining interpersonal connections, encompassing difficulties in cultivating friendships and a diminished inclination towards engaging in social interactions.

The second primary domain is distinguished by the presence of Restricted, Repetitive Patterns of Behaviour, Interests, or Activities. This encompasses the manifestation of repetitive movements, speech patterns, or object utilisation, such as hand-flapping, echolalia (the repetition of others' words), or inflexible adherence to established routines. Individuals diagnosed with ASD frequently exhibit a tendency towards fixated interests or intense preoccupations pertaining to particular subjects or objects. Individuals may also demonstrate a tendency to resist change, resulting in feelings of distress when their established routines are modified. Moreover, a significant number of individuals encounter atypical sensory experiences, which can manifest as either a heightened desire for sensory stimulation or an increased sensitivity to sensory input (APA, 2013).

In addition to medical interpretations, alternative definitions and perspectives on autism exist, which prioritise relationships, social frameworks, and the concept of neurodiversity. It is crucial to recognise these non-medical viewpoints, as they exert a substantial influence on the formation of attitudes towards autism, the advancement of acceptance, and the advocacy for the creation of inclusive and supportive settings for individuals on the autism spectrum.

In the present chapter, we will mainly focus on the neurodiversity lens, according to which, autistic individuals have unique strengths, talents, and ways of experiencing the world that should be recognized and respected (Leadbitter et al., 2021). According to Kapp et al. (2013), these views are not incompatible, since both the "deficit-as-difference" conception and

human behaviour research tend to support approaches that embrace, rather than eradicate, autism, based on one's relationship to the individual's characteristics or level of awareness regarding neurodiversity. Furthermore, the social model of disability has significant implications for researchers in the field of media and digital literacy. It enables them to recognise that the lack of accessibility in their projects is the issue, rather than attributing it to the characteristics of autistic individuals (Barnes, 2020).

Dunn & Andrews (2015) propose that a recommended approach within the realm of Psychology involves soliciting input from project participants regarding their preferred terminology in relation to disabilities. In the context of academic research, it is imperative for writers to thoroughly examine the social, political, and cultural contexts surrounding the individuals they are discussing. It is essential to comprehend that when employing this methodology, there is expected to be variability in preferences and consensus within the collective concerning the selection of linguistic structures and the appropriate timing for their utilisation. Hence, the forthcoming chapter will adopt a person-first and identity-first approach, aiming to foster human dignity while upholding scientific and professional rigour.

Media Literacy and Digital Literacy

Defining concepts like "media literacy" or "digital literacy" can always be a research approach in itself. However, for what matters to the present chapter, it is important to find operational definitions that allow understanding and mapping challenges and opportunities for people on the autism spectrum. To clarify, in the present chapter, the definition of media literacy developed by Renee Hobbs (2010; 2021) will be adopted, considering how it emphasises the development of critical thinking skills, active engagement, and ethical decision-making in relation to media messages. Moreover, the author's approach to media literacy highlights the importance of empowering individuals to navigate the media landscape effectively and to become responsible and creative media users and producers, being in alignment with the currently empowerment-driven and emancipatory models adopted in the field of ASD research (Cascio et al., 2021; Chown et al., 2017). This definition, developed by Hobbs in 2010 and further explored in 2021, is mainly composed of five components, as below.

a) Accessing: Media literacy involves having the skills and resources

to access and retrieve information from various media sources, as well as "accurately comprehending messages" (Hobbs, 2021, p. 5).

b) Analysing: Media literacy includes the ability to critically analyse media messages, identifying the techniques, biases, and intended effects used by media creators. Here, important aspects include veracity, credibility, or point of view.
c) Creating: Media literacy involves the capacity to create meaningful media messages, utilising various forms of media production tools and techniques. To this extent, Hobbs (2021, p.5) emphasises "creativity and confidence in self-expression".
d) Reflecting: Media literacy encourages reflection on personal and societal values, as well as the influence and impact of media on individuals and communities.
e) Taking action: Media literacy encompasses the ability to take informed and responsible action, such as advocating for media justice, participating in media activism, and using media for positive social change.

As for the concept of "digital literacy", Hobbs (2021, p. 9) argues that it is part of a set of terms that emerged due to the "range of people, academic disciplines, and knowledge communities who have come to see the value of new competencies for navigating the media-saturated society of the 21st century". Digital literacy can be described as the knowledge, mindset, and abilities necessary to actively engage and participate in the utilisation of the internet and social media platforms. It encompasses the skills needed to navigate the digital realm effectively, critically evaluate information, and engage in meaningful interactions within the online environment (Hobbs, 2021).

Opportunities for Neurodiversity-Driven Media Education

The utilisation of neurodiversity-focused media education offers a compelling and comprehensive method for building awareness, compassion, and respect towards individuals who have neurodevelopmental variations, such as ASD. Based on the current state of the art, this section examines the potential opportunities that emerge from the inclusion of neurodiversity principles into media education. It presents a transformative viewpoint on the creation, distribution, and consumption of media content.

1) Promoting Authentic Representations

One notable opportunity emphasised in the existing body of literature pertains to the imperative of fostering genuine and varied portrayals of individuals diagnosed with ASD. It is worth noting that the prevailing depictions of individuals with ASD are often fraught with issues and predominantly centred around those with high support needs (Jones et al., 2023). Based on the findings of Jones et al.'s (2023) Systematic Literature Review (SLR), autism is predominantly depicted as a source of fear or as an important hurdle. One instance of a favourable portrayal of autism in the media can be observed in the television series Atypical (Rashid, 2017-2021). Despite the diverse range of identities and behaviours that can exist within the autism spectrum, the show depicts Sam Gardner (Figure 1), a character who possesses a genuine interest and the ability in establishing romantic and sexual relationships. Yet, as we will explore below, the inclusion of individuals with ASD as actors in these representations can make them even more inclusive and acceptable to the community (Nordahl-Hansen, 2017).

Figure 1 - Sam Gardner in Atypical (Rashid, 2017-2021). 2017-2021 Sony Pictures Television Inc. All rights reserved.

2) Enhancing Empathic Media Literacy

The integration of neurodiversity-focused content into media education can be an opportunity to facilitate a greater comprehension and empathy among neurotypical individuals towards the experiences of those who are neurodivergent. Through the exposure of audiences to a range of perspectives, the media has the potential to foster significant connections and bridge the gap in empathy (Throop, 2023). These educational initiatives might have the potential to not only address attitudinal barriers but also have a positive impact on the development of media literacy skills (Sousa & Costa, 2022). By fostering the practice of critically analysing media portrayals of neurodivergent characters and themes, individuals

may cultivate a more discerning attitude towards consuming media. In the given context, an increased level of media literacy could potentially enable individuals to critically analyse and challenge representations that perpetuate detrimental stereotypes of autism. Moreover, it may hypothetically motivate them to actively seek and endorse media content that is more genuine, diverse, and inclusive.

3) Foster Neurodivergent Talent in Media Production

The incorporation of neurodiversity principles into media education has the potential to enhance the acknowledgment and empowerment of individuals with neurodivergent traits in the media production sector. Through the creation of opportunities and accommodations tailored to the needs of neurodivergent individuals, the field of media production can effectively access a diverse range of distinctive perspectives and innovative insights. The act of endorsing and enhancing the voices of individuals who are neurodivergent can contribute to the enhancement of the media environment, thereby fostering a more diverse and complex narrative encounter for viewers. Moreover, to ensure this opportunity as a pillar for the future would imply fundamental changes in the educational scenario, to provide these students with the required skills to be effective media producers (Ressa, 2022).

4) Advancing Social Advocacy Through Media

The utilisation of media education centred around neurodiversity can provide an opportunity to serve as a significant catalyst for promoting social advocacy and facilitating transformative societal shifts. Through the dissemination of narratives that emphasise the obstacles faced by and the unique abilities possessed by neurodivergent individuals, media content might have the potential to enhance public consciousness and support policies that prioritise the provision of accessible environments, inclusive practices, and robust support systems for communities. The media has the potential to function as a platform for the amplification of advocates and activists (Babo & Taborda, 2019; Zúñiga et al., 2014), thereby facilitating a more comprehensive and inclusive public dialogue concerning matters pertaining to neurodiversity.

If we look at the emerging lines of opportunity explained here, with Hobbs' (2010; 2021) definition of media literacy as a framework, it is possible

to realise the potential role of media education for a more neurodiverse society, which has access, analysis, reflection, creation and action through the media as its pillars. These premises are systematised in Table 1.

Table 1 - Summary of opportunities for neurodiversity-driven media education related to the components of media literacy (Author's elaboration, based on Hobbs [2010; 2021])

Opportunities for neurodiversity-driven media education	**Related components of media literacy based on Hobbs (2010; 2021)**	**Explanation**
Promoting authentic representations	Accessing Analysing Taking action	People with ASD's access to the media can be conditioned by the degree to which the media represent them, as well as the amount of bias that emerges when analysing them. This will be greater if they only encounter expressions of identity in the media that are read as neurotypical. Moreover, authentic representations may play a role in how society is more or less sensitised to the experience of those living on the spectrum, taking action for their social inclusion.
Enhancing empathic media literacy	Analysing Reflecting Taking action	The integration of neurodiversity-focused content into media education presents a valuable possibility for engaging in a thorough analysis and critical reflection of media artefacts. The implementation of this comprehensive approach has the potential to enhance individuals' agency in utilising media platforms, thereby fostering a society characterised by empathy and inclusivity, which takes action and provides support for individuals with neurodivergent traits.

Opportunities for neurodiversity-driven media education	Related components of media literacy based on Hobbs (2010; 2021)	Explanation
Foster neurodivergent talent in media production	Creating Taking action	By creating inclusive opportunities and accommodations, the field can consider unique perspectives and innovative insights. Providing neurodivergent students with the necessary skills to become effective creators is essential for their ability to take action through media.
Advancing social advocacy through media	Taking action	Media can serve as a forum for amplifying the voices of activists and advocates, fostering a more comprehensive and inclusive public discourse on issues pertaining to neurodiversity. Through this procedure, group activities can be organised to promote societal change and a higher level of acceptance for neurodivergent people.

Discussions, Limitations, and Future Directions

In order to suggest areas for research and intervention, this chapter has attempted to conceptually map the requirements and traits of people on the autistic spectrum in relation to media literacy. By promoting authentic representations, enhancing empathic media literacy, fostering neurodivergent talent, and advancing social advocacy through media, we can work towards a more inclusive and empathetic society. However, we must remain mindful of the conceptual nature of this exploration and the need for empirical validation. Additionally, there are a number of challenges that need to be addressed, such as the stigma that surrounds autism and the lack of accessibility of media for those with ASD. In the future, it will take a collective effort from researchers, media professionals, and advocacy organisations to address and overcome them.

In order to establish a connection between theoretical concepts and practical applications, forthcoming research endeavours ought to prioritise several pivotal domains. First and foremost, it is imperative for researchers

to explore strategies aimed at reducing the digital divide among individuals diagnosed with autism, thereby guaranteeing their fair and equal access to various forms of media and technology. By acknowledging and seeking to bridge this gap, we can facilitate the advancement of social inclusivity, enabling individuals to effectively and meaningfully interact with and contribute to various forms of media content and platforms.

Furthermore, it is crucial that forthcoming research places significant emphasis on incorporating neurodiversity within media education curricula. This approach entails the integration of inclusive teaching strategies that accommodate the varied learning preferences of individuals who are neurodivergent. By engaging in this practice, educators can enhance their ability to assist students in cultivating essential media literacy skills and cultivate an atmosphere of comprehension and inclusivity within educational contexts.

In addition, it is imperative to highlight the significance of employing participatory research methods in the examination of the link between autism and media literacy. The inclusion of individuals with ASD in the research process facilitates the acquisition of more profound and valuable insights pertaining to their experiences, perspectives, and requirements. By placing a higher emphasis on participatory methodologies, media literacy initiatives can be developed in a manner that is more precise and pertinent, thereby successfully amplifying the perspectives of individuals with autism.

By focusing future research endeavours on these pivotal domains, we can further develop the theoretical framework laid out in this chapter. The empirical studies conducted in these fields will provide valuable insights that can be utilised to develop evidence-based interventions and practical applications aimed at fostering positive outcomes for individuals diagnosed with autism spectrum disorder within the realm of media literacy.

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The Potential Role of TEACCH and PECS for Secondary Education Students with a Focus on Literacy

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Abstract
This chapter emerges from the ASDigital project and offers innovative insights, from a partnership between the views of a practicioner and scholar knowledge. Focusing on Treatment and Education of Autistic and Related Communication-Hazardous Children (TEACCH) and Picture Exchange Communication System (PECS), the chapter provides practical guidance for professionals in fostering literacy skills in secondary education students with Autism Spectrum Disorder (ASD), with an emphasizes on digital competences. The reflection provided in this study explores how both approaches offer structured, visually supported learning environments, benefiting those with autism or communication diversity who struggle with traditional methods. Therefore, it explores how these visual supports can also extend to digital literacy, facilitating communication, social skills, and familiarity with digital symbols. The chapter's insights, also intend to open avenues for future research, through the generation of empirical data for the further validation of these premises.

Keywords: Autism; TEACCH; PECS; Secondary Education; Literacy.

Introduction

The present work is a chapter developed within the scope of a collaborative project known as ASDigital (2020-1-PT01-KA226-SCH-094961). This chapter tries to go beyond the traditional academic discourse, as it represents the culmination of a unique partnership between a highly experienced Polish teacher specialized in the education of autistic children and youth, and a Portuguese academic.

With a particular emphasis on the critical roles that TEACCH (Treatment and Education of Autistic and Related Communication-Hazardous Children) and PECS (Picture Exchange Communication System) might play in fostering literacy and digital skills among secondary education students with Autism Spectrum Disorder (ASD), the goal of this collaboration is to provide practical and hands-on guidance to professionals in the field. Therefore, this chapter aims to provide helpful insights and efficient solutions that may be quickly adopted in educational settings to enhance the learning and development of autistic people by fusing theoretical knowledge with practical experience.

Treatment and Education of Autistic and related Communication-handicapped Children (TEACCH)

What is TEACCH?

The TEACCH model is a scientifically supported intervention designed for individuals diagnosed with ASD. It prioritizes the implementation of visual aids and personalized instruction to facilitate skill acquisition and foster self-reliance (Mesibov et al., 2014). The intervention was formulated during the 1970s by Eric Schopler and his colleagues at the University of North Carolina. Subsequently, it has gained extensive adoption in educational institutions and clinical environments across the globe (Mesibov et al., 2014).

The TEACCH approach is grounded in the recognition that individuals diagnosed with ASD frequently encounter challenges in areas such as social and communication abilities, sensory processing, and executive functioning. The methodology entails establishing a well-organized and foreseeable educational setting that integrates visual aids, including visual schedules, task strips, and visual boundaries, to facilitate comprehension of expectations and facilitate the navigation of daily routines for individuals

with ASD (Mesibov et al., 2014).

This method also places emphasis on employing personalized instruction to impart skills that hold significance for the individual and capitalize on their unique strengths and interests. The methodology entails the decomposition of tasks into more manageable components and the provision of unambiguous and consistent cues and evaluations to facilitate the acquisition of knowledge and self-sufficiency (Mesibov et al., 2014).

Figure 1 - (a) and (b) TEACCH method support materials

Several research studies have demonstrated the effectiveness of the TEACCH intervention in individuals with ASD. These studies have reported positive outcomes in various domains, including adaptive behavior, communication, and social skills (Mesibov et al., 2014; Wong et al., 2015). In general, the TEACCH approach is a method that is characterized by its structured nature, individualized approach, and reliance on empirical evidence. It has gained significant traction and endorsement in the field of ASD due to its extensive implementation and support from research studies.

TEACCH Effectiveness

There is limited research on the effectiveness of the TEACCH approach specifically for secondary school students with ASD. However, some studies have investigated the use of TEACCH principles in secondary school settings and reported positive outcomes.

For example, a study by Mason et al. (2016) examined the use of TEACCH strategies in a secondary school setting for students with ASD. The study found that the use of visual supports and structured routines helped students to increase their independence and engagement in classroom activities.

Figure 2 - (a) and (b) TEACCH method support materials being used

Similarly, a study by Edelman et al. (2017) investigated the use of TEACCH strategies in a high school setting for students with ASD. The study found that the use of visual schedules and task analysis helped students to improve their academic and behavioral outcomes.

In addition, a systematic review by Wong et al. (2015) on evidence-based practices for individuals with ASD found that TEACCH was effective in improving social and communication skills, adaptive behavior, and academic outcomes across age groups.

While more research is needed to fully understand the effectiveness of TEACCH for secondary school students with ASD, these studies suggest that the use of TEACCH principles, such as visual supports and structured routines, may be beneficial for this population.

TEACCH Implementation

How do secondary school teachers can implement the method in the classroom for students with ASD?

Secondary school teachers can implement the TEACCH approach in their classrooms for students with ASD by following these key strategies:

a) **Establish an organized and predictable learning environment:** Give children with ASD a regular daily plan that is clear and consistent, and use visual schedules and task lists to assist them grasp what is expected of them.

b) **Use visual supports:** To assist kids with ASD in navigating everyday activities and transitions, use visual supports including visual limits, checklists, and pictorial schedules.

c) **Divide things into more manageable steps:** To promote learning and independence, break down difficult tasks into smaller, more manageable steps and offer prompts and comments that are clear,

consistent, and timely.

d) **Individualize instruction:** Give students tailored instruction based on their interests and strengths, and change the amount of support as necessary to ensure success.
e) **Encourage independence:** Teach students with ASD self-care and independent living techniques, and gradually reduce support as they gain self-assurance and competence.
f) **Use positive reinforcement:** To reinforce desired behaviors and boost motivation, use positive reinforcement techniques including compliments, material prizes, and social reinforcement.
g) **Work together with other professionals:** To create a thorough and well-coordinated strategy for supporting students with ASD, work together with other professionals such speech and language therapists, occupational therapists, and behavioral specialists.

In the secondary school setting, the implementation of the TEACCH approach encompasses the establishment of a structured and nurturing educational milieu that is tailored to cater to the unique requirements of every student diagnosed with ASD. Teachers can facilitate the academic success and overall development of students with ASD by employing various strategies. These strategies include the utilization of visual aids, the division of tasks into manageable components, and the encouragement of independent learning.

TEACCH Advantages

One of the key benefits of the TEACCH method is its ability to establish a structured and predictable learning environment for individuals diagnosed with ASD. This intervention has the potential to mitigate anxiety levels and foster cognitive development and self-reliance.

The TEACCH method places a strong emphasis on individualized instruction, tailoring the educational approach to the unique strengths and needs of each student diagnosed with ASD. This can facilitate the advancement of achievement and enhance one's self-worth.

Visual supports play a crucial role in the TEACCH method, encompassing tools such as visual schedules, checklists, and picture cues. This intervention has the potential to facilitate comprehension and facilitate the successful completion of daily routines and tasks for students diagnosed with ASD.

The TEACCH method is specifically designed to foster independence and enhance self-help skills among students with ASD. By implementing this approach, individuals with ASD can cultivate a sense of self-assurance and attain higher levels of accomplishment.

The approach places significant emphasis on a collaborative line when working with individuals diagnosed with ASD. This approach involves active involvement and cooperation among parents, teachers, and other professionals to establish a comprehensive and well-coordinated support plan.

Figure 3 - (a) and (b) TEACCH method support materials

TEACCH Challenges

People who have been diagnosed with ASD can benefit significantly from the use of the TEACCH technique because it makes it possible to create a learning environment that is organized and consistent. This intervention has the ability to reduce feelings of anxiety, as well as to stimulate cognitive growth and independent thinking.

Individualized training is given a significant amount of weight in the TEACCH method, which modifies the instructional strategy to cater to the specific abilities and requirements of each child who has been identified as having ASD. This has the potential to increase a person's sense of self-worth and aid the advancement of their achievements.

Visual supports are an important component of the TEACCH technique. These supports might take the form of visual schedules, checklists, and pictorial signals, among other things. Students who have been diagnosed with ASD may benefit from this intervention since it has the ability to improve their cognition and make it easier for them to successfully complete their daily routines and tasks.

Students can benefit tremendously from the TEACCH technique, which was developed with the express purpose of encouraging independence

and developing self-help abilities. Individuals who have ASD are able to create a sense of self-assurance and achieve higher levels of performance if they use this strategy.

When working with people who have been diagnosed ASD, the TEACCH method lays a considerable emphasis on taking an approach that emphasizes collaboration. This strategy calls for the participation and collaboration of parents, educators, and other relevant professionals in order to develop a support strategy that is both comprehensive and well-coordinated.

Picture Exchange Communication System (PECS)

What is PECS?

The Picture Exchange Communication System (PECS) is a communication intervention that uses pictures to teach functional communication to individuals with developmental disabilities, including ASD (Bondy & Frost, 2001). PECS is designed to teach individuals to initiate communication by exchanging pictures with a communication partner, which can be a teacher, therapist, or peer. The system consists of six phases that gradually increase in complexity, from exchanging single pictures to constructing sentences with picture cards.

Figure 4 - PECS Visual Communication Cards

It was originally developed for use with preschool children with ASD and other related developmental disabilities. These children had not developed useful language and they did not initiate communication with others. Over time, PECS has been used with individuals of many ages and with diverse abilities. PECS is used to provide a child with an alternative way of communicating if they have not yet developed speech. It can also be used to teach a child how to initiate communication with another person. The child first learns to request for highly desirable items and then expands

this for commenting and sentence formulation. The child is taught to make their request by handing an exchange card representing what they want, to an adult who is holding the desired item. PECS is taught in six phases. Some children will master each phase quite quickly, while others may never reach Phase 6.

PECS Effectiveness

Research on the effectiveness of PECS has shown promising results. Several studies have demonstrated that the implementation of PECS has led to improvements in communication skills, social interactions, and behavior in individuals with ASD (Bondy & Frost, 1994; Ganz & Simpson, 2004; Charlop-Christy et al., 2002).

Figure 5 - PECS Visual Communication Cards

A meta-analysis of 27 studies found that PECS was associated with significant improvements in communication outcomes, including increased use of verbal language, use of spontaneous speech, and initiation of communication (Ganz & Simpson, 2004). Another study compared the effectiveness of PECS to traditional speech therapy and found that both interventions were effective in improving communication skills, but PECS was more effective in promoting functional communication (Flippin et al., 2010).

PECS Implementation

How do secondary school teachers can implement the method in the classroom for students with ASD?

a) **Introduce PECS:** Begin by explaining the PECS system to the student with ASD. Emphasize the value of using PECS for communication. Encourage children to choose a picture to express their needs or wants after demonstrating how to utilize the PECS book or board.

b) **Create a book or board in PECS** containing images of objects or activities that the student would want or need to communicate. Images of washroom items, food and beverages, school materials, and leisure activities may be included.
c) **Use PECS in class:** Encourage your students to express themselves throughout class using PECS. For instance, if a kid needs a break, they can let the teacher know by drawing a picture of one.
d) **Encourage the usage of PECS:** When a student effectively communicates using PECS, encourage them. This could take the form of verbal affirmation, a high-five, or a modest incentive like a sticker or a favorite activity.
e) **Expand the PECS system:** As the kid gains confidence utilizing the system, progressively extend it to cover more complicated communication, such asking for help or expressing emotions.
f) **Work together with the student's parents and therapists** to make sure that the PECS system is consistent across various settings and environments and to make sure the student is improving their communication abilities.

Summarizing, when it comes to helping kids with ASD, improve their quality of life and their ability to communicate clearly, using PECS in the classroom can be extremely beneficial.

PECS Advantages

- PECS is a non-verbal mode of communication that offers an alternative means of expressing oneself. This can provide significant benefits for individuals who face difficulties in verbal communication. Moreover, as a systematic and structured approach to communication, it provides individuals with a **clearly defined and reliable method** to express their wants and needs.
- PECS is distinguished by its **simplicity in acquisition**, making it readily available to a wide range of individuals, including those with limited cognitive or motor skills.
- Positive reinforcement plays a crucial role within the framework of the PECS, as it functions as a **motivating factor for promoting communication**. The aforementioned feature proves to be advantageous for individuals who may face challenges when using traditional methods of communication.

PECS Challenges

- **The scope of PECS is limited** as it primarily emphasizes the communication of requests for items or activities. It may not be deemed appropriate for more intricate modes of communication, such as the articulation of emotions or participation in social exchanges.
- Some individuals may struggle to apply the skills and strategies learned through PECS in one setting to other settings (**generalization**). For instance, individuals may exclusively employ PECS within the confines of the educational setting, while refraining from its utilization in domestic or alternative contexts.
- Maintenance of the PECS requires **continuous efforts to update and revise the communication book or board**, thereby ensuring its continued relevance to the specific needs and desires of the individual.

Figure 6 - Example of PECS Communication Boards

Reflections on Literacy

As mentioned in the introduction, the aim of this chapter was also to develop a critical analysis on the roles of TEACCH and PECS in the development of Literacy. As communication support systems, both methods can support learning processes, with the emergence of differentiated connections to the development of literacy.

TEACCH facilitates the development of familiarity with written language and the establishment of associations between symbols and their respective meanings through the consistent utilization of visual supports. The aforementioned organization has the potential to make a significant impact on the advancement of foundational literacy abilities, including the recognition of letters and the identification of words.

On the contrary, PECS is a specialized method of communication that aims to support individuals who have diverse or no verbal language capabilities. The process entails utilizing a set of visual cards that are exchanged between the individual and a communication partner in order to convey their needs, wants, and thoughts. The primary system lies in the promotion of functional communication. However, it can also have an indirect impact on the development of literacy skills. The utilization of visual symbols facilitates the acquisition of knowledge regarding the representation of objects, actions, and concepts. This comprehension establishes a fundamental basis for subsequent reading comprehension and word decoding, as individuals begin to acknowledge that written words consist of symbols that convey significance.

It is possible to hypothesize that both TEACCH and PECS provide a structured and visually supported learning environment, which can be beneficial for individuals with autism or communication diversity who may have challenges with traditional instructional methods. By incorporating visual supports, these approaches offer opportunities for individuals to engage with and make connections to written language, ultimately supporting the development of literacy skills. Nevertheless, it is very important to clearly establish what is literacy after all, highlighting the perspective of authors like Keefe & Copeland (2011), which goes far beyond reading and writing. For the authors, literacy is a fundamental human right that involves communication, contact, and interaction for all individuals. It is a collective responsibility, involving meaning-making through various communication modes, and can lead to empowerment Keefe & Copeland (2011).

Through a similar framework, but considering now digital literacy, TEACCH and PECS might contribute to its development by leveraging visual supports, fostering communication and social skills, building familiarity with digital symbols, and utilizing digital tools for learning. Nevertheless, and according to Sousa & Costa (2023), empirical data to support the study of media education for children with disabilities is scarce, so this premises need further experiential validation.

Conclusion Remarks and Advice

Specific education needs arise from a unique way of acquiring knowledge and skills during the learning process, which is influenced by an individual's

cognitive-perceptual functioning. It is imperative to acknowledge the distinct requirements and abilities of children and adolescents in order to choose suitable approaches, strategies, and instructional and educational engagements that foster ideal circumstances for cognitive and character growth.

In order to facilitate effective instruction for students diagnosed with ASD, it is imperative to utilize targeted methodologies. In order to foster consistency and predictability within the educational setting, it is imperative to implement a structured daily schedule for school activities. This can be achieved through the clear labelling of classrooms in a manner that is comprehensible to students, providing advance notice of any changes, and explicitly specifying the duration of various activities. In addition, it is imperative to mitigate stress, offer sensory comfort, and employ a regulated mode of communication.

Educators have the ability to facilitate independent work by breaking down tasks into smaller, manageable stages, enhancing intrinsic motivation, implementing a system of rewards, fostering circumstances that promote success, and nurturing peer relationships. Utilizing a diverse range of pedagogical approaches is imperative, encompassing visual, kinaesthetic, imitative, and multimedia modalities.

Ultimately, the establishment of effective collaboration among parents, caregivers, and teachers is of paramount importance in order to provide comprehensive support to the child within and beyond the educational setting.

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"Desktop Adventure": a Tool for the Development of Digital Competencies in Students with Autism Spectrum Disorder

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Abstract
In this chapter the process of ideation and development of the serious game "Desktop Adventure" is presented. Desktop Adventure is a point-and-click game to develop digital competencies in youth with autism spectrum disorder (ASD). Our conceptualization of digital competencies emphasizes the development of critical thinking in "children's digital interactions" as well the empowerment of their creative expression. Children and youth are diverse, and while this gamified app was developed for the specificities of teachers and their ASD students, Desktop Adventure aims to contribute to Educational Open resources that can be used with all children and by children themselves.

Keywords: Children; Youth and Media; Educational Game; Autism Spectrum Disorder; Digital Competencies.

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) represents a disorder in human development with an impact on social interaction, verbal and non-verbal communication and symbolic play (Monteiro, Pimenta, Pereira, & Roesler, 2017). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA, 2014) describes three levels of ASD with different support needs (Level 1 – Support; Level 2 – Substantial support; Level 3 – Very substantial support) in terms of social communication and restricted and repetitive behaviours.

The General Directorate of Education and Science Statistics (DGEEC) estimates that in Portugal between the academic years 2016/2017 and 2017/2018, the number of students with ASD attending Structured Teaching Units increased 9%, mostly in basic education.

What is "Desktop Adventure"?

"Desktop Adventure" is a serious digital game app, developed under the ASDigital Project (2020-1-PT01-KA226-SCH-094961) aimed to develop "digital" competencies for verbal autism spectrum disorder (ASD) students at secondary school. While some authors use digital competencies with the same meaning as media literacy competence, the last one could be a better conceptualization for citizens since the focus is on being able to access, read, write, and critically engage with digital media environments. "Desktop adventure" was developed for PC, Windows 10.

Digital competencies as part of media literacy competence

Frau-Meigs (2014) states that core media literacy skills include operational skills (including coding and computing), editorial skills (including multimedia writing-reading-producing and mixing), and organisational skills (including navigating, sorting, filtering, evaluating) that are central to media education in a digital age. Beyond its importance as an individual skill, media literacy opens up a social and cultural dialogue that emphasises its plurality. People don't create meanings individually but as members of "interpretive communities" (Livingstone, Wijnen, Papaioannou, Costa, & Grandio, 2013) where literacy practices evolve. Using the Internet has become part of the daily habits of a constantly growing number of people, and this process has evolved to become a bidirectional exchange of information where the audiences are able to be consumers and producers

of information. This trend started with the appearance of the first blogs, evolved with the paradigm of virtual reality, and has reached its current maturity with the generalisation of social networks. But as the opportunities for publishing, one's thoughts, pictures, videos and whereabouts grow, the need for having these pieces of information associated with our own selves creates the need for providing information about our identity, so that one can be recognized and remembered, and our contribution does not remain anonymous. This, of course, raises the issue of managing identities, and since it takes place in a digital world, we may refer to it as the issue of Digital Identity Management (Costa et al., 2017; see Figure 1).

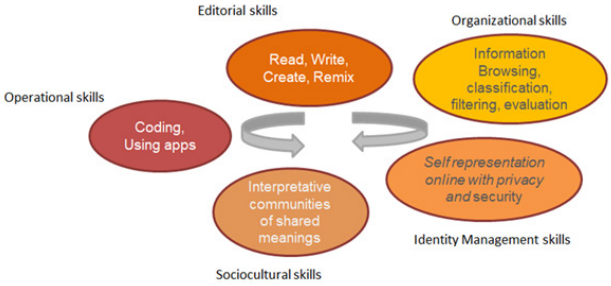

Figure 1 - Scheme of a theoretical framework for media literacy skills (Costa et al., 2017; Frau-Meigs, 2014; Livingstone, Wijnen, Papaioannou, Costa, & Grandio, 2013)

The Desktop Adventure in Practice

High Concept

Desktop Adventure is a point-and-click educational game. The game takes place in a simulated desktop environment.

The player controls a character that is careless with their digital identity and general security. There is a deadline for a school assignment. The moment the player logs into the computer he/she notices something is wrong. A friend hacked the computer and hidden his/her assignment documents, so he/she needs to unravel the puzzle.

Learning Statement

Players will feel safer, empowered, and more knowledgeable about the dangers of the bad management of their computer and digital identity. The player will learn how to create a strong password and what are the consequences of a weak one, how to use email and attach files, how to recover files from recycle bin, and how to connect to WIFI. Additionally, the

player could express/represent him-herself through drawing. Using the file explorer, changing passwords, themes, and other basic computer settings.

Learning Outcomes

- Create digital content safely.
- Identify and validate risky and unsafe situations and behaviours.
- Analyse online communications and what consequences a seemingly innocent situation can quickly go downhill.
- Apply skills to generate and manage digital content safely.
- Understand how to properly access and understand fully digital content.

Learning Content

- To send messages safely.
- To create strong passwords.
- To recognize the importance of strong passwords in security and safety
- Managing personal information.
- To recognize possible threats and know what to do in that situation.
- To creatively express oneself online.

Desktop Adventure Step by Step

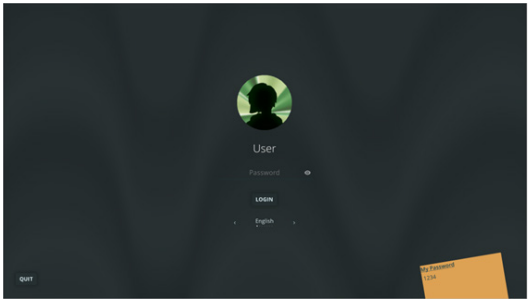

Figure 2 - User interface for “Login screen”

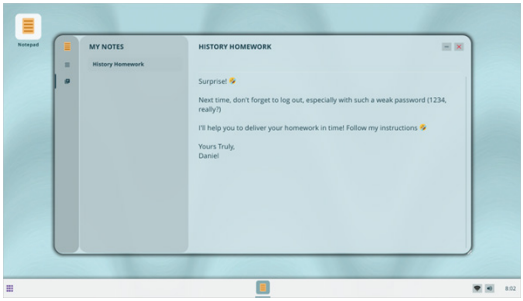

Figure 3 - After Login: Home of Desktop Adventure

Closing the active Window is the only possible move. A chat with “best friend” starts in order the player could change the password to a strong one, as to customise his/her avatar and background.

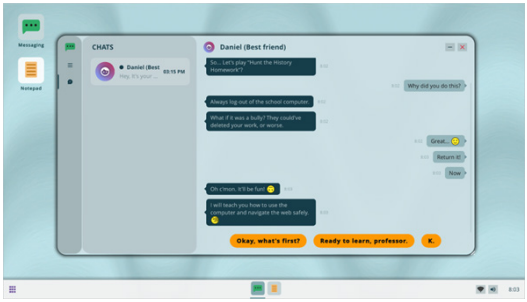

Figure 4 - Chat screen. The dialogue continues to introduce “homework recovery”

Step-by-step instructions are made available (see Figure 5).

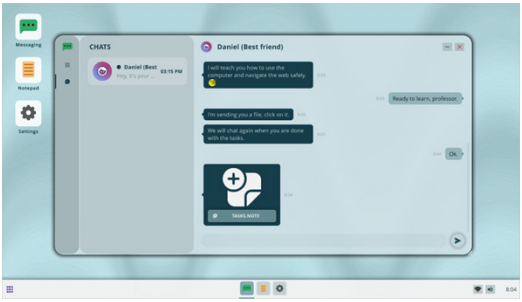

Figure 5 - Chat screen. The dialogue introduces the “tasks note”

Now “settings” are available, such as in a usual app or desktop. Clicking on the file “tasks note” the player will see them on the desktop.

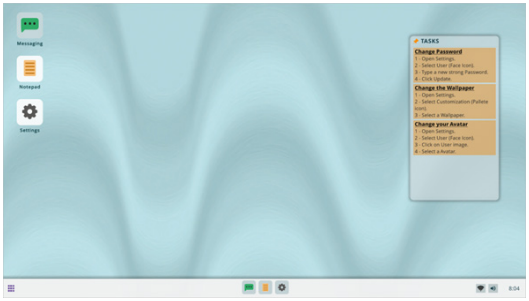

Figure 6 - Tasks to be done to customise the app and create a strong password

Figure 7 - Reset password

In “Reset password” the strength of it is indicated with red sentences that change to green every time a rule for a strong password is accomplished.

Figure 8 - Feedback for a strong password

The player needs to confirm by clicking on the “update” button. Next time the player enters the app the new password should be provided.

After the three tasks are completed, the chat appears with a positive message “nice job” and presenting a new challenge: “Internet connection is lost. Please reconnect” (Figure 9).

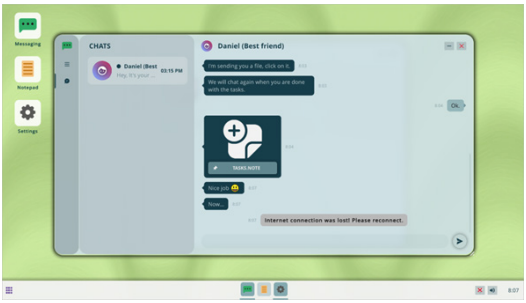

Figure 10 - Clicking on Wi-Fi button opens up two available networks

If the “MT-Online_5GHZ” is selected a password is required (and not available) therefore the only option to reconnect is to select the “FreeForAll”. The player realises he/she is online again to the next challenges since positive feedback is provided on the chat. The conversation changes to the “Art teacher’s email”, which is about a new assignment.

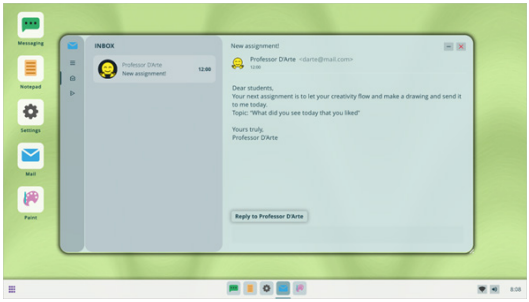

Figure 11 - Using email with an attachment

The email from the teacher is formal and it can be explored in training about “how to write an email” (see module XPTO). Selecting the button “reply to Professor D’Arte” a proper response from the student appears and the button “Make a drawing” opens the paint application where students

can freely express themselves (figure 12).

Figure 12 - Using paint

Following the player workflow there is the possibility to "attach" the draw to the email for the teacher, to save the draw, or to create a new draw.
The next challenge is to recover the homework from "trash" and when it is done the games Tetris and Pacman appear on the desktop and open on the respective websites. The respective websites were carefully chosen but advertisements could appear, and such is the real web. Therefore, there is an opportunity here for professionals to discuss with children what to do, how to avoid it, and how to ignore and close it. Moreover, the concept of "free internet" could be explained as being not so free with ads or our data as forms of payment.

Concluding remarks

Desktop Adventure can be used by children at home or at school, with or without the presence of their teachers or families. If you are a professional working with children who have ASD, kindly assist the access and use of desktop adventure by using any necessary alternate communication methods. Students from our partners in Poland and Turkey reviewed the "desktop adventure" before the current release, and the findings helped to improve it.
It is necessary to have prior experience with starting up a computer and using an app, to operate the "Desktop Adventure".

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Software Availability Statement

"Desktop Adventure" is an open access, multi-language, digital game, available for download at: https://cicant.itch.io/asdigital-desktop-adventure.

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Hands-On Minds:Fostering Conceptual Learning through Tangible Analogue Games in Higher Education

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Abstract

In this chapter, the transformative potential of using analogue games, like board or card games, in higher education is explored in order to improve conceptual learning. Analogue games offer tangible, engaging experiences that connect theoretical ideas with real-world applications. They provide tangible representations of intricate concepts, easing cognitive load and promoting knowledge transfer. Along with encouraging critical thinking, problem-solving, and analytical skills, analog games actively involve students. These games contextualise information so that students can explore ideas in contexts that are relevant to them and thus increase comprehension. In line with social constructivist learning theories, social interaction and collaboration are encouraged, improving communication and interpersonal skills. By promoting practical experience, reflection, and metacognition, analog games aid experiential learning. They encourage multisensory learning by involving a variety of senses for better comprehension. They also foster problem-solving and critical thinking abilities, which are applicable across a variety of fields. Analogue games promote metacognition, which empowers students to manage their own learning by enabling self-regulated learning. Finally, analogue games provide a dynamic and engaging approach to conceptual learning in higher education, encouraging active engagement, teamwork, critical thinking, and multisensory experiences, ultimately enhancing the learning process.

Keywords: Analogue Games; Higher Education; Conceptual Learning; Experiential Learning; Multisensory Education.

Introduction

Through tangible elements and interactive experiences that go beyond conventional instructional methods, the use of analogue games in education, such as board or card games, has proven effective in fostering conceptual learning. Analogue games offer a special way to foster conceptual understanding and advance learning because they get students actively involved in hands-on learning. This chapter explores the various ways that analogue games can improve conceptual learning in higher education.

Concrete Representation

Board or card games are examples of analogue games that provide tangible elements and interactive experiences that improve conceptual learning in higher education. The abstract ideas and imaginary scenarios are brought to life in these games by tangible representations. The use of ramps and blocks in a board game that simulates forces and motion is an example of how students can learn through tangible manipulation of how variables affect outcomes (Merkouriset al., 2019). By helping students embody and put concepts into practice through cognitive processes, this concrete representation closes the gap between theoretical knowledge and real-world application (De Freitas, 2006). Additionally, analogue games' physical manipulation gives players a multisensory experience that strengthens conceptual understanding (Su, Cheng, & Lin, 2014). By providing physical representations of complex concepts, analogue games also lessen cognitive load, allowing students to devote more mental resources to more in-depth cognitive processing (Göbel, Hardy, Wendel, Mehm, & Steinmetz, 2010). For instance, a math card game in which players arrange cards to create equations helps students effectively understand mathematical concepts (Nicole R. Scalisea, Emily N. Daubertb, 2020). Additionally, analogue games help students apply their conceptual knowledge outside of the confines of the gaming environment (Clark, Tanner-Smith, & Killingsworth, 2016). For example, historical strategy games that use physical tokens to represent territories and resources, help students better understand geopolitical dynamics and their capacity to apply knowledge in practical situations (Klopfer, Osterweil, Salen, Groff, & Roy, 2009). Analogue games provide a special way to advance conceptual learning in higher education by incorporating tangible manipulation and

concrete representations. These games improve students' comprehension by giving concrete examples of abstract ideas, easing cognitive strain, and promoting knowledge transfer between various subject areas. For teachers looking to improve conceptual learning in their classrooms, analogue games are a fun and effective teaching tool.

Active Engagement

The elements of challenge, competition, and fun that analogue games provide, boost students' engagement and motivation to learn. These games' engaging and interactive features pique students' interest and motivate them to participate actively in their education (Connolly et al., 2012). As students make decisions, solve problems, and apply knowledge and strategies to effectively play the game, this active engagement fosters deeper learning, critical thinking, and analytical skills. For instance, a board game with a scientific theme can pique players' interest and enthuse them about scientific ideas, increasing engagement and motivation (Clark et al., 2016). By requiring students to analyse information, weigh options, and make decisions based on their comprehension of the concepts, analogue games help students improve their problem-solving and decision-making abilities (Vlachopoulos & Makri, 2017). As students evaluate resources, predict opponents' moves, and adjust their strategies accordingly, strategic card games also encourage analytical thinking (Gutierrez, 2014).

Additionally, since students actively engage in the game's mechanics and decision-making procedures, analogue games offer an immersive experience. For instance, playing the parts of historical figures in a board game with a historical theme helps players understand historical events and their implications (O'Neill & Holmes, 2022). Additionally, analogue games promote social interaction and cooperative gameplay, which promotes teamwork and effective communication skills (Adachi & Willoughby, 2013). Cooperative board games that require communication and coordination between players to solve problems improve interpersonal and teamwork skills (Zagal, Rick, & Hsi, 2006). In general, analogue games encourage active participation, critical thinking, problem-solving, and social interaction, which makes them useful teaching tools, for conceptual learning, in higher education.

Contextualisation

Analogue games provide contextualised learning opportunities that let students investigate and comprehend ideas in useful contexts. Analogue games offer a rich environment for applying knowledge and skills because they immerse students in particular themes or scenarios (Ritzhaupt & Squire, 2013). This contextualisation aids students in making the connection between theoretical knowledge and practical applications, deepening their comprehension of how ideas appear in real-world contexts (Clark et al., 2016). For instance, historical board games allow students to re-enact historical events while understanding the complexities and connections of history (Wright-Maley, Lee, & Friedman, 2018). When the game context is in line with the desired learning outcomes, analogue games help players transfer what they learn from the game environment to real-world situations (Zagal et al., 2006). When playing analogue games, students are frequently presented with real-world issues or situations that call for information analysis, judgment calls, and solution-finding. This encourages real-world problem-solving abilities and a deeper comprehension of ideas and their applications (Gutierrez, 2014). Students learn to think critically and make decisions by interacting with the game's meaningful challenges. To help students better understand environmental issues, an environmental-themed game, for instance, can ask them to make choices regarding the management of pollution and resource allocation. By making learning relevant and personally meaningful, the contextualisation of analogue games improves student engagement and motivation (Prensky, 2003). Students become more engaged in the learning process when they can relate the context of the game to their own lives or interests (Clark et al., 2016). These higher levels of motivation, effort, and perseverance result in better learning outcomes as a result of the increased engagement (Zagal et al., 2006). For instance, a biology-themed game built around a medical mystery can pique students' interest and encourage them to investigate biological ideas and problem-solving techniques (Adachi & Willoughby, 2013). In general, contextualised learning experiences offered by analogue games help students in higher education develop their understanding of complex concepts, solve real-world problems, and become more engaged and motivated.

Social Interaction

Analogue games promote social interaction and collaboration among students, fostering a collaborative learning environment. Through gameplay, students engage in dialogue, cooperative problem-solving, and teamwork, which enhances their understanding of concepts (Cranley et al., 2017). The social interaction in analogue games aligns with social constructivist learning theories, where students actively construct knowledge through meaningful discussions and the exchange of perspectives (Vygotsky, 2019). This promotes the co-construction of knowledge and shared understanding (D'Aprile, Di Bitonto, De Asmundis, & Severino, 2015). Communication and language skills are also developed as students engage in effective communication, express their thoughts, and listen to others (Phuong, Nguyen, & Nguyen, 2017). Analogue games provide a platform for students from diverse backgrounds to learn from each other and gain cultural competence (J van Gaalen et al., 2021). Additionally, analogue games facilitate the development of emotional and social intelligence as students manage their emotions, understand others' perspectives, and practice empathy (Bagwell & Schmidt, 2011). The cooperative nature of analogue games nurtures teamwork and interpersonal skills, which are essential for higher education and professional settings.

Experiential Learning

Students can learn through hands-on experience and experimentation by playing analogue games, according to (Bergquist et al., 2009). Students gain a deeper understanding of concepts through these games' hands-on activities, choice-making, and observation of the results (Kolb, 1986). Analogue games help students actively construct knowledge by interacting with the game's elements and drawing connections between abstract ideas and real-world experiences (Piaget, 1973). Through analogue games, reflection and metacognition are encouraged, enabling students to reflect critically on their gameplay experiences, pinpoint knowledge gaps, and hone metacognitive skills (Foster & Shah, 2015; Schraw et al., 2006). By giving students the chance to use their knowledge and skills in fresh contexts, analogue games also aid in the transfer of learning. Students can transfer their understanding to real-world situations by playing contextualised games to close the gap between theory and practice (Romero et al., 2017).

Critical Thinking and Problem-Solving

Through their intricate rules and engaging gameplay, analogue games encourage students' critical thinking and strategic abilities (Noroozi et al., 2020). To improve their problem-solving skills and conceptual understanding, students must analyse the game situation, weigh their options, and predict outcomes (Gardner, 1993). By requiring students to think critically, take into account various viewpoints, and reach well-informed conclusions, these games foster higher-order thinking skills (Freire et al., 2016). Within the context of the game, students apply problem-solving techniques, dissecting issues, spotting patterns, and coming up with solutions (Egenfeldt-Nielsen et al., 2020). Additionally, analogue games foster transferable abilities like critical thinking, problem-solving, and decision-making that can be used in a variety of academic fields and real-world contexts (Girard et al., 2013). With the abilities developed through play, students can approach complex problems methodically and analytically, giving them power across a variety of domains (Clark et al., 2016).

Metacognition

As players reflect and evaluate their own performance, analogue games encourage metacognitive processes (Ross, 2011). Students gain metacognitive awareness and become aware of their areas for growth by observing how they make decisions and analysing the effects of those decisions (Vlachopoulos & Makri, 2017). With this knowledge, they can modify their tactics and make better decisions (Bjork, Dunlosky, & Kornell, 2013). As students actively participate in directing, controlling, and monitoring their learning experiences, analogue games also encourage self-regulated learning. They establish agency and autonomy, make plans for their actions, set goals, and modify their strategies in response to input (Dignath & Büttner, 2008). Through cooperative gaming, students participate in discussions and keep track of their teamwork (Colman, 2003). Metacognitive processes can be used to support lifelong learning by transferring them to other contexts when they are used in analogue games (Schwarz, 2015). In both academic and practical contexts, students can use their reflective practices and metacognitive techniques (Whitebread et al., 2009). Through educational board games, for instance, metacognitive skills can be developed that help with self-evaluation and monitoring in

other academic tasks (Winne & Hadwin, 1998).

Multisensory Learning

Analogue games feature tangible elements that appeal to a variety of senses while being played (Chen & Tu, 2021). These games offer different modalities for processing information by involving the visual, auditory, and tactile senses (Ke, 2008). According to Sousa (2022), the sensory integration provided by analogue games improves student engagement, attention, and learning outcomes. The idea of embodied cognition, in which physical actions support cognitive processes, is also supported by analogue games (Wilson et al., 2009). For instance, moving game pieces in mathematically based board games reinforces numerical concepts through physical movements (Alibali et al., 2013). Analogue games' multisensory design encourages students to make stronger connections between abstract ideas and sensory input, leading to improved conceptualisation (van der Kamp, Withagen, & Orth, 2019). It is easier to conceptualise and internalise underlying concepts when there are physical game elements that represent abstract ideas (Skulmowski & Rey, 2018). Additionally, the multisensory experiences offered by analogue games boost students' motivation, engagement, and active participation in their studies (Philip, 2015). Higher levels of motivation and engagement result in more thorough information processing and fulfilling learning opportunities (Ewijk et al., 2013).

Conclusion

Numerous analogue games encourage cooperative learning settings where students cooperate to accomplish shared objectives. Students gain skills for effective communication, bargaining tactics, and group problem-solving through teamwork. By encouraging conversations and the expression of ideas, these social interactions improve conceptual learning. Furthermore, the cooperative aspects of analogue games can promote a sense of community among students, improving the learning environment. In higher education, analog games are a tangible and engaging way to encourage concept learning. These games provide a supportive, dynamic learning environment pedagogy through active participation, multi-sensory experiences, collaboration, critical thinking reflection and experiential learning. Analog games can be a useful tool

to promote student understanding and engagement in higher education as educators continue to explore cutting-edge approaches to advance conceptual learning. Although analog games have potential, promotes conceptual learning, it is important to remember that students' success depends on careful play selection, consistent with learning objectives and effective teaching design. To make sure that similar games have the greatest possible educational impact, educators should carefully integrate curriculum, creating a clear connection between play and learning goals, and supporting communicate and reflect effectively.

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Bringing Hues to the Spectrum: A Journey with Autism, Gender Identity, and Pokémon

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Abstract

This chapter recounts the life journey of Didi, a non-binary individual diagnosed with Asperger's Syndrome at the age of 16, now a 30-year-old adult. Didi shares their experiences of growing up in the autism spectrum, navigating the challenges of social interaction, and discovering their unique interests and passions. Didi's journey is a testament to resilience, self-discovery, and the power of shared interests through media to forge connections. Pokémon has been a constant companion throughout their life, offering not only a source of joy and nostalgia but also a means to initiate interactions in unfamiliar environments. Didi's story serves as an inspiring example of how passion and perseverance can lead to personal growth and meaningful connections, despite the challenges of living in the spectrum.

Keywords: Autism Spectrum; Gender Identity; Non-Binary; Self-Advocacy; Media Franchises; Resilience.

Hello. I'm Didi. I'm 30 years old, and when I was 16, I was diagnosed with Asperger's Syndrome (now part of the autism spectrum).

The late diagnosis brought along some difficulties during my development, some of which I've managed to overcome, while others I'm still learning to handle. As a child, I always struggled with social situations. I knew I had very different and highly specific interests compared to others. I'm also non-binary, though at the time, I didn't fully understand how this influenced me. The terms "boys' games" and "girls' games" confused me, contributing to my difficulty in fitting into groups.

I often got lost in my imagination; I played with any toy or object, creating fantastic stories within my own world. I was rarely bored, and if I didn't have something to do, I'd start counting things around me like tiles, chairs, etc. I think this mechanism is one of the few advantages we have compared to neurotypical people.

My mother and "Mimi" (someone who took care of me when my mother worked) were always attentive and engaged in regular conversations with me, which reduced the feeling of not belonging. This was partly because I didn't share common interests with kids my age. I love collecting and organizing. I had collections of bottle caps, cans, marbles, and Imaginarium animals. When I acquired a new item, I liked organizing everything by colors or sizes.

Even though I no longer have any of those collections, I'm still a very organized person who likes to keep things in a certain order or place. I've always had a strong interest in animals and their ecosystems. I had books and encyclopedias and enjoyed learning curious facts to share at home since no one at school shared my interests. My parents tell me that a teacher once asked the class about our favorite animals, and my response was a Musk Ox, which left everyone, including the teacher, quite puzzled.

As a way to fit in with groups as a child, I used to ask my primary school classmates if I could watch their football games and be their cheerleader. While they played, I sat there shouting and supporting them; eventually, this helped me connect a bit more. Despite being able to entertain myself, I wished I could share interests with classmates my age and, if possible, foster friendships, as I didn't have any friends by this point.

Fortunately, my situation started to change with the arrival of the "Pokémon" franchise in the West. I used to spend weekends at my grandmother's with "Mimi." One Sunday, when my mother came to pick me up, she

surprised me with the “Pokémon Red” game for the Game Boy. I became an instant fan and haven’t let go of this passion since. I was mesmerized by the concept—an imaginary world inspired by real locations, inhabited by creatures resembling various species of fauna and flora, coexisting with people. It involved exploration, collection, and player interaction. As the Western tagline said, “Gotta catch ‘em all.” I spent hours playing, trying to complete my Pokédex (the in-game encyclopedia) that documented everything about these fantastic creatures. With the game, my interest in collectible cards, toys, the anime, and drawing books also grew.

Besides becoming a long-standing interest, Pokémon became a means for me to finally connect with classmates and potential friends who shared the same interest. Since I didn’t know how to make friends, I’d ask people if they wanted to be my friend and trade Pokémon with me. This approach helped me integrate better, and by the end of fourth grade, I had friendships I really cherished. We spent weekends together, forming decks, battling, trading Pokémon, completing collections, and watching cartoons.

When I entered fifth grade, I moved to a different residential area and had to attend a new school away from the people in my neighborhood. I felt anxious because I had established routines and knew what to expect from each social interaction at my old school. Before moving to our new house, we stayed in another house during the transition period while renovations were completed; it lasted less than 2 months. This was extremely tough for me because I couldn’t connect with my classmates, and I felt unable to create routines knowing it was a transitional place. I spent several days feeling sad, unable to enjoy any free time or concentrate on studying at home.

When we finally settled into the new place, with the help of my mother, I managed to establish routines because I knew this house was where we would live for many years. The process of change is never easy. I need to know all the paths by foot, or now by car, to various places, and from there, I strictly follow the best routes, where I feel more secure.

In fifth grade, I managed to integrate more easily than in primary school, thanks to Pokémon once again. The second generation was at its peak, with the third generation just a few years away, and all the friends I made up to eighth grade were thanks to the franchise. Around this time, as part of adapting to changes, my mother created a schedule for me at home—

when to study, when to play. Schedules are crucial for me to manage how much energy to invest in each activity.

I still had difficulty discussing other topics; there was a phase when I got interested in wrestling, but Pokémon was a more constant presence among others. There was a boy from another class who brought a small portable television to school, and every morning, he would watch a bit of Pokémon on SIC before the school bell rang. That's when I achieved another important milestone—connecting with people beyond closed circles like family and classmates.

In ninth grade, I changed schools and began to struggle with academic performance. No matter how much I studied, summarized, or tried the methods teachers recommended, I couldn't achieve the results I pressured myself to attain. This affected me until the 11th grade, when I failed due to not grasping what was covered in classes. It was during that summer that I received my diagnosis.

I had difficulty assimilating information and connecting concepts. I was good at memorizing sequences or small facts/curiosities, which served me well until the educational demands became more complex, requiring abstract thinking and the ability to relate different concepts—something that proved to be challenging and detrimental for me. I gained access to special education, and things improved somewhat.

In 12th grade, when my original class went on to college, I felt abandoned at school. It was one of the years where I felt the most social pressure to become a different person. I didn't identify with anyone, didn't really like most of my classmates, and they even tried to bully me. At first, it affected me, but with my mother's help, I managed to turn things around. My relationship with my mother has always been incredible—she has always been the person who believed in me the most, fought for me, and continues to help me overcome obstacles. Without her, I wouldn't have completed high school and entered college.

In college, I studied Biology and had a chance for a fresh start. Despite still expending a lot of energy, I felt increasingly integrated into social contexts. I participated in some academic organizations and even led one for a year. Completing the degree was tough, but with my support network, I managed to overcome the challenges. I met fantastic people, including Catarina, with whom I've been in a relationship for a decade, and great friends who are part of my close circle. My desire to connect with others emerged when

I realized I was in an environment with numerous Pokémon fans. Around this time, the franchise celebrated its 20th anniversary, and nostalgia and memories affected everyone. For the first time, people admired me for openly expressing my passion for my interests, and from then on, I rarely hid them. With each transition, from primary to secondary school, from college to work life, Pokémon has always been there for me—a mechanism to initiate interactions in unfamiliar environments.

Despite improving socially over the years, one obstacle I still struggle to manage is the overwhelm I feel in handling social stimuli. Being around other people in personal or work settings deeply affects me. I always become drained of energy and often even physically unable to move when I spend several consecutive days with people whom I don't feel entirely comfortable with.

Familiarity and routine in contexts are very important to me. Whenever I deviate from my routine, I often experience the same problem in the following days. I have a different auditory sensitivity compared to most people; I frequently find myself bedridden due to this reason. Being "present" is something I struggle with—I'm always thinking about past interactions and those yet to come. Navigating unfamiliar social contexts requires me to endure this.

As an adult, I managed to form a circle of people who also face many challenges related to this topic, providing a small support network to discuss certain matters. While it doesn't solve everything, it at least makes me aware of the challenges my friends also experience. In this circle too, the reason for our unity was once again Pokémon.

For me, Pokémon will always be about memories, life stories, friendship, and love.

Resumo
Este capítulo relata a jornada de vida de Didi, uma pessoa não-binária diagnosticada com Síndrome de Asperger aos 16 anos, agora um adulto de 30 anos. Didi partilha as suas experiências de crescer no espetro do autismo, navegar pelos desafios da interação social e descobrir os seus interesses e paixões únicas. A jornada de Didi é um testemunho de resiliência, auto-descoberta e do poder de interesses partilhados através dos media para criar conexões. Pokémon tem sido um companheiro constante ao longo da sua vida, oferecendo não apenas uma fonte de alegria e nostalgia, mas também um meio para iniciar interações em ambientes desconhecidos. A história de Didi serve como um exemplo inspirador de como a paixão e a perseverança podem levar ao crescimento pessoal e a conexões significativas, apesar dos desafios de viver no espetro.

Palavras-Chave: Espetro do Autismo; Identidade de Género; Não-Binarie; Auto-Representação; Media Franchises; Resiliência.

Olá. Sou Didi. Tenho 30 anos e com 16 anos diagnosticaram-me com Síndrome de Asperger (agora espectro de autismo).
O diagnóstico tardio trouxe-me algumas dificuldades durante o meu desenvolvimento, algumas que já consegui ultrapassar, outras com as quais ainda estou a aprender a lidar.
Em criança sempre tive dificuldade em enfrentar contextos sociais, sabia que tinha interesses muito diferentes das outras pessoas e muito específicos. Sou também uma pessoa não-binária, apesar de na altura não perceber como isto me influenciava, fazia-me confusão os termos brincadeiras de rapazes e de rapariga o que contribuía para ter dificuldades em inserir-me em grupos .
Perdia-me várias vezes na minha imaginação; brincava com qualquer brinquedo e objeto e criava histórias fantásticas sobre o meu mundo. Raramente me aborrecia, e se ficasse sem algo para fazer andava por onde estivesse a contar coisas (azulejos, cadeiras, etc.), acho que este mecanismo é uma das poucas vantagens que acabamos por ter em relação a pessoas neurotípicas
A minha mãe e a “Mimi” (uma pessoa que tomava conta de mim quando a minha mãe trabalhava) sempre se mostraram atentas e conversavam comigo regularmente, o que diminuía o sentimento que eu tinha de não

pertença, em parte por não partilhar interesses em comum com as crianças da minha idade.
Adoro colecionismo e organização. Tinha coleções de caricas, latas e berlindes, e animais da Imaginarium. Quando adquiria um item novo gostava de organizar tudo por cores ou tamanhos.
Apesar de já não ter nenhuma destas coleções, continuo a ser uma pessoa bastante organizada que gosta de manter tudo numa certa ordem ou num certo local.
Sempre me interessei de forma muito intensa por animais e os seus ecossistemas. Tinha livros e enciclopédias e gostava de saber factos curiosos para partilhar em casa já que na escola ninguém tinha o mesmo interesse que eu. Os meus pais contam-me que uma professora da escola da altura uma vez perguntou à turma qual era o nosso animal favorito e a minha resposta foi Boi almiscarado, o que levou um ar confuso de toda a gente, incluindo da professora.
Como tentativa de me integrar nos grupos em criança, contam-me que pedia aos meus colegas da primária se podia assistir aos jogos de futebol e fazer de claque. Então enquanto eles jogavam eu ficava sentado a gritar e a apoiar; acabei por conseguir conectar-me um pouco dessa forma.
Apesar de me conseguir entreter sozinho, desejava poder partilhar interesses com colegas da minha idade e se possível fomentar amizades porque por esta altura não tinha amigos.
Felizmente, a minha situação começou a mudar um pouco com a chegada da franquia "Pokémon" ao ocidente. Costumava passar fins-de-semana em casa da minha avó com a "Mimi". Num domingo, quando a minha mãe me foi buscar surpreendeu-me com o jogo "Pokémon Red" para o Game Boy. Fiquei fã instantaneamente e não larguei esta paixão desde aí. Fiquei mesmerizade com o conceito. Um mundo imaginário inspirado em localizações reais e habitado por criaturas semelhantes a várias espécies de fauna e flora que partilham o mundo com pessoas. Além de ter uma vertente de exploração, tinha também uma de colecionismo e interação entre jogadores. Como dizia a tagline que criaram no ocidente "Gotta catch 'em all". Passava horas a jogar a tentar completar a minha Pokédex (a enciclopédia do jogo) que registava tudo sobre estas criaturas fantásticas. Com o jogo veio também o interesse pelas cartas e os cromos colecionáveis, os brinquedos, a anime, os livros de desenho.
Para além de um novo interesse que mantenho até ao presente, Pokémon

na minha vida foi usado como um meio de finalmente conseguir conectar-me com os meus colegas e futuros amigues que também partilhavam do mesmo interesse.
Não sabia como fazer amizades então perguntava às pessoas se queriam ser minhas amigas e trocarem Pokémon comigo. Foi graças a isto que me integrei melhor e pelo final do 4º ano tinha amizades das quais gostava muito, conseguia ter amigues a passarem fins-de-semana comigo e vice-versa que para mim era o marco de uma boa amizade. Passávamos manhãs e tardes a formar decks, a fazer batalhas e trocas Pokémon, completar coleções juntes, ver desenhos animados.
Quando fui para o 5º ano mudei de zona residencial e tive de ir para uma escola diferente das pessoas da minha zona.
Senti-me ansiose porque já tinha criado uma rotina e sabia o que esperar de cada interação social na escola antiga. Quando saímos da casa antiga e antes de ir para a nova, ficámos numa outra casa durante um processo de transição, enquanto as obras terminavam, durou menos de 2 meses. Isto custou-me horrores porque não tinha forma de me conectar com os meus colegas, e sentia-me incapaz de criar rotinas sabendo que era um sítio transicional. Passava vários dias triste, sem conseguir aproveitar nenhum tempo livre nem me conseguia concentrar a estudar em casa.
Quando finalmente estivemos no sítio novo, com a ajuda da minha mãe, lá consegui criar rotinas porque sabia que a ideia era ser uma casa onde iriamos passar muitos anos e julgava talvez eu a casa que os meus pais teriam para o resto da vida.
O processo de mudança nunca é fácil. Preciso de saber todos os caminhos a pé, ou agora atualmente de carro, para ir para vários sítios e a partir daí sigo as melhores rotas à risca, onde me sinto mais segure.
No 5º ano, consegui integrar-me mais facilmente que na primária e também foi graças a Pokémon. A segunda geração estava no seu auge com a terceira a poucos anos de sair e até ao 8º ano todos os amigues que fiz foi graças à franquia. Por volta desta altura, e também para me habituar à mudança a minha mãe criou-me um horário do que fazer em casa, quando estudar, quando brincar. Horários são importantes para mim para conseguir gerir atempadamente quanta energia meter em cada atividade.
Ainda tinha dificuldade em falar de outros temas, houve uma fase em que me interessei por wrestling mas Pokémon teve sempre presente durante mais tempo com as outras pessoas. Havia um rapaz de outra turma que

levava uma televisão portátil pequenina para a escola e todas as manhãs via um bocadinho de Pokémon na SIC antes do toque de entrada. Foi aí que consegui outro marco importante, conectar-me com pessoas fora de círculos fechados como família, turma.

No 9º ano acabei por mudar de escola e comecei a sentir dificuldades no aproveitamento escolar. Por muito que estudasse, fizesse resumos, tentasse todos os métodos que os professores diziam não conseguia obter os resultados que me pressionava a ter. Isto afetou-me até ao 11º ano quando acabei por reprovar por não conseguir acompanhar o que se passava nas aulas. Foi então, nesse verão, que recebi o diagnóstico.

Tinha dificuldade em assimilar informação e relacionar conceitos. Sempre fui bom a decorar sequências ou pequenos factos/curiosidades e isso facilitou-me o processo até o ensino começar a ser mais exigente e a pedir para relacionar conceitos, que é algo mais abstrato e que pode ter interpretações diferentes e isso acabou por me prejudicar. Tive então acesso ao ensino especial e as coisas acabaram por melhorar um pouco.

No 12º ano quando a minha turma original entrou na faculdade senti-me abandonade na escola, e foi dos anos que mais senti pressão social para ser uma pessoa diferente. Não me identificava com ninguém, não gostava de quase nenhum dos meus colegas, tentavam fazer-me bullying; ao início afetou-me, mas graças à minha mãe consegui dar a volta. A minha relação com a minha mãe sempre foi incrível, sempre foi a pessoa que mais acreditou em mim e lutou por mim e até ao dia de hoje ajuda-me a ultrapassar obstáculos. Sem ela não teria acabado o secundário e entrado na faculdade.

Na faculdade tirei Biologia e tive uma oportunidade de começar do zero. Apesar de ainda me consumir muita energia, sentia-me cada vez mais inseride em contextos sociais, participei em algumas organizações académicas e estive à frente de uma delas durante um ano.

Acabar o curso custou-me, mas com a minha rede de suporte acabei por conseguir superar.

Conheci pessoas fantásticas, desde a Catarina com que estou numa relação há uma década, e excelentes pessoas amigas também que pertencem ao meu círculo mais fechado.

Toda a minha vontade de conectar-me veio quando percebi que estava num meio com imensas pessoas fãs de Pokémon. Por esta altura a franquia completava o seu vigésimo ano e a nostalgia e as memórias atingiram toda

a gente. Pela primeira vez senti admiração das pessoas por todo o carinho que eu demonstrava publicamente pelos meus interesses e a partir daí raramente voltei a escondê-los. A cada mudança de ciclo desde a primária à secundária, desde a faculdade à vida de trabalho, Pokémon sempre esteve lá para mim e sempre foi um mecanismo para iniciar interações em ambientes onde não conhecia ninguém.

Apesar de ter ficado melhor a interagir socialmente ao longo dos anos, um obstáculo que ainda tenho muita dificuldade em gerir é a incompetência que sinto a gerir estímulos sociais. Estar com outras pessoas em contextos pessoais ou de trabalho impacta-me profundamente, fico sempre sem energia e muitas vezes sem me conseguir mexer quando estou vários dias seguidos com pessoas com as quais não me sinto muito à vontade.

A familiaridade e a rotina de contextos é muito importante para mim, quando às vezes faço algo fora da minha rotina, muitas vezes nos dias seguintes sinto-me também com o mesmo problema.

Tenho uma sensibilidade auditiva diferente de muitas pessoas, muitas vezes fico incapacitade na cama devido a esta mesma razão. “Estar presente” é algo que não consigo fazer pois estou sempre a pensar em interações que tive na vida e noutras que irei ter. Tenho que passar por isto para conseguir navegar contextos sociais que não conheço.

Já em idade adulta consegui inserir-me num círculo de pessoas que também enfrentam muitos obstáculos relacionados com este assunto o que acaba por ser uma pequena rede de suporte que consigo ter para falar de certos assuntos. Não resolve absolutamente nada, permite-me só estar consciente também dos obstáculos de amigues.

E também neste círculo, o motivo da nossa união foi mais uma vez Pokémon. Pokémon para mim vai ser sempre sobre memórias, histórias de vida, amizade e amor.

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Minding the Gap: Building Bridges through Intergenerational Media and Information Literacy

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Abstract

This chapter delves into the relevance and richness of intergenerational media education, shedding light on its role in bridging generational divides and fostering a conscientious use of digital devices and technologies. Drawing from previous research experience, we reflect upon the pivotal factors of access, knowledge, competencies, connections, interests, and motivations in moulding the landscape of media and information literacy (MIL). Taking these conditions into account and exploring the impact of each one in digital media usage and literacy's generational gaps can point a picture of how to promote intergenerationality and collectively and collaboratively develop MIL competences. Ultimately, this reflective analysis underscores the urgency of understanding these aspects for the effective implementation of intergenerational media education, charting a course towards an all-encompassing, well-informed, and harmonious digital landscape.

Keywords: Intergenerational Media Education; Generational Divides; Digital Media; Media and Information Literacy; Digital Landscape.

Martha was a proud grandmother of a 10-year-old child - Lucie. They had been building a good relationship, and even though they didn't spend as much time together as they both wished, they learned how to make the most of it. They shared a common passion for designing cloths and painting colouring books. They also enjoyed reading and playing in the park. But as time went by, Lucie gradually became interested in other types of play – digital media caught her eye and had become a major focus of interest. Martha tried to keep up with her granddaughter. She bought a smartphone and a tablet and hoped for the best! But she struggled. Nor she knew what kind of online content Lucie appreciated, nor she knew how to make it available for her – no buttons do not always mean more accessible or easier to use. She also found it difficult to ensure that she was appropriately using the devices and providing suitable, educational, and entertaining content for Lucie. "How difficult can it be to keep up with them, kids?", she wondered as she slowly felt Lucie further away, raising barriers that prevented them from interacting, playing and even communicating.

To make matters even more difficult, Martha's husband - Mike - was afraid to use digital tools. Although he had worked with computers for a large part of his life, he had allowed himself to grow old in constant fear of doing something wrong, of letting a virus strike his equipment or of giving away personal information without realizing it. The millennium bug (National Geographic, n.d) was something that had a huge impact on him – by that time, he had a responsible job where any software or electrical failure could put the lives of dozens of people at risk.

Though this could be the beginning of a short tale, it is the portrayal of hundreds of families. Data has been showing that even though the digital gap has been fading (Bolin & Skogerbø, 2013), there are still generational differences between younger and older generations. Older individuals tend to share more disinformation-related content (Guess, Nagler & Tucker, 2019) and interventions that aim to promote their media and information literacy (MIL) competencies frequently pay less attention to understanding and creating media content (Rasi & Rivinen, 2020). Furthermore, and although the pandemic has forced many people into digital communication dynamics – mainly for staying in contact with others -, it has further accentuated existing disparities (Pérez-Escolar & Canet, 2022). But how can we take advantage of the generational gap to promote digital empowerment and enhance MIL?

What's this gap thing?

In today's interconnected world, the internet and digital media have become essential for numerous activities. From education and work to entertainment and civic engagement, new digital practices and dynamics are now an intrinsic part of our routines. Though, a significant number of individuals are confronted with barriers that prevent them from fully embracing the advantages of the digital era. Limited internet access, insufficient technological know-how, lack of access to devices, and socio-economic inequalities are some of the factors that contribute to this challenge. All in all, the term 'digital gap' denotes the various inequalities that arise between those who have access and the necessary skills to use digital technology and those who do not. And let's make no mistake - this is not just a problem for older generations. Massimo Ragnedda & Muschert (2017) warn of the problem and urgency of a new theoretical lens to interpret and deal with digital inequalities. The researchers underpin a three-level approach. First, and at a basic level, citizens need to have access to the Internet; then, they need a specific set of technical, social, critical, strategic, and creative skills to use and experience it; and finally, they require a motivation to use it. If one of these three levels fails, then we may be facing digital inequalities or disadvantages. Digital divides are then a matter of access-use-benefits (Ragnedda & Muschert, 2017).

The implications of this digital breach for individuals and communities can be of great extent. On the one hand and considering the demands of today's economy – highly interconnected, dynamic, and driven by technological advancements -, those that are excluded from accessing technology can risk lagging in terms of educational and employment opportunities. On the other, restricted access to online information can limit civic engagement and participation in various types of democratic processes – e.g., elections and legislative processes, engaging in the public sphere's discussions. There is also the matter of fear towards technology – doing something wrong, making some kind of mistake, or ending up in a difficult or dangerous situation. To make matters even more worrisome, digital exclusion can amplify pre-existing social and economic inequalities and prejudices and intensify the disparity between different media users.

Generational (dis)connections

According to the Council of Europe, ageing and digitalization are two major trends and challenges of the 21st century (European Commission, n.d.). The technological evolutions and transformations that took place since the beginning of this millennium revolutionized the way different generations connect, but also engage with technologies. Digital and mobile media brought us closer together but also imposed new distances between individuals – something that seems kind of counterintuitive. New digital devices and technologies opened exciting avenues for intergenerational communication and engagement. Social media and video conferencing tools, for instance, provided younger and older individuals with new opportunities to connect, share their experiences, and overcome geographical distances. Looking at our recent past, these played a crucial role during the subsequent periods of lockdown that many countries faced during 2020 and 2021 (Azevedo et al., 2022; Padeiro et al., 2021). In contrast, they enhanced a novel set of fears – fear of missing out, of not knowing, of not understanding, of being vulnerable in digital environments. Some studies even highlight a fear that information and communication technologies (ICTs) may be painting a changed picture of human nature (Wu et al., 2015) or an overwhelming feeling towards its endless possibilities and functionalities (Mitzner et al., 2010).

Looking at these issues through the generational point of view, even though digital technologies and the internet are embedded in our lives, digital practices are not intrinsic to all individuals in every sphere of their lives. Knowing how to use technology, being diligent in carrying out internet searches, properly reading online information or participating in online activities involves different **access, knowledge, competencies, connections, and interests**. And I consider that these are key to understanding generational gaps in digital media usage and literacy.

Media education as a strategy to connect generations

For the past years, my research has brought me closer to many Marthas, Mikes and Lucies. Taking these experiences as a basis, I will explore how reflecting on **access, knowledge, competencies, connections, interests and motivations** can help us positively address media education in an intergenerational manner, for an enriching and enlightened use of digital devices and technologies.

Firstly, it's about whether you have and to what you have access. Having or not having access to the devices will have an impact on the ways we understand technology, the usefulness we identify and in how comfortable we are with it. Therefore, it forms the essential foundation on which MIL is built. Just like a key unlocks a door, access to hardware, software, the internet, and educational opportunities can unlock the potential for individuals to participate in online learning, communication activities, and further opportunities for development and involvement in our interconnected world.

Then, it's about what you learn – your ***knowledge***. Knowledge is a crucial base. Being able to navigate, understand, and make the most of the media depends greatly on having a solid understanding of various topics - basics of hardware and software, understanding online communication, data privacy, and how to assess digital information critically. But it is vital to recognize that people do not all learn the same things or in the same way. Being aware of these differences can help designing strategies that collaboratively enable knowledge creation, through sharing and mutual help. Just like a strong foundation is needed for a stable building, knowledge acts as the essential groundwork that enables people to interact confidently in a world that is increasingly connected, and technology driven.

It's also about what you can do – your ***competencies****.* For the past 22 years, Mark Prensky has been refuted. The flaws and prejudice that imbue the idea(l) of digital natives (Prensky, 2001) have opened the door for other labels that intend to describe generations from their media and digital competencies perspective. Yet, employing these concepts seems increasingly 'frivolous' when we look at data that highlights disparities that go beyond age gaps – e.g., demography, social and economic range. Developing MIL competencies in an intergenerational manner involves recognizing diverse skills and expertise across age groups. It centres on leveraging these differences for dynamic learning. By acknowledging each generation's strengths and fostering collaboration, it is possible to create an inclusive environment for skill exchange. Collaboration is crucial here - while older generations can provide traditional insights, younger ones can offer digital expertise. This exchange enriches collective understanding and camaraderie.

But make no mistake because it's too about who you learn and develop knowledge and competencies with. From a generational perspective, the

connections we establish with those we learn from carry great weight. In the SMaRT-EU – Social Media Resilience Toolkit (LC-01563446) project, the focus groups conducted with families showed that the close bond between grandparents and grandchildren contributed positively to learning about, consuming, and using the media. According to Oliveira, Brites & Cerqueira (2022), grandparents and grandchildren recognized that, despite the barriers and different interests, their complicity and comradeship had been essential for grandparents to become more media literate and curious about media technologies. Alongside this, the context was also relevant - the COVID-19 pandemic and the recurrent confinements strengthened their relationships by pushing them to communicate through digital platforms and devices (Oliveira, Brites & Cerqueira, 2022).

*Finally, it's about your **interests and motivations**.* However, if there is no interest or motivation to discover media, the aspects mentioned above will not have an impact on MIL competencies. Diving into the world of media and digital platforms requires an 'x' of curiosity that we cannot assume all individuals have. Michael is a typical example: he enjoyed his life, and his routines, he could get all the info he needed through the radio, newspaper, or television, and he could reach every relevant person in his life by calling them by phone or smartphone. So why change this? What were the benefits for him? Assuming that this resistance is wrong and that all individuals necessarily need to use the media to their full extent puts us - educational actors, researchers, thinkers, policymakers, and other citizens - in a position of prejudice.

Looking ahead

Drawing from past experiences, this reflection looks into the important details that make intergenerational media education successful. By taking a closer look at things like how people get to technology, what they know, their skills, who they connect with, what interests them, and what motivates them might help us forge a transformative path towards embracing digital devices and technologies in an enriching and informed manner. This transcends a mere technological journey and involves weaving together the threads of access, knowledge, competencies, connections, interests, and motivations into an all-encompassing and enlightened approach. Through this collective effort, generations can develop the necessary characteristics to navigate the digital landscape harmoniously, fostering

a society that holds media and information literacy in high esteem while celebrating the diversity and uniqueness of intergenerational learning.

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PART II

ASSISTIVE TECHNOLOGIES, EMPOWERMENT, AND INCLUSION

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Introduction

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Assistive Technologies (AT) show great promise in supporting people with diverse abilities and expertise, including people with Autism Spectrum Disorder (ASD) and Intellectual Disability (ID). Intuitive, inclusive design and proper implementation of AT can foster confidence and self-sufficiency to truly empower and socially include individuals across the ASD and ID spectra.

A project that seeks to address these concerns is the **a-STEP**[1] COST action (19104), which aims to "build an interdisciplinary, intersectoral ... network which will enhance social inclusion and empowerment of individuals with Autism Spectrum Disorder (ASD) and/or Intellectual Disability (ID)" (Leader, 2020). Within a-STEP, Working Group 2 (WG2) called "Collaboration Evaluation", seeks to "identify and evaluate existing Assistive Technologies (AT) ... for enhancing social inclusion of individuals with Autism Spectrum Disorder and/or Intellectual Disability" (Leader, 2020). The work of COST a-STEP WG2 is highly relevant to the present manuscript, and the leaders of WG2 are also serve as the editors of the book: Carla Sousa (leader of WG2), and Alan H. Tkaczyk (co-leader of WG2).

The second half of this book is entitled "**Part II: Assistive Technologies, Empowerment, and Inclusion**" The goal is to delve into a broad range of assistive technologies at the nexus of empowerment and inclusion.

1 https://www.a-step-action.eu/

Photo by Hiki App at Unsplash

In the first chapter on "The Role of Social Robots as Assistive Technologies in the Treatment of Autism Spectrum Disorder and Other Neurodevelopmental Disorders: Possible Interactive Play Scenarios", **Paulina Tsvetkova** examines how social robots can support the treatment of children and adolescents with ASD and other neurodevelopmental disorders. Specifically, the potential of Socially-Assistive Robots (SARs) is explored in therapeutic and interactive play sessions. Finally, the chapter presents some approaches on how SARs can make therapy more friendly and effective.

In the second chapter, **May Agius** examines "Augmentative and Alternative Communication Assessment: Considerations for Autistic Children Who Are Beginning Communicators". The chapter explains what augmentative and alternative communication (AAC) is and why it is important for autistic children who are just starting to communicate. The chapter also provides some suggestions on how to assess AAC and improve AAC protocols for autistic children.

The third chapter investigates how Virtual Reality (VR) technologies can help autistic adults find and keep jobs. It is called "Virtual Reality: Unlocking Employment Opportunities for Autistic Adults?" and is written by **Sally Whelan** and **Geraldine Leader**. The chapter covers topics such as: VR systems for vocational training, research on their use and effectiveness, good design practices, and future research directions.

"Gaming, Assistive Technologies, and Neurodiversity" is the fourth chapter in the book and is written by **Carla Sousa**. The main goal of this chapter is to analyse Assistive Technologies (AT) that can make gaming more accessible and enjoyable for people who are neurodivergent, especially

those with Autism Spectrum Disorder (ASD). The chapter aims to start a discussion on how gaming and AT can empower autistic people, promote social inclusion, and support self-expression.

The fifth chapter is "Technological Innovations for Assessing Motor Impairments in Autism Spectrum Disorder" and is written by **Aditi Gandotra** and **Renata Cserjesi**. This chapter explains how technology can help in the early detection of ASD by using wearable devices, video analysis, and sophisticated algorithms. These technologies can provide objective measurements, support early intervention, and empower people with ASD. These findings show the potential to change the way ASD is diagnosed and treated, and to improve the quality of life for affected individuals.

Isabel Trancoso and **Soraia M. Alarcão** have written the sixth chapter on "Assistive Technologies in Psychomotricity Sessions with Children Diagnosed with Autism Spectrum Disorder". This chapter describes how Psychomotricity implemented via Assistive Technologies (AT) can help children with ASD. A case study is presented: a seven-year-old girl had trouble making friends and controlling her emotions including aggressiveness. After implementing Psychomotricity, the girl's communication skills were gradually enhanced and she was able to improve her interactions with peers and family, her academic performance, and her ability to join group activities.

Saime Arslan has written the seventh chapter on "A Study on the Use of Virtual Reality in Teaching Independent Living Skills to Individuals with Autism Spectrum Disorder". VR can make learning easier for people with ASD because of its features such as a high level of interaction and immersion, controlling distracting stimuli from the environment, and allowing students to learn while having fun. In the study, people with ASD are taught skills such as driving, fire and hurricane safety, and job interview skills through VR.

In the eighth chapter, **Cátia Casimiro** has written about "Enhancing Participatory Research with Neurodiverse Individuals: The Potential Role of Assistive Technologies in Facilitating Informed Consent". The chapter discusses how assistive technologies (AT) can help in recruiting

neurodiverse individuals to study their self-determination and accessibility. AT can improve the communication between the researchers, the consultants, and the participants, and also help in facilitating informed consent.

"Implementing Intervention Studies with Autistic People and Digital Technologies in Natural Settings: a Guide to Best Practice" is the ninth chapter and is written by **Patricia Pérez-Fuster** and **Gerardo Herrera**. The chapter presents a ten-step guide to implement intervention studies that use digital technologies to improve skills in autistic persons. The guide covers important aspects such as choosing the right technology and applying the best research design.

The tenth and final chapter by **Gerda Sula** is entitled "Building an Inclusive Future: Empowering Through Assistive Technologies". This chapter examines how assistive technologies can promote empowerment and inclusion for people with disabilities. The chapter highlights key best practices, such as user-centered design, accessibility standards, continuous improvement, training and support, and fostering collaborations among stakeholders.

The aforementioned chapters can be useful to a broad range of stakeholders in the AT, ASD, and ID areas. In particular, these materials could be used collaboratively by subject matter experts as well as individuals lacking formal training. The long-term goal is to empower individuals with disabilities and give them the opportunity to contribute meaningfully to their communities.

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The Role of Social Robots as Assistive Technologies in the Treatment of Autism Spectrum Disorder and Other Neurodevelopmental Disorders: Possible Interactive Play Scenarios

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Abstract

This chapter explores the utilization of social robots as assistive technologies in the treatment of children and adolescents with ASD and other neurodevelopmental disorders. It has been observed that these robots provide effective and engaging experiences for such individuals and both parents and children show a positive attitude towards this technology. In addition, parents perceive robots as more child-friendly than tablets or smartphones. That is why, the current section examines the potential of different Socially-Assistive Robots (SARs) in therapeutic sessions and presents various interactive play scenarios, designed by a team of specialists. Possible applications are explained and challenges, faced during the sessions, are pointed out. The paper also offers perspectives on the use of SARs which can create a nurturing and non-intrusive environment, leading to enhanced therapeutic results.

Keywords: Social Robots; Assistive Technologies; Autism Spectrum Disorder; Interactive Play Scenarios; Therapeutic Sessions.

The utilization of advanced technology in the treatment of Autism Spectrum Disorder (ASD) and other neurodevelopmental disorders has garnered increasing attention. Socially Assistive Robots (SARs) have become a focal point in the field of speech and language therapy. Although initial findings have shown promise, more investigation is required to comprehensively grasp the potential and practicality of SARs in ASD. Notably, these robots have been observed to offer effective and captivating therapy experiences for children and teenagers with diverse neurodevelopmental and communication disorders.

Robots possess the capability to repetitively reproduce specific words and actions, which can aid children in retaining and applying acquired vocabulary in their daily lives. In accordance with the systematic review conducted by Pivetti et al. (2020), the incorporation of educational robots in various types of interactions with children diagnosed with neurodevelopmental disorders has resulted in enhanced social engagement with peers and/or teachers/ other professionals. Children exhibit enthusiasm and active participation when a robot is involved in therapy sessions. As stated in Stankova et al. (2021), both parents and children show a positive attitude towards this technology. Furthermore, according to Lin et al. (2021), parents believe that robots are more child-friendly compared to other technologies like smartphones, tablets, and televisions. (This is attributed to the ability to predetermine and control the content of programs delivered through robots. Researchers face challenges when trying to develop an optimal design for child-robot interaction that effectively emulates natural human communication and can be applied in both in-person and online sessions. This endeavor necessitates the establishment of comprehensive evaluation criteria to assess the effectiveness and quality of the interaction, as well as the child's engagement, social behavior, and more. Various objective and subjective measurement methods, such as observation, behavioral analysis, gaze and speech detection, as well as questionnaires, are employed to gather data in this regard.)

The 2022 UNICEF (2022) report on assistive technologies for children with neurodevelopmental disorders highlights socially assistive robots as high-tech assistive technologies that show significant potential for enhancing social interaction and communication. SARs can function as friendly companions in games, facilitators in interactions with peers and adults, stimulate social engagement, and transform the child's role from a passive

observer to an active participant. Among the wide array of interventions available, social robots have emerged as a promising tool to support the development of daily skills and enhance the overall quality of life (Scassellati et al., 2012; Valadão et al., 2016). Recent research indicates that robots are well-accepted by children and young individuals diagnosed with autism spectrum disorder, and their utilization is associated with positive effects on various aspects such as imitation abilities, eye contact, shared attention, behavioral responses, as well as repetitive and stereotyped behaviour (Pennisi et al., 2015; Van den Berk-Smeekens et al., 2020).

According to ICD-11 Neurodevelopmental Disorders, include Autism Spectrum Disorder (ASD), Disorders of Intellectual Development, Developmental Language Disorder, Developmental Learning Disorder, and others (WHO, 2019/2021). Scientists from the Institute of Robotics, Bulgarian Academy of Sciences, have developed a couple of game scenarios, specifically designed for children with different neurodevelopmental disorders. The aim of the current chapter is to present these scenarios, explain possible applications, point out challenges that were faced during sessions, and provide insights on the use of SARs in the treatment of ASD and other neurodevelopmental disorders in speech and language therapy.

The humanoid robot NAO is one of the socially assistive robots that have been used in play scenarios with children with ASD and other neurodevelopmental disorders. NAO is the most frequently used robot, which assists children with neurodevelopmental and communication disorders in individual sessions. It is equipped with many sensors and actuators that allow different modalities for interactions. It can perform gestures, play sounds, and recognize objects, words, landmarks, and barcodes. NAO has a preinstalled operating system, NAOqi. The programming of the robot is performed in two ways: by using the graphical interface of the Choregraphe environment and/or in Python programming language inside Choregraphe or from an external IDE.

EmoSan is the other robot involved in the therapy sessions. A group of scientists from the Institute of Robotics have developed it. The robot has six degrees of freedom and two platforms – a base and a moving platform. EmoSan incorporates head movements. The robot design is built upon the Gough-Stewart platform. This innovative utilization of the Gough-Stewart platform allows for a compact and easily manageable emotion-expressive robot (Pancho Dachkinov et al., 2018).

One of the scenarios, designed by speech and language therapists and the engineers from the Institute, is about farm animals and their voices and names. This scenario can be performed in remote speech and language therapy, and its objective is to enrich a child's vocabulary. The treatment domain is the language one, and the scenario is appropriate for children with ASD and other neurodevelopmental disorders. The techniques that have been used are identification of farm animal voices, as well as identification and pronunciation of words related to a farm. This is a cognitive play, and the child who participated in the experiment was four years old. There are five participants in this scenario - a speech and language therapist (who controls the game), a social robot NAO (in the role of an instructor), a social robot EmoSan (which is a playmate), a parent (who is a co-therapist) and a child with ASD or other neurodevelopmental disorders (who is a playmate). During the experiment, the social robot NAO gives instructions to the child to identify and pronounce words, based on pictures of farm animals and the social robot EmoSan interacts with the child as a playmate throughout the game. The platform BigBlueButton is used for telepresence.

Another play scenario with the two robots is called "Storytime". The objective is for the child to follow a story and to represent a story as a sequence of scenes in time. This scenario is again appropriate for children with ASD and other neurodevelopmental disorders. The experiment has been conducted with 15 children between the ages of 3 and 10 years. Three pictures of story scenes and a whisk have been used in the game.

The other game, which the scientists created, is about colors. Its objective is to improve the receptive vocabulary of children. Children have to identify the vocabulary of a closed set of words. This is a cooperative and practiced play. Two pictures are placed in front of a child. NAO says, "Give me X". The child chooses the picture of the color he/she has heard and puts it in the robot's hand. The four participants in this scenario are the same: a speech and language therapist, a social robot NAO, a social robot named EmoSan and a child with neurodevelopmental disorders. The children, involved in the game, were in the age group of 3-10 years.

Another game, called "Shopping Game", represents environmental sounds and vocabulary used in everyday routine. The vocabulary is related to running water in the bathroom when taking a shower and the sound from teeth brushing. NAO can play the sound of a shower and, at the same time, show the relevant body movements, e.g., "brushing" the teeth. First, the

child chooses products for taking a shower – soap, shampoo, and bath sponge and shows them to NAO in order to check if they are the correct ones. After that, NAO plays the sound for teeth brushing, and the child selects the appropriate products (Andreeva & Ioannou, 2020; Polycarpou et al., 2016). In this game, a cash desk toy has been used. The child pretends that they help NAO check the products on the cash desk. The child decides whether to pay with a plastic card or cash. The children were in the age group 3-10 years.

The children, who were involved in the therapy sessions, have ASD, Developmental Language Disorder and/ or Developmental Learning disorder. The scenarios in all plays described, have been carried out in a clinical setting over multiple sessions. The activities can also include more participants to promote a cooperative play. The results indicated that nearly all children readily participated in the play-like activities and displayed a keen interest in interacting with the robots. The reported results show that the SARs have increased motivation and enhanced children's attention. One of the challenges during the sessions was that the children, especially those with ASD, had difficulties initiating, maintaining joint attention, and interacting with their interlocutor (Andreeva et al., 2022). After employing NAO in speech therapy, the project team found out that there was a necessity to broaden the communication environment between children and robots, so this is a perspective for future work with NAO (Georgieva-Tsaneva et al., 2023).

Unfortunately, the number of children involved in the interactions with the robots was insufficient, and further investigation is required to broaden and enhance our understanding of this subject. However, the implementation of SARs into speech and language therapy for children with ASD and other developmental disorders can establish a supportive and unobtrusive environment for children, resulting in improved therapeutic outcomes. Based on a comprehensive review, done by the scientists from the Institute of Robotics and other academic organisations, it has been found that there is an increasing number of studies that have documented encouraging outcomes in the implementation of SARs in the context of speech and language therapy (Georgieva-Tsaneva et al., 2023). Both the kids and the parents have enjoyed playing games and doing activities with the robots, which has motivated them to continue the sessions with SARs' help. We hope that incorporating SARs into speech and language therapy will

enhance the language development of children with neurodevelopmental disorders and have a positive impact on their overall growth and quality of life.

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Augmentative and Alternative Communication Assessment: Considerations for Autistic Children Who Are Beginning Communicators

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Abstract

The overall goal of this chapter is to provide some considerations for augmentative and alternative communication (AAC) assessment which could improve AAC protocols for autistic children. This is considered important as improved AAC assessment protocols could lead to improved overall AAC outcomes. A brief overview of augmentative and alternative communication (AAC) and its relevance for autistic children who are beginning communicators is provided. An overview of the AAC assessment process focussing on the Participation Model as the framework is discussed. The inclusion of sensory processing as part of the AAC assessment process is considered as a means of improving AAC assessment protocols for autistic children. Relevant research which has described the sensory processing characteristics of the participants is presented for consideration.

Keywords: AAC; Autism; AAC Assessment; Sensory Processing; Child Characteristics.

Many children with autistic spectrum disorder (ASD) present with little or no functional speech and these children are often referred to as beginning communicators (Tager-Flusberg & Kasari, 2013). Such children are in the early stages of language development and therefore use communicative behaviours such as gestures and facial expressions to express themselves (Holyfield, 2019). Recent estimates indicate that as many as 40% of children diagnosed with ASD may be beginning communicators (Centres for Disease Control and Prevention (2018).

Difficulties in social communication and social interaction are a key diagnostic criterion for ASD (American Psychiatric Association, 2013). These difficulties may impact the child's ability to communicate their needs, preferences and ideas (Lund et al. 2021). Such difficulties are also likely to influence societal inclusion. Finding ways to support communication development is therefore important because the ability to communicate has also been linked to outcomes in both education and employment (Iacono, 2016). For these children, augmentative and alternative communication (AAC) is often considered as an intervention strategy.

Augmentative and Alternative Communication

ISAAC (2021) states that AAC refers to tools and strategies which are used to support communication. AAC may be implemented to replace speech in situations when it has not developed, or to augment existing speech when it may not meet the individual's communication needs. Recently, AAC is also used to teach the child about the process of communication as well as to support language development (Hustad & Miles, 2010).

AAC may include both unaided and aided means of communication. Unaided AAC strategies refer to the use of the body including the use of manual signing and gestures. Aided communication systems are considered as forms of assistive technology and may be low tech in nature e.g., the use of pictures and communication books which are paper based. Aided AAC also includes systems which provide voice output and are typically computer based. Such systems are referred to as high tech AAC systems and may include mainstream technology such as a tablet with AAC software or application or dedicated AAC systems which are built for the purpose of communication.

The use of AAC to support the communication of individuals with ASD is considered an evidence-based practice by the National Clearinghouse on

Autism Evidence and Practice (Steinbrenner et al., 2020). While both aided and unaided AAC have been demonstrated to be effective for children with ASD, there are challenges in the selection of AAC systems and/or strategies for individual children especially in situations when no previous AAC has been implemented (Ganz et al., 2023).

AAC assessment

Assessment for AAC is a complex process in which a team of practitioners aims to select the most appropriate AAC systems and/or strategies for a particular individual. This process is particularly challenging for practitioners for many reasons; large amounts of information about the individual need to be collected and integrated, and the wider communicative context and practitioners must be aware of rapid advances in AAC options. There is also huge heterogeneity to be found within the population of individuals which require AAC (Lund et al., 2017). While assessment should lead to the selection of the most appropriate communication modes for an individual, this is considered the start of a long journey in which the individual eventually learns to use AAC to communicate with many communication partners in multiple communication contexts. In view of this, assessment does not stop at the identification of the AAC system and/or strategy but also aims to identify intervention strategies which support the individual and communicative environment to use the AAC system and/or strategies (Naughton et al., 2019).

One framework which is typically utilised to guide the AAC assessment process is the Participation Model (Beukelman & Mirenda, 2013). This model may be utilised by the AAC Team to establish the best fit in terms of AAC systems and/or strategies but also supports the Team to consider the intervention strategies which will be utilised to teach the child how to use the AAC. It begins by identifying the individual's participation patterns and communication needs. An assessment of opportunity and access barriers then follows.

Opportunity barriers refer to barriers which may be identified in the individual's extended environment and may include policies and practices, facilitator knowledge and skill, as well as attitudes. Assessment of these barriers allows the AAC Team to consider wider issues such as communication partners, which may present a potential barrier in the implementation of AAC thus mitigating the risk of potential device

abandonment which is prevalent in the field of AAC (Sievers et al., 2018). The assessment of access barriers refers to the individual's capabilities and is focussed on the individual who potentially could benefit from AAC. This includes assessment of current communicative skills, motor, cognitive, linguistic, literacy, and sensory perceptual skills (vision and hearing) as well as the child's potential for natural speech and possible environmental adaptations that could support communication.

It has been suggested that the Participation Model may need to be applied differently according to the individual's diagnosis e.g., Agius & Borg (2022) and Lund et al. (2017). This is because although the Participation Model provides a model of best practices, it does not provide specific guidelines on assessment protocols for individual populations such as children with ASD (Lund et al., 2017). This is important when it is considered that children with ASD present with unique difficulties in the area of social communication which could impact the selection and learning of AAC.

Individual characteristics: Sensory Processing

Apart from the core deficit in social communication and social interaction, the DSM-5 (2013) states that the second core deficit of autism is restricted, repetitive patterns of behaviours and interests making reference to sensory reactivity as a core deficit of ASD for the first time (Ben-Sasson et al., 2019). Sensory processing theory hypothesises that for optimal functioning to occur in daily living environments information received through the senses must be efficiently received and integrated (Baker et al., 2008). Sensory processing difficulties may occur when an individual has difficulty organising and regulating behavioural responses to sensory inputs in accordance with environmental demands (Miller et al., 2007). The DSM-5 includes references to hyper-reactivity and hypo-reactivity. Hyper-reactivity refers to exaggerated, possibly negative responses to stimuli (Uljarevic et al., 2017). Conversely, children who display hypo-reactivity may be slow to respond to incoming stimuli. Sensory-seeking behaviour, a third category, refers to a preoccupation with or a craving for certain sensory experience (Hazen et al., 2014) It is estimated that over 90% of children diagnosed with ASD may present with atypical sensory processing (Ben-Sasson et al., 2019).

The importance of sensory processing

It is theorised that adequate sensory processing underpins all learning laying down the foundation for social, communication and language development (Ben-Sasson et al., 2019; Watson et al., 2011). Research has indicated that some sensory processing profiles, particularly hypo-reactivity and sensory-seeking are more associated with delays in language and communication development (Tomcheck et al., 2015; Watson et al., 2011).

Given the existing research on the relationship between sensory processing and communication development it could be hypothesised that sensory processing assessment should be included in AAC assessments of children with ASD. Typical AAC research often describes children's current communication levels, adaptive functioning as well as the results of cognitive assessments. Much of this information has been synthesised to support practitioners to understand how these characteristics might impact AAC outcomes e.g., Ganz et al. (2023), but information on how children process information through their senses is generally not included. This information could provide the practitioner with important information to plan the AAC intervention programme for specific children with ASD, especially those who are beginning communicators to ensure the likelihood of improved AAC outcomes.

AAC research which includes sensory processing in participant descriptions

Three consecutive single case experimental design (SCED) studies which refer to sensory processing for children with ASD are described by Agius (2019). This research was carried out in a national assistive technology centre in Malta. The aim of the studies, which included a total of 12 young children with ASD described as beginning communicators, was to teach requesting using mainstream tablet technology with the Scene and Heard© AAC application. The sensory processing profiles of each of these children is described using the results of the Short Sensory Profile (McIntosh et al., 2009). This was administered alongside other assessments aimed to assess autism severity, communication level and adaptive functioning.

Study 1, which had four participants, was an adapted alternating design embedded in a multiple probe SCED used to compare learning to request with a traditional grid display format and a visual scene display. Photos of reinforcers were presented in rows and columns in the grid display. For the visual scene display a photo of the reinforcers was taken and hotspots

were created. Two participants were described as sensory-seekers while the other two had typical sensory processing. The results for all four children were similar for the two displays but the two children who had sensory processing difficulties failed to achieve criterion in either of the displays within the allocated number of treatment sessions. As the children also presented with the lowest scores in the areas of adaptive functioning and communication, their difficulties with learning to use the AAC could not be attributed solely to their sensory processing difficulties. The study results did, however, provide a springboard for future research as it led the researchers to question whether the provision of sensory processing interventions in addition to the AAC intervention might have supported these two participants to achieve criterion.

In Study 2, a further four participants were recruited. This study replicated Study 1 with the addition of a sensory processing intervention programme which was tailor made for each child according to the results of their sensory processing assessment (Schaff et al., 2014). In this study, two children were hypo-reactive, one was a sensory-seeker and the fourth was hyper-reactive. Again, all four participants achieved similar results for both displays. Three children achieved criterion within the sessions allocated, the fourth achieved criterion in the post-intervention phase. The children who presented with a hypo-reactive sensory processing required the most sessions of intervention. These children also presented with the lowest levels of communication development and adaptive functioning.

As the children did not demonstrate any significant differences in learning to use the two displays in Study 1 and 2, in Study 3 a further four children were taught to request using only the grid display. Again, sensory processing interventions were provided to support the AAC intervention. In this study, one child presented with a profile of hypo-reactivity, one was hyper-reactive, one was a sensory-seeker, and the fourth fluctuated between hypo- and hyper-reactivity. The child with the hypo-reactive sensory processing pattern took the longest to achieve criterion. The child who fluctuated between hypo- and hyper-reactivity required modifications to the treatment protocol but then achieved criterion. The child who presented with a hyper-reactive profile achieved criterion in the least number of sessions.

As only 12 children took part in the three studies, the conclusions that can be drawn are somewhat limited. When the results of all 12 children

are taken into consideration it was evident that children who presented with typical sensory processing took a fewer number of sessions to learn to use AAC. Children with a hypo-reactive sensory profile took the longest to learn to use AAC suggesting that practitioners and families may need to plan for longer trial and intervention periods. This could be expected given that published sensory processing research indicates that this group of children are the most likely to experience communication delays and be nonverbal (Patten et al., 2013; Watson et al., 2011). Children who were hyper-reactive took the shortest time to learn to use AAC and this correlates with research which has found that these children are less likely to have difficulties with communication (Patten et al., 2013; Watson et al., 2011).

Conclusion

This research indicates that there could be some benefit to considering sensory processing in the AAC assessment protocol to ensure a more comprehensive assessment of AAC. Firstly, this could be integrated in the assessment of access barriers within the Participation Model. In terms of opportunity barriers, it would be important to include the family and educators' skills, attitude and knowledge on the child's sensory processing as part of the information gathering process. Taken together, this additional information could provide the assessment Team with the information that is required to plan interventions. This may take the form of the provision of sensory processing interventions as an adjunct to AAC interventions according to the individual child's sensory processing profile and communication needs.

Consideration of specific sensory processing profiles and their impact on achieving AAC outcomes requires further research. Ultimately, improving AAC assessment protocols for children with autism will lead to improved AAC outcomes.

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Virtual Reality: Unlocking Employment Opportunities for Autistic Adults?

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Abstract
This chapter explores the potential for Virtual Reality (VR) technologies to enhance employment opportunities for autistic adults. The Chapter will describe VR, review the research literature and evaluate its potential benefits to autistic people. Examples of VR systems are presented that have been investigated for vocational training, along with the evidence regarding their usability and effectiveness. Recommendations are made for good design practices and future research directions.

Keywords: Autism; ASD; Social Inclusion; Assistive Technology; Vocational Training.

Introduction

Globally, the employment rates of autistic adults are significantly lower than their neurotypical (NT) peers. In addition to the socio-economic implications, unemployment impacts negatively on self-esteem, mental health and quality of life. (Chen et al., 2015). Therefore it is problematic that employment rates for autistic adults vary between 40% and 68% (Coleman & Adams, 2018; Frank et al., 2018). Furthermore, even when employed, autistic people frequently experience poor levels of employment retention and may also experience underemployment in poorly paid jobs, volunteering, or with part-time hours (Warfield, 2016).

Vocational rehabilitation training can help autistic people to overcome workplace challenges (Waisman-Nitzan et al., 2021). This training includes three categories of interventions that focus on the skills needed to gain employment and those needed to complete tasks during employment and to retain employment (Seaman & Cannella-Malone, 2016). A review of n=20 studies found that most interventions aim to promote skills for job related tasks, whereas few interventions, focus on pre-employment or job retention skills (Seaman & Cannella-Malone, 2016). This review also identified that 62% of vocational skills are taught through video modelling or prompting, and 21% involve intervention packages or audio prompting.

Virtual reality (VR) technologies have been used in the vocational training of autistic adults (Schmidt et al., 2021). VR technologies create a digitally constructed virtual environment (VE) using computer-generated graphics. Human users interact with this VE, controlling avatars and aiming to experience the VE as if it is real through feelings of telepresence.

Training via VR may be beneficial to autistic people because VR can be visually stimulating and intrinsically reinforcing (Schmidt et al., 2021). It is relatively low in cost, increasingly accessible (Chang & Chen, 2017), and it has the potential to be customised to meet individuals' needs, particularly to avoid sensory overload (Morton-Cooper, 2004). VR is able to create repetitive training opportunities that are safe, without the risk of physical danger or social embarrassment. Real-time prompts and user feedback can be provided through animations, pictographs, or verbal cues. Another potential benefit is that virtual scenarios can involve situations that are difficult to create in real life. For example, dealing with difficult customers or working during a thunderstorm.

Types of VR Systems

A recent systematic review found that four VR Systems have been used to investigate employment skills in autistic adults (Whelan et al., under review). The key features of these systems are summarised in Table 1. It can be seen that these VR systems have varied user interfaces and methods to capture and translate the movements of the user into the VE e.g. clicking keyboard/mouse, joysticks, wheels, and movement tracking (Glaser & Schmidt, 2021). Bozgyuikli et al., (2017a) noted that VR systems vary in the degree of immersivity they afford and they can be regarded as having antecedent and consequence components. Antecedents take place before using the learning part of the VR system and include verbal/written/modelling instructions given by real life job coaches or virtually within the system. Consequence components include the feedback given to users, provided in real-time whilst interacting with the system or after the session. For example, the VR Job Interview Training (VR-JIT) system provides feedback during a simulated interview in which the user interacts with a virtual job coach, and after the session users receive a transcript of the interview, marked by a human coach, to tell them what they did well, and what could be improved. Most research to date has investigated the VR-JIT system.

Table 1 - Key Features of VR Systems used for Vocational Training in Autism

Study IDs	Name of System	Immersivity Level	System Components	Intervention
Bozgeyikli et al 2017; 2018b	Vocational Rehabilitation of individuals with disabilities (VR4VR)	Fully	Head Mounted Display (HMD), Optical motion for real-time tracking component, 2* 180 degree curved screens with cameras, touch screen controls & trainer control panel.	Modules with levels for common job training & transferrable skills. Verbal instructions & modelling, behaviour prompts. Corrective feedback words/pictures
Burke et al., 2017	Virtual Interactive Training Agent (ViTA)	Semi	3 camera pieces for motion capture & scoring of movement & facial expression; a flat-screened monitor for VE, emulating an office space	Coach instructs user on interview strategies, user role plays interview, corrective feedback via VR.
Adiani et al., 2022	Career Interview Readiness in VR (CIRVR)	Desktop None HMD Fully	Closed-loop adaptive interview training. 2 versions Desktop & HMD. VE & avatar on screen. Webcam. Monitor, headset, eye tracking camera, keyboard, & mouse. A wristband to measure stress; Eye gaze, & facial scanning for emotional indicators.	User interacts with virtual human interview. Real-time gaze, facial expression (not validated for autistic people's faces), & stress detection. Feedback to coaches & user.

Study IDs	Name of System	Immersivity Level	System Components	Intervention
1. Genova et al 2021; Schmidt et al., 2021; Smith et al., 2014; 2015; 2017; 2020; 2021** 2. Ward et al., (2019); Humm et al., (2014)	1.VR Job Interview Training (VR-JIT) 2.VR-JIT with Molly Porter developed by SIMmersion LLC	1 & 2 None	1 & 2 User interacts with virtual human through internet or computer software. 2. Commercially available internet software programme	1 & 2 Self-guided e-learning on interview strategies and process, interview with virtual interviewers. Feedback non- verbal from VR job coach & prompts, real-time coach, interview score, transcripts review & participant given feedback colour coded responses user & reward tokens**.

Satisfaction and Challenges using VR systems

The VR-JIT system has been regarded as relatively uncomplicated to use (Schmidt et al., 2021), and enjoyable to use (Ward et al., 2019) and 75% to 90% of participants have rated it as having moderate to high usability (Smith et al., 2015, 2021, 2022). The feasibility and usability of the Career Interview Readiness in VR (CIRVR) was assessed involving autistic (n=9) and NT (n=8) people (Adiani et al., 2022). In this study, both participant groups reported they were satisfied with CIRVR. However, the autistic group had higher stress levels using the system and they regarded usability as being ''okay'' whereas it was regarded as ''good'' by the NT group.

However, some researchers have emphasised the need for human facilitators (Schmidt et al., 2021). In addition, problems with cyber sickness and feelings of disorientation have also been reported. Cyber sickness particularly occurs when several visual stimuli are introduced or with prolonged head-mounted display (HMD) use (Glaser et al., 2022).

Effectiveness of VR for Interview and Employment Skills Training

Twelve studies have investigated VR technologies for interview performance training (Whelan et al., under review). Several of these studies found that VR-JIT was effective in improving skills (Genova et al., 2021; Schmidt et al 2021; Smith et al., 2014; 2015; 2017; 2020; 2021). For example, Smith et al. (2014) conducted a single-blinded, randomised controlled trial (RCT). This involved n=16 autistic adults, with no intellectual disability (ID) who used the VR-JIT for approximately 20 sessions, and n=10 participants who had training as usual (TAU). They found that the VR-JIT users felt more prepared for future interviews and they had greater improvement than the TAU participants when role-playing real-life job interviews (p=0.046).

The use of the VR-JIT improved eye gaze and conversational reciprocity (Ward et al., 2019), whereas training through the CIRVR improved verbal responses to interview questions (Adiani et al., 2022). Training using the Virtual Interactive Training Agent (ViTA) during four sessions coincided with an improvement in mean interview scores, pre-post usage by 0.58 units (Burke et al., 2017). This improvement was statistically and clinically significant (Burke et al., 2020). There is also evidence that sociability and social skills can be improved through training via the Vocational Rehabilitation of Individuals with Disabilities (VR4VR) (Bozgeyikli et al., 2017b).

A few studies have found that training using the VR-JIT can translate to improved real-world interview skills, and improved job offers. For example, six months following the initial training, vocational outcomes were followed up with 23 out of 26 participants (Smith et al., 2015). Using logistical regression, they found that autistic VR-JIT users had greater odds of obtaining a position than those in the TAU group (OR 7.82,p\0.05). Another study identified that the number of conducted virtual interviews, predicted enhanced post-test interviewing skills, and the latter predicted job offers after subsequent in-person interviews (Smith et al., 2017). These results concurred with those of Genova et al., (2021), who found that the likelihood of being hired increased in participants who used the VR-JIT, compared to participants who did not use the system.

Bozgeyikli et al., (2017a, 2017b) investigated the effectiveness of using VR for training for self-efficacy, whilst undertaking specific employment tasks, including stocking shelves, loading trucks, cleaning, and money management. These researchers found that all skill levels improved after using the VR4VR.

Further evidence concerning the efficacy of VR is supplied by two recent systematic reviews. Skjoldborg et al. (2022) reviewed studies (n=8) to evaluate the efficacy of VR interventions using HMDs for social and practical skill improvement in autistic individuals. They found that one study reported statistically significant results, one reported no change in abilities, and in the remaining six studies there were varying degrees of improvement. Overall Skjoldborg et al., (2022) concluded that the studies examined were not of strong methodological quality and therefore, firm conclusions about the efficacy of VR could not be drawn.

Carnett et al. (2022) also evaluated the role of VR in behavioural interventions designed to support independent functioning for autistic adults by synthesizing studies (n=10) that targeted vocational skills. Two of the studies reviewed were classified as methodologically strong, and eight studies were classified as adequate. These authors concluded that using VR to teach autistic people interview and driving skills can be considered an evidence-based practice.

Good Design Practices

Table 2 presents the characteristics of VR systems that autistic users have preferred.

Bozgeyikli et al., (2018) explored the impact of user interfaces with autistic users without ID (n=15) and a control group of NT people (n=15). Using a task in which participants identified the quality of boxes on warehouse shelves, they tested five aspects: instruction methods, clutter, motion, view zoom, and visual fidelity. They found that good design practices using VR included avoiding verbal instructions, unnecessary clutter or motion, and using animated instructions, low visual fidelity, and normal view zoom. They also recommended that wearable equipment be securely fitted as participants fidgeted with unsecured equipment indicating their discomfort. In addition, Bozgevikli & Bozgeyikli (2017b) also recommended that designs should build on the strengths of autistic individuals, who may pay close attention to detail and have a strong visual memory and that designs should accommodate the need for the user to feel in control. This means that games should not move backwards as a penalty, or have a blank screen for over 5 seconds (Bozgevikli & Bozgeyikli, 2017b).

Table 2 - Summary of Design Recommendations

Study ID	**Recommendation**
General recommendations	
Bozgeyikli et al., 2017; Smith et al., 2021	Human sounding avatars with human voices rather than computer-generated voices. Bright colours. Encouraging rather than negative words Object alignment in backgrounds should remain consistent to reduce distraction. Emphasis on the repetition of tasks. Clearly explained task instructions and prompts. Goals and objectives need to be clearly stated. Consistency in routine and structure throughout the training levels regarding relationships and rules.
Recommendations to prevent Cyber sickness	
Glaser et al., 2022; Schmidt et al., 2021	Simulation realism may be preferred but this may increase the risk of cyber sickness with HMD. Gradually acclimate user to VR system to minimize cyber sickness. Avoid concurrent multiple stimuli.

Future Research Directions

There are large variations between the VR systems and these impact the examination of learner interactions, how learning takes place, and its potential benefits (Glaser & Schmidt., 2021). To date, desktop applications have been frequently investigated and because these don't offer an immersive experience to users, it has to be questioned whether they are actually VR systems (Glaser & Schmidt 2021). Future research should develop a consensus in relation to the definition of VR.

One potential strength of VR technology is its ability to be individualised. This potential has not to date been fully exploited. Several VR training systems include levels of difficulty, but Skjoldborg et al. (2022) found no studies where the amount of sensory input into HMDs was adjusted.

Future research needs to investigate VR with individuals who have more severe autism and other co-occurring conditions including ID. This work should be undertaken by assessing and responding to the needs of individuals and employing a strength-based approach (Urbanowicz et al., 2019). This means the training content, process, and job opportunities should be matched to a person's identified strengths and skills.

Several studies have reported using iterative phases of development guided by user feedback. The use of user-centered design (UCD) processes needs to continue. Potential research-practice gaps will be reduced by close collaboration between all stakeholder groups from the outset and throughout the research. Indeed, the quality of UCD processes can now be measured using a validated instrument: the User-based Information in Designing Support (UIDS) (Zervogianni et al., 2020, 2023).

It is essential that research continues to examine the assumption that behaviour learnt in a virtual world will be used in real world situations. Therefore outcome measures of VR training in real life settings are needed to ensure that the VR learning processes have ecological validity (Skjoldborg et al., 2022).

Conclusion

This examination of the literature has found that the VR systems used with the aim of promoting workplace inclusion for autistic adults vary hugely regarding their levels of immersivity. Therefore the definition of VR needs clarification. The evidence concerning the efficacy of VR training in this context is currently inconclusive and RCT's are needed that include real

world employment outcomes and involve larger sample sizes. Future research also needs to employ USD principles that are informed by both the strengths and needs of individual autistic people.

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Gaming, Assistive Technologies, and Neurodiversity

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Abstract

In light of the significant influence of games within contemporary society, it is crucial to examine the processes via which they include or marginalise people with diverse characteristics, in order to promote inclusivity on a broad scale. The primary objective of this chapter is to analyse Assistive Technologies (AT) in order explore the potential benefits of gaming for those who are neurodivergent, particularly those diagnosed with Autism Spectrum Disorder (ASD). In order to achieve this objective, an examination is conducted on several current ATs designed to facilitate gaming, with particular attention given to the cognitive accessibility requirements commonly encountered by these individuals. The objective of this research is to spark a discussion on the utilisation of accessible gaming and AT as ways to empower individuals on the autism spectrum, foster social inclusion, and facilitate self-representation.

Keywords: Autism; Neurodiversity; Assistive Technologies; Gaming; Diversity.

Introduction

Video games constitute a significant component of the cultural and creative landscape, contributing more than 50% of the added value within the broader European Union audiovisual market. In key European markets, approximately half of the population aged between six and 64 has engaged in gaming activity within the past year. Furthermore, a significant majority of this group, specifically 76%, dedicate a minimum of one hour per week to playing video games. These statistics indicate that game playing can no longer be regarded as a niche form of entertainment. Therefore, the cultural impact of gaming extends to various domains, including artistic expressions, aesthetics, and popular culture (European Video Games Society [EVGS], 2021).

Given the prominent role of games in modern society, it is imperative to consider the processes by which they include or exclude individuals with diverse characteristics, with the aim of ensuring widespread accessibility. This chapter focuses mainly on the examination of assistive technology as a means to explore the potential benefits of gaming for individuals who are neurodivergent, specifically those with Autism Spectrum Disorder (ASD).

Gaming Assistive Technologies

Since the launching of the hand free controller for Nintendo Entertainment System (NES), in 1986 (Takeda, 2020) – frequently seen as the first artefact of mainstream gaming assistive technology – the existing hardwares to support this activity have been crucially evolved. The contemporary approaches have the XBOX adaptive controller (Figure 1) as a central figure, due to its adaptability to different games, accommodation needs, and even platforms – see "Using the XBOX Adaptive Controller on Playstation 5" (https://www.youtube.com/watch?v=AToh5B2prYM).

Figure 1 - XBOX adaptive controller being used (Source: https://www.xbox.com/)

Other hardware pieces frequently used include the Hori Flex Controller, the Praetorian Game on One, the Azeron Gaming Keypad, the Logitech G Adaptive Gaming Kit, and/or Titan Two. Even if we can consider that there is a lot of work to be done, most – if not all – of these technologies are based on control remapping methods to ensure accessibility, which emphasises a certain person-centred design notion, instead of an hardware-driven view. Regarding assistive software, mainstream approaches seem to remain centred around eye gaze gaming and related technologies (see Figure 2), as well as the use of voice control systems or the Microsoft's Copilot system.

Figure 2 - Eye Gaze Gaming (Source: https://www.specialeffect.org.uk/)

Approaching Neurodiversity

Although there seems to be a relatively structured and people-centred path for the evolution of assistive technologies for gaming, the concrete examples that exist still seem very much focused on motor accessibility needs, sometimes sensory, but not on neurodiversity/cognitive accessibility aspects. In this regard, customizable settings seem to assume a central role (Jaramillo-Alcázar et al., 2022; Sousa et al., 2022a). Such options provide users with the ability to personalise various settings, enabling them to modify elements such as the level of challenge, sensory stimuli (e.g., visual and auditory elements), and the arrangement of the user interface. The flexibility inherent in this approach allows for the accommodation of the unique requirements and sensitivities of individuals with autism who engage in gaming activities.

Another essential element pertains to the presence of text-based communication features within games (Manninen, 2003), which offer a convenient and regulated avenue for interaction, particularly for individuals who encounter difficulties with verbal communication or social engagements. This might enable individuals to actively participate with

fellow players based on their own preferences, thereby promoting a gaming environment that is more inclusive.

An additional crucial factor to be taken into account is the incorporation of sensory integration features within games (Li et al., 2012). These features enable users to exert control over or mitigate excessive sensory stimuli, such as rapid light changes or high decibel levels, thereby accommodating the sensitivities of individuals with sensory sensitivities.

Games that adhere to predictable patterns and provide structured gameplay can have the potential to yield significant advantages for individuals with autism, if we consider the premises of design for learning (Carrington et al., 2020), and the identified relevance of predictability (Jaramillo-Alcázar et al., 2022). The presence of a structured and coherent framework in these games can offer a sense of security, enabling players to effectively navigate and engage with the virtual environment.

For those individuals who have a preference for engaging in gaming activities on their own, the availability of a comprehensive single-player mode or the option to play offline holds significant value (Jaramillo-Alcázar et al., 2022). These characteristics afford players the opportunity to engage in games at their preferred speed, free from the demands typically associated with real-time multiplayer engagements, thereby facilitating a more serene and gratifying gaming encounter.

In order to mitigate stress and anxiety, game developers have the capacity to incorporate elements that circumvent the imposition of time constraints (Leite et al., 2019; Orme, 2021). For certain individuals with autism, the imposition of time constraints can elicit a sense of overwhelming pressure, thereby impeding their capacity to derive complete enjoyment from the game.

Furthermore, the inclusion of comprehensive progress tracking mechanisms and visually appealing representations of achievements (Leite et al., 2019) can serve as a crucial factor in fostering motivation among individuals diagnosed with autism.

For analogue games – and even though the board gaming community is considered particularly inclusive (Booth, 2021) – little has been explored about the ways in which assistive technologies can facilitate this activity. Besides the usage of alternative and augmentative communication, as in other social or playful situations (Pelosi et al., 2017), assistive technologies such as augmented reality are also being approached as paths to support

board game playing for individuals in the spectrum (Hsu & Lee, 2020).
Another noteworthy perspective to consider is conceptualising games as assistive technologies due to their unique characteristics, as they possess the capacity to support the daily activities of individuals on the autism spectrum. Ringland et al. (2016) emphasised the potential of Minecraft as a tool to facilitate social interaction among children with ASD and their peers.

Empowerment, Inclusion, and Activism

As in other areas of assistive technologies and critical disability studies, activism and self-representation have proven central to the evolution of more accessible and inclusive gaming (Anderson & Schrier, 2022; Guo & Ellis, 2023; Sousa, 2020).
AbleGamers and SpecialEffect are two well-known instances of these groups, both of which significantly contribute to the advancement of inclusivity and the improvement of the gaming experiences for players with disabilities (Sousa, 2020).
In 2004, Mark Barlet and Stephanie Walker established the nonprofit organisation AbleGamers, which has been in the forefront of promoting accessibility in the gaming sector. Their goal is to remove any obstacles that prevent people with disabilities from fully appreciating video games. By working together, AbleGamers teaches game developers about accessibility best practices and guidelines, promoting the development of games that are inclusive from the start. A wider range of players will benefit from the seamless integration of accessibility elements into game design thanks to this proactive approach (The Able Gamers Charity, n.d.; Barlet, 2020 July 14; Barlet & Spohn, 2012).
In addition, AbleGamers offers vital resources and assistance to gamers with disabilities, including funding for the purchase of specialised gaming gear and assistive technology made specifically for their need. By bridging the accessibility technology and gaming divide, AbleGamers enables people to actively participate in gaming while overcoming the constraints put on them by their disability (The Able Gamers Charity, n.d.).
The goal of SpecialEffect, a UK-based nonprofit established by Mick Donegan in 2007, is to make gaming accessible to everyone. They concentrate on developing specialised solutions for those with significant physical limitations so that they can play video games with the help of

adaptive technologies. SpecialEffect pioneers ground-breaking solutions that address the unique issues faced by gamers with disabilities by collaborating directly with developers and technical experts (SpecialEffect Charity, n.d.).

These self-advocacy groups have an impact that goes well beyond just one player. Their initiatives have increased awareness of the value of taking accessibility and inclusion into account when designing games within the gaming industry. Because of this, many game designers are now more aware of accessibility features and have begun to include them in their games on a regular basis.

Furthermore, discussing best practices and defining gaming accessibility guidelines have been important contributions made by both AbleGamers and SpecialEffect (Barlet & Spohn, 2012; SpecialEffect Charity, 2023). Their advice has grown to be an invaluable resource for game designers looking to make their creations more inclusive, fostering a sense of belonging and support for gamers with disabilities. These organisations offer places where people may interact, share experiences, and help one another through workshops, events, and online platforms, eventually promoting community building and a sense of belonging (Carey, 2011).

More generally, and bringing a type of intersectional accessibility to accessible and technology-supported gaming (Sousa et al., 2022b), the work of other activist organisations, such as Women in Games (https://www.womeningames.org/), Women in Games International - WIGI (https://www.getwigi.com/), UKBlackTech (https://ukblacktech.com/), or Qweerty Gamers (https://www.qweertygamers.org/) has also been fundamental. As an example, in July 2023, WIGI highlighted on its weekly newsletter – through the image on Figure 3 – the celebration of Disability Pride Month, through a collaboration between ES Gaming and Oxygen Esports to enhance inclusion and accessibility for 46 million people with disabilities in the United States.

Figure 3 - Activist image shared in the WIGI newsletter on the 26th of July 2023 (Source: http://giphy.com/)

Moreover, assistive technologies and other strategies to foster accessible gaming seem even more crucial if we consider the recent evidence of the potential role of both digital and analogue games in the promotion of a set of constructs related to empowerment and well-being, in neurodivergent individuals.

Regarding ASD, serious games have been shown to have a significant role in the promotion of social and emotional intelligence (Hassan et al., 2021), while some studies also emphasise the importance of entertainment (commercial) games to foster social skills (Silva et al., 2021). Specifically, analogue games have also been shown to foster rich in-person interactions, seen as central to meaningful interventions with some individuals with ASD (Atherton & Cross, 2021). Furthermore, game design has been progressively seen as a strategy to promote inclusive research, by including individuals with autism in knowledge production and, consequently, promoting their empowerment (Carlier et al., 2020; Waardenburg et al., 2022).

Conclusion and Future Directions

In conclusion, the evolution of gaming assistive technology has seen significant advancements in hardware, and also in software. Although advancements have been made, it remains imperative to prioritise the considerations of neurodiversity and cognitive accessibility. The incorporation of customizable settings is of the utmost significance in addressing the distinct needs of individuals with autism. The incorporation of text-based communication features within games serves as a regulated platform for interaction, thereby fostering inclusivity. The inclusion of sensory integration features enables users to effectively manage or reduce overwhelming sensory stimuli, thereby providing support for individuals with sensory sensitivities. The incorporation of structured gameplay,

inclusive single-player modes, and the elimination of time constraints can potentially augment the gaming experience for this group. Moreover, the examination of the utilisation of assistive technologies in analogue games and the conceptualization of games as assistive technologies can provide additional avenues to individuals who are on the autism spectrum.

Moreover, activism and self-representation have played a crucial role in advancing accessibility and inclusivity in gaming for players with disabilities. Organisations like AbleGamers and SpecialEffect have made significant contributions by promoting accessibility best practices, providing resources and assistance, and collaborating with developers to create adaptive technologies. These initiatives have increased awareness within the gaming industry about the importance of considering accessibility features and guidelines. Additionally, the work of other activist organisations, such as Women in Games and Qweerty Gamers, has also been instrumental in promoting intersectional accessibility and representation in gaming. The use of assistive technologies and inclusive game design has shown potential in promoting empowerment and well-being for neurodivergent individuals, particularly those in the autism spectrum.

Ultimately, the utilisation of assistive technologies and inclusive game design has proven to have the capacity to enhance empowerment and well-being among individuals who are neurodivergent, specifically those who are on the autism spectrum. In order to further expand the limits of accessibility, it is imperative for future research endeavours to prioritise the comprehension of the psychological and social ramifications associated with gaming assistive technologies. The inclusion of these players in the design process and the collection of their feedback can be of great significance in the development of assistive technologies that are both efficient and meaningful.

In addition, conducting an examination of the effects of policy initiatives and accessibility standards driven by the industry on the acceptance and execution of assistive technologies in gaming can yield significant knowledge on strategies to advance this domain. Through the cultivation of collaborative efforts among researchers, game developers, disability advocates, and user communities, a future can be envisioned wherein gaming becomes more accessible and enjoyable for all different individuals.

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Technological innovations for assessing motor impairments in autism spectrum disorder

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Abstract

There is an increasing demand for the identification of biomarkers and symptoms associated with Autism spectrum disorder (ASD) to enable its early detection. Substantial evidence indicates that individuals with ASD often experience motor skills impairments encompassing challenges with gross motor skills, fine motor skills, and gait-related issues. Nevertheless, conventional assessment methods for evaluating these motor skill deficits have proven ineffective for assessing children with ASD for various reasons. In view of this, the present chapter focuses on elucidating the utilization of technology-assisted approaches in the early detection of ASD. Research has demonstrated that wearable devices, video analysis, and sophisticated algorithms can deliver objective measurements, facilitate early intervention, and empower individuals with ASD. These findings highlight that technology possesses the potential to revolutionize the early detection and management of ASD, ultimately improving the quality of life for those affected by the disorder.

Keywords: Technological Innovations; Motor Impairments; Autism Spectrum Disorder; Early Detection; Wearable Devices.

Introduction

Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders characterized by impairments in social communication skills and restricted, repetitive patterns of behavior (American Psychiatric Association, 2013). The global prevalence of ASD has significantly increased, with approximately 1 in 54 children being diagnosed with the disorder (Maenner, 2020). The economic burden associated with caring for children with ASD is substantial, involving diverse expenses like healthcare services, therapy, support for families and the labor contributed by caregivers (Lavelle et al., 2014). As a result, there is a growing emphasis on understanding biomarkers and symptoms of ASD for early detection. Early detection allows for timely intervention, enabling children with ASD to receive appropriate therapies and support during critical developmental stages which in turn can significantly outcomes in areas such as communication, social skill, and cognitive development (Elder et al., 2017). Additionally, the timely detection of ASD empowers parents to seek appropriate professional help and make informed decisions regarding their child's development (Mitchell & Holdt, 2014). It also provides them with an opportunity to access resources, support groups, and education programs tailored to meet their child's needs.

Autism Spectrum Disorder (ASD) and Motor Skills

Recent research has sparked renewed interest in the motor development of young children with ASD, as evidence suggests that motor skill impairments may precede and potentially exacerbate the social-communicative symptoms observed in ASD (Harris, 2017; MacDonald et al., 2014). Children, adolescents, and adults diagnosed with ASD have been observed to display various motor impairments during standard motor assessments, which are typically designed for neurotypical individuals (for review see Gandotra et al., 2020; Garot et al., 2022). These impairments often manifest as poor coordination in tasks involving balance, ball play, agility, and speed. Additionally, studies have identified deficits in gross motor skills, such as running, jumping, ball catching, throwing, ascending stairs, jumping upwards, and balance-related skills like one-board balance, walking heel-to-toe, and hopping on mats (Ament et al., 2015; Mari et al., 2003). Furthermore, motor impairments extend to gait patterns, where individuals with ASD exhibit longer stance phases, shorter steps, altered

contact patterns, and differences in cadence, hip, and ankle kinetics (for review see Kindregan et al., 2015). Fine motor skill impairments are also evident, including difficulties in manual dexterity, holding and manipulating small objects, cutting with scissors, dressing skills, hand function during activities of daily living, writing skills, tracing, and prehension movement and planning (Green et al., 2009; Miyahara et al., 1997). Children with ASD have also been found to show delays in hand preference development and show qualitative differences in their performance (Pope et al., 2010). Challenges with imitating sequences of motor movements have been noticed as well (Mostofsky et al., 2006).

Motor Skills Assessment

Considering the motor difficulties exhibited by individuals with ASD, there is a clear need for motor assessments tailored to this population. Currently, the motor assessments of children with ASD relies on standardized instruments such as the the Bruininks-Oseretsky Test of Motor Proficiency 2nd edition (BOT-2) (Bruininks & Bruininks, 2005), Test of Gross Motor Development 2nd edition (TGMD-2) (Ulrich & Sanford, 2000), the Movement Assessment Battery for Children (MABC) (Henderson & Sugden, 1992), and the Battelle Developmental Inventory (BDI) (Guidubaldi et al, 1984). However, these tools are not suitable for effectively assessing children with ASD for several reasons (for review see Downs et al., 2020). These assessments often require subjective input from trained professionals, making them prone to bias. Moreover, they are time-consuming and tedious to rate. Additionally, the evaluation process can be tiring for the child. Furthermore, these assessments do not allow for evaluating children's behavior in everyday contexts, limiting their ecological validity. These limitations result in restricted access to these tests, leading to long waiting lists even in affluent countries (Batteh et al., 2023). In view of these challenges, technology assisted motor assessments provide new ways to characterize children's behavior in more natural contexts. Some of these technologies are briefly described below:

Technology assisted motor assessments

Postural Analysis: Children with Autism spectrum disorder (ASD) often experience frequent postural instability (for review see Lim et al., 2017). They exhibit a larger support polygon and take shorter strides which can

result in difficulties in maintaining head control sitting and walking (Nobile et al., 2011). Nintendo Wii™ Fit balance board (Nintendo, Kyoto, Japan), is a device that can be utilized to evaluate balance and postural stability. This device features sensors in its four corners and operates at a relatively high sampling frequency of 60 Hz. In a study using the Wii balance board to evaluate the balance and postural stability of individuals with autism spectrum disorder (ASD) found significant differences in postural stability between individuals with ASD and typically developing peers who were matched on age and IQ (Travers et al., 2013).

Motor stereotypies: Three-axis accelerometers and pattern recognition algorithms are commonly employed for the automated detection of body rocking and hand-flapping behaviors. Research (Albinali et al., 2009; Rad et al., 2018) have demonstrated that these pattern recognition algorithms have an average accuracy of approximately 90% in correctly identifying repetitive stereotypical motor movements. This effectiveness has been observed in various settings, including controlled laboratory environments as well as real-life ecological settings like classrooms (Goodwin et al., 2011).

Gait: Individuals with ASD exhibit altered walking patterns with numerous abnormalities such as toe-walking, variable stride length and duration, lack of coordination, abnormal head and trunk positioning, reduced plantar flexion, and increased dorsiflexion (for review see Kindregan et al., 2015). Infrared cameras are commonly employed for gait analysis, with the prevailing system being comprised of eight infrared cameras (Elite System™, Bts® Bioengineering, Milan, Italy). The utilization of multiple cameras enables to continuously track each body part, thereby minimizing occlusion issues. Nobile and colleagues (2011) utilized a system equipped with markers to analyze the walking patterns of children with ASD (N = 16) and a control group (N = 16) on a 10-meter walkway. The results revealed that children with ASD exhibited significantly shorter step length, wider step width, and marginally slower mean velocity compared to the control group. Furthermore, there was a notable reduction in the range of motion in the hips and knees. Similarly, another study employed automatic motion analyzer consisting of markers and six cameras (Vicon Motion Systems, Oxford, UK) to examine the steps of children with ASD (N = 11) and controls (N = 9). The findings showed that the steps of children with ASD were generally smaller and slower, there was increased variability in movements

of the head, shoulders, and hips compared to the control group (Longuet et al., 2012).

Grasping: Impairments in grasping can be assessed using different kind of technical aids such as infrared cameras, accelerometers, gyroscopes and more complex robotics systems. Additionally, the assessment of grasping abilities can also involve the use of sensors integrated directly into the objects of interest. One example is the work by Campolo and colleagues (2008), who developed a ball embedded with sensors to analyze the grasping patterns of children with ASD. Crippa and colleagues (2017) demonstrated that a three-dimensional infrared camera optoelectronic 60-Hz SMART D system™ (Behavior Tracking System Bioingegneria, Garbagnate Milanese, Italy) could effectively assess simple upper-limb movements. This system utilized markers placed on the wrists and hands of participants. By employing an SVM classifier based on seven features related to the goal-oriented part of the movement, the system successfully classified the movements of low-functioning children with ASD compared to controls. The system achieved an impressive accuracy of 96.7%. Similarly, Campione and colleagues (2016) utilized the same system to demonstrate that children with ASD exhibited a longer duration to complete the entire reaching movement.

Conclusion

The use of technology in the early detection of ASD through the identification of motor abnormalities holds great promise for improving outcome for individuals with ASD. By leveraging wearable devices, video analysis, and advanced algorithms, technology can provide objective measurements, facilitate early intervention, and empower caretakers of those with ASD. Despite the advancements, there are still obstacles to overcome in this field, which include the varying nature of motor abnormalities and ethical concerns related to recruiting participants for research studies. Nonetheless, with continues research and development, technology has the potential to revolutionize the early detection and management of ASD, ultimately enhancing the lives of individuals with ASD.

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Assistive Technologies in Psychomotricity Sessions with Children Diagnosed with Autism Spectrum Disorder

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Abstract
This chapter aims to describe how Psychomotricity can be beneficial for children with ASD through the use of ATs. We present a practical case of a seven-year-old girl whose main difficulties were establishing friendships and regulating her emotions, namely her aggressiveness. The results obtained after six months of follow-up revealed that the girl's interactions with peers and family, her academic performance, and her ability to participate in group activities improved as her communicative skills were progressively encouraged. Although ATs were not used in this practical case, we suggest adapting the instruments used, hypothesizing that their use will be even more beneficial in intervention with children with ASD in the context of Psychomotricity.

Keywords: Assistive Technologies; Psychomotricity; Autism Spectrum Disorder; Communication Skills; Intervention Adaptation.

Assistive Technologies (AT) are an increasingly explored domain in the context of neurodevelopmental disorders, as they aim to improve the functional capacities of people with disabilities (Boucher, 2018). As Autism Spectrum Disorder (ASD) is considered a disability of this nature, we present a use case of a girl with this diagnosis who participated in Psychomotricity sessions in which the use of AT was advantageous. Psychomotricity is the science that has as its object of study the human being in its relation to the external world through interactions with objects, other individuals, and oneself (Jesus, 2019). In this sense, the human's physical body is considered the tool that is essential to perform those interactions since it is the result of cognitive and organic acquisitions. This way, in Psychomotricity, attention should be paid to three main domains that are undoubtedly related to human development: movement, intellect, and affection.

According to Henri Wallon (n.d., cit. in Mahoney & Almeida, 2005), a child's development depends not only on their genome but also on the conditions of the environment where they are inserted, knowing that these conditions will promote her maturation through observation and experimentation. This way, there's a biological potential waiting for some external stimuli capable of initiating specific changes in the individual, leading to different behavioral responses. So, the assessment of a child's development could not be limited to just one perspective but through the analysis of several developmental domains, characterizing the human being as "genetically social" (Wallon, 1925, cit. in Mahoney & Chamorro, 2005).

On the other hand, the way children respond to different meaningful stimuli through their body movements will also benefit their neurological maturation. So, one could say that there is a multi-factor relationship that induces the growth of an individual as a whole. If initially there are primitive motor reflexes in infants whose function is to explore the world and its characteristics, later, when neurological maturation takes place, those reflexes are inhibited, being replaced by motor actions capable of expressing feelings and intentions (Wallon, 1925, cit. in Fonseca, 2010).

In other words, the origin of all types of movement and voluntary actions occurs due to our capabilities to interact socially. This predisposition depends on establishing meaningful bonds with what surrounds us and ourselves (Fonseca, 2010). Therefore, psychomotor therapy should focus on carrying out ludic-pedagogical activities that provide children with

ways of building their personality and maintaining the balance between personal affirmation and respect for others, which is only possible through the construction of relationships (Lapierre, 1968, cit. in Fonseca, 2010).
The practice of Psychomotricity with children diagnosed with ASD is essential to develop their cognitive, emotional, and social domains, educating the body and mind as a whole. For these children, it is often difficult to communicate (verbally and/or non-verbally) and express feelings through social interaction. These limitations can be characterized by difficulties in posture, facial expressions, and inappropriate gestures for the context, and by reluctance to share objects, make friends and participate in group activities (American Psychiatric Association, 2013). Regarding ASD and taking into account the most common symptoms presented in children with this diagnosis, the main purposes of AT focus on communication skills, social interaction, and independent living.

Practical Case

To begin with, it is important to keep in mind that psychomotor therapy is not exclusively aimed at intervening in a specific disorder such as ASD. Psychomotricity sessions intend to train the body and mind together through the development of multiple skills, such as communication, motricity, cognition, and affectivity, making Psychomotricity suitable for every person, even the ones without any diagnosed disorder.
Each session is unique, given the individual characteristics of both the person with disabilities and the therapist. Although the symptoms of a given disorder may be common to several individuals with the same diagnosis, some particularities differentiate each one, such as personal preferences, previous experiences, family context, and receptivity to new stimuli. So, the therapist must build an intervention plan oriented to minimize the difficulties experienced by the person with the disability, always focusing on these specificities. Thus, the activities chosen for the intervention plan should meet the child's interests to motivate them. In some cases, it is useful to let the child choose the activities and the materials they prefer to use. In this way, the therapist can get to know the child better and is able to assess their behavior and the intentional content represented in each activity. On the other hand, the child has enough freedom to decide what to do, so they will feel more comfortable and confident in establishing a bond with the therapist.

Example of Alice:

- Alice (fictitious name) is a girl that was diagnosed with ASD at the age of four;
- Before the diagnosis, she never had any therapeutic follow-up and started participating in psychomotor rehabilitation sessions with seven years old;
- Her mother's main concerns were her aggressive tone of voice and difficulty sharing toys with her two brothers;
- After talking to Alice's teachers, it was noticed that it was difficult to find an activity that motivated her during the classes and that her academic evaluation was below the average for the class;
- Her favorite hobbies were playing Super Mario on the console and watching cartoons, while at home. At school, Alice avoided spending breaks with her classmates and refused to participate in group activities.

In the first session, Alice was free to explore the therapy room and the available materials. The goal was for the girl to familiarize herself with the space and our presence, showing her that she was safe and could be herself during those sessions. In free and spontaneous activities, children "tell us" a little about themselves through their bodies (Araújo & Chamorro, 2021). They can choose whether to speak, shout or remain silent, whether they want to jump or sit, and whether they prefer to explore the space or show disinterest. And these types of behavior are essential for a therapist to know the main aspects to be worked on. The following sessions aimed to establish a bond with Alice, in which we chose to play games like the memory game (with cards), find hidden objects in the room, and touch an object of the intended color. At the same time, we asked questions about the girl and incited her to do the same about us. According to Araújo & Chamorro (2021), the act of playing is one of the most important ways to welcome a child, establish an affective bond and allow their independence and autonomy during Psychomotricity sessions through the development of motor, cognitive, and emotional domains.

Over time, we realized that Alice avoided talking about herself, even after some sessions in which verbal communication was already more fluid and confident. So, to overcome this barrier, we opted for the make-believe game using puppets, in which Alice could choose the puppets, create the characters and invent the story in her own way. The most interesting thing

about this activity was that Alice began to portray her life: how she saw her siblings, the tasks her mother asked her to do at home, and how her classmates treated her at school. And session after session, we discussed her feelings and frustrations about her day-to-day events and the possible reasons for explaining them. Through this activity, Alice became aware of her behavior. Whenever something happened during the week for which she could not control her aggressiveness, for example, this was discussed in the next session.

This example of the intervention with Alice shows us that the exclusive interaction between the therapist and the child is not always enough. In this case, using AT, such as puppets and other objects in the room, promoted Alice's trust and openness to talk about herself and act freely during the therapeutic sessions. In addition, the progress seen during the sessions was reflected in the improvement of interaction between Alice and her colleagues and family, so that communication was less aggressive and showed greater empathy. The psychomotor rehabilitation sessions lasted about six months, and it was expected that Alice would be monitored for some more time with the help of her family and teachers. In this sense, it would be beneficial for the work done during the therapy to continue. For that to happen, we give some suggestions in terms of the applicability of the AT used, given Alice's interest in video games and technology: i) replacement of puppets by interaction with virtual agents in an application for the tablet or computer; ii) promoting playing with didactic and educational games; iii) use of tangible objects for multi-sensory stimulation.

Changing the AT used during therapy to AT with a "more technological nature" will allow a child to be supported for a longer period of time throughout the week instead of just one day a week. In addition, these ATs will enable the child to gain a sense of autonomy when trying to solve problems by themself and, when this is not possible, to be able to interact with teachers and/or family for help, promoting social interaction. On the other hand, digital games have the advantage of having several characteristics through different visual and sound effects, which makes it possible to stimulate the senses while contributing to the child's cognitive development. And finally, because tactile experiences are very important, especially for children with ASD, the use of tangible objects can not only contribute to tactile stimulation but also allow children to recognize that every action on the object has a virtual consequence. This type of reasoning

can be reflected in the day-to-day life of these children, promoting self-awareness in their behaviors, leading to greater care with objects, other people, and oneself.

As previously mentioned, AT are designed to help people with disabilities to have more autonomy and to overcome the difficulties experienced. Through Alice's example, it is possible to verify that the use of AT in the context of psychomotor rehabilitation is essential to ensure greater effectiveness of the therapy, especially in improving interpersonal relationships. However, it is important to point out that ATs should not be restricted to the therapeutic context to allow people with difficulties to be independent in their daily lives, where the aid of family and friends is crucial. On the other hand, some of the currently existing ATs are not accessible to all people, either because of their price, size, or practicality of use, so it is increasingly relevant to explore and develop this scientific area, facilitating the inclusion of people with disabilities in society.

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A Study on the Use of Virtual Reality in Teaching Independent Living Skills to Individuals with Autism Spectrum Disorder

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Abstract

The aim of this section is to examine the research on virtual reality (VR) technology used in teaching independent living skills to individuals with Autism Spectrum Disorder (ASD). Recently, an increasing number of studies have been trying to find the best way to teach independent living skills to individuals with ASD and use technology-assisted intervention methods, which is one of the effective evidence-based practices. As one of these technologies, VR can facilitate the learning of individuals with ASD due to its features such as a high degree of interaction and immersion, controlling confusing stimuli from the environment and allowing students to learn while playing. In the examination, it is seen that individuals with ASD are taught mostly driving skills, fire and hurricane protection skills, and job interview skills through VR. For this reason, it is thought that there is a need to investigate how, in which contexts and with what kind of support VR technologies will be effective and productive in teaching independent living skills to individuals with ASD.

Keywords: Virtual Reality; Independent Living Skills; Autism Spectrum Disorder; Technology-Assisted Intervention; Immersive Learning.

Diagnostic features of ASD such as lack of social interaction and communication, limited repetitive behaviors and interests, deficiencies in attention, joint attention and imitation, and excessive adherence to routines continue throughout life. These basic features of disability can be expressed as one of the biggest reasons that prevent an individual from living an independent life with ASD (Hume & Loftin, 2009).

Candio (2019) states that among disability groups, ASD individuals have the lowest rate of independent living. In the National Longitudinal Survey of Transition-2 (NLTS-2) (Sanford et al., 2011), it has been reported that 17% of individuals with ASD can lead an independent life. This means that many ASD individuals need the support of their family or an adult to survive. Families with children with ASD expect their children to acquire various skills during the transition to adulthood after school. Among these skills, independent living skills such as shopping, ordering food on the phone or in a restaurant, using public transportation and having domestic skills are primarily expressed (Bahçalı & Odluyurt, 2020). It is important to gain independent living skills during the school period because education services decrease in the after-school period and it becomes difficult to acquire new skills (Smith et al., 2012), in a longitudinal study in which they followed the development of daily living skills (DLS) in individuals with ASD and Down Syndrome, concluded that both groups had developed IDD until their 20s, but the development of individuals with ASD stalled after these years. In addition, when individuals with and without ASD matched on the basis of their mental age are compared, it is seen that the daily life skills performances of individuals with ASD are lower than the other group (Liss et al., 2001). For all these reasons, the school period in which effective educational interventions are carried out is important in helping individuals with ASD acquire independent living skills.

One of the main responsibilities of special education schools is to provide the best service necessary for the child with special needs to become an independent individual. With this vision, “Individualized Education Plans” are prepared, adequate exercises, appropriately guided repetitions and opportunities to encourage generalization are created to offer the best learning experience. However, it can be challenging to do all these in a group with heterogeneous needs, where they all need intense support (Ayres et al., 2009). At this point, one of the applications that will help educators is auxiliary personnel support. Another is assistive technologies

that will support students' individual learning without the need for adult guidance. In the report of NPDC (The National Professional Development Center, 2015) and NAC (National Autism Center, 2015), it is stated that technology-based interventions (TTM) are one of the evidence-based practices frequently used in the education of individuals with ASD. Recently, various researchers and technicians have been developing various software and hardware such as computer-based tools, virtual/ augmented reality, mobile and tablet-based applications and robotics that can support or replace standard teaching methods (Esposito et al., 2017). There are various compilation studies/systematic review studies on what kind of technologies are used in teaching independent living skills to individuals with ASD. In the first review on the subject, Mecling's (2008) research is preliminary. In this research, 22 studies were found that provide information about four types of technology used to teach food preparation to individuals with ASD between 1986 and 2006. These are expressed as picture-based systems, Palmtop personal (hand-held) computer-based systems, audio systems and video-based systems. Gardner and Wolfe (2013), on the other hand, examined the studies in which independent living skills were taught to individuals with ASD only by video model and video hinting methods. Although the focus is not on individuals with ASD, another study on technologies used in teaching independent living skills is the study of Brok and Sterkenburg (2015). In this study, mobile technologies, robots and virtual reality technologies, which are self-controlled and used with temporary help, are examined. In the study of Çattık and Ergenekon (2019), however, the use of technology was not intended, but the results show that technology-based applications are mostly used in teaching independent life skills to individuals with ASD. One of the most recent studies on this subject is Hrabal et al. (2022) is a comprehensive literature review. In this study, 27 studies examining the effectiveness of various technologies in teaching independent living skills to individuals with ASD were reached. These studies a, it is seen that most of the methodically, video models and video tips are used, in which food preparation and cleaning skills are studied the most. In parallel, it is stated that the most commonly used devices are tablets, followed by computers, televisions and smart phones, respectively. In the researches above, it is seen that the technologies used in teaching independent life skills to individuals with ASD have also changed over time with the developing technologies. One of the current technologies in this

regard is mobile devices.

Devices such as iPod touch, iPad, and smartphones have universal design features such as being user-friendly, relatively inexpensive, and portable. The educational features provided to these devices can facilitate learning by providing the learner with the opportunity to practice as much as they want at their own pace, while providing the individual with the opportunity to be actively involved in the completion of the assigned task. These devices, which are suitable for use in daily life due to portability, self-management or greater social acceptance, also contribute to the use of technology by individuals with special needs (Mechling, 2009). Yeong et al. (2022) developed a video model-based e-book with an iPad device. This research consists of two stages. The first stage is the stage in which children with autism are taught to use the Ipad along with the sandwich and table cleaning skills. The second stage is the stage where the ASD individual learns the skills of making instant pasta, preparing a table and folding clothes by using the iPad independently. Visual differentiation is allowed on the cover pages to help them distinguish and choose from different educational e-books in the iPad design of this research. Visual cues (photos and icons), textual cues (words), audio cues/messages (voice recordings) are posted offline for easy accessibility. Mecling et al. (2009), ASD participants were given the option of touching the picture or watching the video section as a clue to perform the step in skill analysis. This design ASD provided a flexible usage feature by allowing the individual to use hints at the desired density. As can be seen, the interaction, individualization of education, accessibility, touch screen, photo, audio, video recognition features and ecological validity features of these technologies offer more customization opportunities to support the independence of ASD individuals and they are becoming more effective. One of the technologies that attracts great attention in order to gain skills is virtual reality

Hale and Stanney (2014) defined virtual reality (VR) as “a model of reality in which a person can interact, receive information from the model with ordinary human senses such as sight, sound and touch, and/or control the model using ordinary human actions such as location” (cited in. Glaser and Schmith, 2021). At the same time, VR systems that can transform the user’s experiences into a virtual environment provide a high degree of interaction and immersion (Bozgeyikli et al., 2018). It is stated that these features of VR help the ASD individual to understand the cues from the

natural environment more easily and to take action. Simulated virtual reality environments allow confusing stimuli from the environment to be controlled, allowing students to learn while playing. This situation enables individuals with ASD to learn important skills and can increase the possibility of transferring them to daily life. Research summary and synthesis studies on virtual reality environments show that this technology has a significant impact on the learning of individuals with ASD (Karami et al., 2021). The heterogeneity of the ASD group and the different possibilities and limitations of VR technologies reveal the problem of generalization in studies on this subject (Glaser and Schmidt, 2021). For this reason, it highlights the importance of design features in VR-based learning environments. In VR systems, the more realistic and real-world-like experiences VR provides, the more users behave in real-world situations. The users' perception of VR as a real experience is defined as the feeling of being surrounded and presence. Virtual reality glasses using CAVE realistic virtual graphics and interactions, producing spatial sounds or equipment that offer different realistic sensory experiences, strengthen the sense of presence (Gökoğlu and Çakıroğlu, 2019). When the studies in which independent living skills are taught to individuals with ASD in the VR environment are examined, in studies in which driving skills are taught (Bian et al., 2019; Wade et al., 2016; Zhang et al. 2017) eye tracking provides adaptive responses by the system and desktop VR technology offered with the Logitech 27 steering wheel set with add-ons such as eeg row. In the study in which fire and hurricane protection skills were taught (Self et al., 2007), desktop VR technology was used, in which software that helps to create realistic sounds and images such as 3DS Max 6.0 and EON Professional 5.0. In their study, in which job interview skills were taught (Smith et al., 2015), participants with ASD interacted with virtual characters representing the human resources manager in a large store by using desktop VR technology. In their 2008 study, Josman et al. taught the ability to cross a virtual street divided into four with desktop VR technology using fSuperscape's 3D Webmaster software. Bozgeyikli et al. (2017) designed virtual environments such as warehouses, grocery stores, open car parks, offices and streets with Unity software. In these environments, it is aimed to teach vocational skills by adding various distractors to the system. Apart from these single-user systems, there are also mobile-based VR environments that teach ASD individuals the ability to communicate with the police and job interview skills

in virtual environments that allow multi-user use (Parish-Morris et al., 2018; Strickland et al., 2013). When examining the presentation of instruction in VR studies in which independent living skills are taught to individuals with ASD, adaptive systems that give instant feedback according to the actions of users (Bian et al., 2019), video models and systems that use visual cues (Jarrold et al. , 2013; Self et al., 2007; Strickand et al., 2013), systems that provide feedback by the trainer or the system (Parish-Morris et al., 2018; Strickand et al., 2013) and virtual environments where the level of difficulty increases through distractors (Jarrold et al., 2013; Simoes et al., 2013). Generally speaking, it is seen that various devices that offer single-user or multi-user interaction are used in researches in which independent living skills are taught to individuals with ASD, the real world is simulated in the scenarios created, and feedback and interaction come to the fore. When the skills aimed to be taught to ASD individuals through VR are examined, it is seen that social skills and emotion recognition and discrimination skills are mostly studied, while daily life skills are less studied, as seen in the research of Sani Bozkurt (2021).

As a result, considering the limited number of studies on the teaching of independent living skills, the need to develop teaching tools that promote independence emerges. Another requirement arises as a result of the different effects of different technologies in the teaching of independent living skills. So much so that researchers may choose to use certain technologies to teach certain types of skills. For example, using mobile devices to teach daily life skills, robots to support interaction, VR technologies to teach dangerous skills. Therefore, there is a need to investigate how VR technologies will be effective and efficient in teaching independent life skills to individuals with ASD, in which contexts and with what kind of support.

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Enhancing Participatory Research with Neurodiverse Individuals: The Potential Role of Assistive Technologies in Facilitating Informed Consent

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Abstract

The following chapter aims to address the potential that assistive technologies can have in facilitating the participation of neurodivergent individuals in participatory research. Considering that their participation can help them to have meaningful participation in society, equal opportunities, advocate for their rights, show their point of view, and be valued as important and active members of society, it is crucial to have their presence when research impacts them directly. When recruiting this specific group of people is crucial to respect their self-determination and have accessibility as the front and center of the research. The use of assistive technologies can prove to be a great resource to facilitate interpersonal communication between the researchers, the consultants, and the participants, as well as to obtain informed consent or assent. Although there is some research developed about the barriers faced before, during, and after the whole research timeline, there is not enough when it comes to the role that assistive technologies can have in mitigating these barriers.

Keywords: Participatory Research; Neurodiversity; Assistive Technologies; Informed Consent; Accessibility and Inclusivity.

The term 'Neurodiverse People' emerged from the autism rights movement in 1998 (Kapp, 2020) and although is not yet well defined (Russell, 2020) it is usually used to refer to autistic people, as the neurodiversity movement is led by autistic people (Hughes, 2016; Kapp, 2020). Notwithstanding, Hughes (2016) defines 'Neurodiversity' as an umbrella term that includes the diverse variations of neurocognitive functioning, such as autism and intellectual disability, a vision shared by Dwyer (2022). This perspective embraces a more empowering notion in scientific discourse (Dwyer, 2022) including both neurodivergent people and neurotypical people (for more detailed information see Kapp, 2020 and Hughes, 2016). While using the term 'Neurodiverse People', we are distancing ourselves from the medical model of disability that frames disability as something that needs to be prevented, cured, and, overall, changed (Marks, 1997).

The Convention on the Rights of Persons with Disabilities was adopted in December 13th, 2006 and according to the last data available has been signed by 193 countries, of which: 186 are state parties, 8 are signatories and 4 took no action (for more details go here) (Office of the High Commissioner for Human Rights, 2006, 2023). In the article 3 of the Convention is possible to find its eight general principles of which we decided to highlight six, not intending to devalue the importance of the remaining two:

1) Respect for inherent dignity, one's self-determination and independence;
2) Non-discrimination;
3) Full and meaningful participation and inclusion in society;
4) Value diversity and embrace individuals with disabilities as integral parts of humanity;
5) Equality of opportunity;
6) Accessibility.

Why participating in research matters?

Having the opportunity to participate in studies can help them: have a meaningful participation in society, have equal opportunities, advocate for their rights, show their point of view and to be valued as important and active members of society that have different characteristics that need to be met. Accordingly, when research needs to have Neurodiverse people participating and/or supporting it is essential that while recruiting

to: not discriminate based on their need for support, respect their self-determination, needs and opinions, and have accessibility as front and center of the research.

One type of research where Neurodiverse People participate on equal grounds in research is participatory research. This method of research is commonly used when doing inclusive research with People with Neurodiversity, since its ideology is of a collaborative process of partnership that values equality and transparency. In this approach the person takes the role of co-researcher that contributes continually in the various phases of research process, for that it is necessary to disclose, clarify and inform the co-researchers of the complete process, which in turn will ensure that their experiences and knowledge are taken into account giving them the opportunity to be heard, having has a ending result better research (Boxall & Ralph, 2009; Morgan et al., 2014).

Moreover, for Participatory Research with Neurodiverse People to be successful it might be needed to use assistive technologies to facilitate interpersonal communication between the research, the consultants, and the participants. Assistive technologies (ATs) are any objects, either in physical form or digital, that support the well-being of individuals by helping them to increase, maintain or improve their functioning in normal life activities (Assistive Technology Industry Association, 2015; Austin & Holloway, 2022). Usually, this technology is used by people who have difficulties "speaking, typing, writing, remembering, pointing, seeing, hearing, learning, walking, and many other things" (Assistive Technology Industry Association, 2015) which includes not only people with disabilities but also older adults that due their longevity have difficulties in their day-to-day life. Addicionally, because ATs facilitate day to life activities they end up being used by everyone.

In this sense ATs can be (Assistive Technology Industry Association, 2015):

- Low technology, for example, communication boards;
- High technology, for instance, computers designed for specific purposes;
- Hardware, for instance, prosthetics;
- Computer hardware such as, specialized keyboards, mice and controllers;
- Computer software, such as, voice-to-write programs or screen reading software;

- Learning materials and curriculum aids, for instance, books written in braille;
- Specialized curriculum software, for example, enCORE (TeachTown, n.d.);
- Other types of objects, for example, eye-gaze and head trackers.

Regarding the participation of Neurodiverse People in research, some of the assistive technologies that might be used in order to facilitate their participation, understanding and communication are (Assistive Technology for Education, n.d.): communication and visual boards/augmentative and alternative communication; memory aids; mind mapping, brainstorming, and graphic organizers; among others.

Inquiring the potential role of assistive technology

Neurodiverse People are seen as vulnerable, as they belong to the group of people that are more subjected to harm, abuse, and exploitation (McDonald et al., 2017; Morgan et al., 2014; Scully, 2013). Due to the several protections implemented that were put in place to prevent them from exploitation, abuse and harm they encounter several barriers that prevent them participating in research (Hall, 2013; McClimens & Allmark, 2011; St. John et al., 2022).

Accordingly, when we are intending to or are carrying out research with People with Neurodiversity it is necessary to have several considerations, mainly when it comes to their willingness and interest in participating in research. One tool for verifying that is through informed consent or, if a guardian is needed to sign the informed consent, through assent. Both of these tools are extremely important for the study to have ethical approval and is allowed to commence, notwithstanding, it is in this crucial stage that most of the barriers occur (St. John et al., 2022; Strickler & Havercamp, 2023).

Concerning the obtaining of the informed consent the problem lays, mainly, in the lengthy process and words used in it can lead to difficulties in understanding what is written, which in itself can lead to frustration and need for help of others, something that can hinder their autonomy and self-determination (Strickler & Havercamp, 2023). Additionally, the worry about potential harm, abuse, exploitation and coercion are also present (Goldsmith & Skirton, 2015).

Finally, regarding the process to obtain assent from the participants, this

is where the assistive technologies can become a great ally to both the potential member of the team with Neurodiversity and the rest of the team. Assent is when the person who will participate in the study did not sign the informed consent and when asked if they want to participate answers affirmatively to the question, if they respond negatively then is dissent (Meierer et al., 2022). Neurodiverse People and Neutotypical People may have difficulty communicating between them if they do not know each other beforehand, and during the assent and dissent process it is fundamental that both parties understand what is being communicated. As such, using assistive technology that facilitates interpersonal communication both ways can be instrumental to their participation.

Summarizing, one way of promoting the autonomy of People with Neurodiversity could be through the use of assistive technology during (but not limited to) the informed consent/assent/dissent process.

With this being said, in order to understand if People with Neurodiversity feel the need to use assistive technologies, while being part of a participatory research, we will be conducting two different studies that intertwine with each other. The first is related to the development of a PhD thesis, developed on the scope of the GameIN project (2022.07939.PTDC), where we will work alongside Neurodiverse People. In the PhD thesis, we propose to develop guidelines to help create accessible game rulebooks for Persons with Neurodiversity, as a strategy to foster their autonomous engagement in playing analog games. The GameIN project, on the other hand, has as its aim to create a game toolkit to be enjoyed by everyone, including Persons with Neurodiversity.

In both cases, Participatory Research will be implemented as the involvement of Neurodiverse Persons is fundamental for its success and implementation. Therefore, it is important to understand what's the best strategy to eliminate the barriers associated with consent and/or the (in) capacity to consent, either by the use of assistive technology or another method.

The research will be divided into three main parts to have a better understanding of the barriers that Neurodiverse People face while being part of Participatory Research regarding informed consent and/or the (in) capacity to consent, of which (Figure 1):

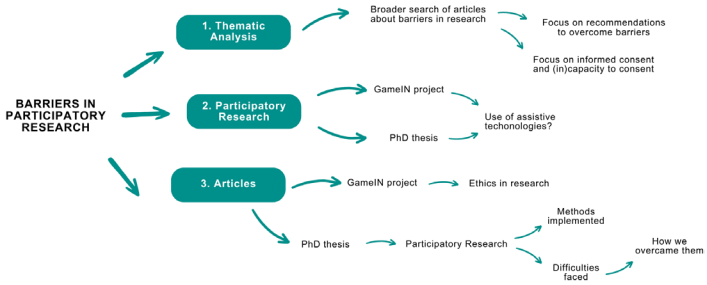

Figure 1 - Mind-map of the research methodology

For the first part of our research, we are doing a thematic analysis based on the parameters established by Braun and Clarke (2006). For this analysis, we searched for articles that mention the several barriers that People with Neurodiversity face while participating in research and came upon five main dimensions:

1) Research accessibility
2) Power imbalances
3) Vulnerability
4) Self-Determination
5) (Un)ability to consent
6) Informed Consent
7) Methodological approaches

After the first phase, and based on the information collected, we will be doing several Participatory Researches in the GameIN project and in the thesis, where assistive technologies can be used to facilitate the communication among and between the team, the participants and the consultants.

The last phase will consist on the elaboration of two articles: one about ethics in research that has the participation of Persons with Neurodiversity, which will be done under the scope of the GameIN project, and the other, which will be related to the PhD thesis, will consist on describing the methods that were implemented in the Participatory Research to minimize, as much as possible, the barriers faced by the group, as well as the difficulties that we faced and what we did to overcome them in the research.

At the time of the writing of this chapter we are on the first part of this proposal, very close to finalizing the report.

There is still a lot more work to be done

Although there is some research developed about the process of obtaining informed consent with People with Disabilities and the several barriers faced during that period (McDonald et al. (2009, 2017), McDonald and Kidney (2012), Mietola et al. (2017), Munford et al. (2008), St. John et al. (2022), Strickler and Havercamp (2023), Van Goidsenhoven and De Schauwer (2022), to name a few), there are not enough when it comes to studying the possibilities that assistive technology can have on promoting a safe, autonomous and self-determination research.

The same is valid when it comes to the barriers faced before, during and after the whole research timeline, including but not limited to the ethics committee approval, the recruitment of Neurodiverse People, working with this group in research and the dissemination of results. It is also important to acknowledge that there is a lack of awareness in ethics committees about the capabilities of this group and what can be done to overcome obstacles to the participation of People with Neurodiversity, which can be the fruition of the lack of research and training, as maintain by Boxall and Ralph (2009, 2011), Dee-Price (2020), Martino and Schormans (2018), and Northway et al. (2015).

Also, there are some similarities between the approaches that are done when recruiting and developing research with People with Disabilities and children. So I end this chapter with the following question: Do these similarities happen by chance and are nonetheless valid and correct or do they occur because people without disabilities view People with Disabilities as 'eternal' children?

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Implementing Intervention Studies with Autistic People and Digital Technologies in Natural Settings: a Guide to Best Practice

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Abstract

With the rapid advance of technological developments and the ongoing increase in the number of studies that evaluate the efficacy of its use in autistic people, the need arises to do so with increasing scientific rigor and provide researchers and participants (e.g., professionals and families) in these studies with a framework that guides them in this practice. This chapter presents a ten-steps best-practice guide to successfully implement intervention studies that are aimed at improving skills in autistic people and use digital technologies. Key aspects such as selecting the most appropriate technology or applying the most suitable research design are included in the guide, which is based on the authors' perspective to empower autistic people and professionals who work with them, with the ultimate aim of bridging the gap between science and practice. This guide is especially valid for studies aimed at autistic people who also have intellectual disability, as in every step, the needs of this vulnerable collective are considered.

Keywords: Intervention Studies; Autistic Individuals; Digital Technologies; Natural Settings; Best Practices.

With the rapid advance of technological developments and the ongoing increase in the number of studies that evaluate the efficacy of its use in autistic people, the need arises to do so with increasing scientific rigor and provide researchers and participants (e.g., professionals and families) in these studies with a framework that guides them in this practice. This chapter presents a ten-steps best-practice guide to successfully implement intervention studies that are aimed at improving skills in autistic people and use digital technologies (e.g., tablet applications or augmented reality games). By intervention study we refer to any psychoeducational action which implies the implementation of a series of sessions with one or more improvement targets. This guide is based on the authors' perspective to empower autistic people and professionals who work with them, with the ultimate aim of bridging the gap between science and practice.

1. ***Purpose of the intervention.*** It is of paramount importance to have a clear objective of what the intervention is for. What is the skill that needs improvement? What do we and what do we not know about this skill? What kind of change would be considered clinically significant? Previous intervention studies as well as systematic reviews and meta-analyses available in the field can be highly informative (e.g., Soares et al., 2021). One should also have a good understanding of the social validity component: Is the chosen target skill really needed for the participant? For instance, would an improvement in this skill actually help their development or social inclusion? Besides, given the time and possible other costs associated with the implementation of an intervention, there is an important ethical component: Is my intervention purpose important enough to justify participation instead of other activities that could be equally beneficial? This question calls for a cost-benefit analysis. Finally, given its potential contribution to the validity of the technology-mediated intervention (TMI) study, one should consider involving autistic people in the cocreation of the intervention and study design, following well-established principles of participatory design research (Benton, Johnson, Ashwin, Brosnan, & Grawemeyer, 2012).

2. ***Technology selection.*** In line with the previous, a proper technology selection is always necessary, and this should be done in the context of an appropriate person-technology matching. As suggested by Odom

et al. (2015), researchers should check if there is a good fit between stakeholders involved (autistic participants as well as practitioners and caregivers who are supporting these participants in their technology use), the technology selected, and the activity in which that technology is to be used. If a particular technology is going to be used as the central element of the intervention, its usability needs to be tested prior to the start of the intervention study, as a low usability score would negatively affect the desired intervention effect (Mazon, Fage, & Sauzéon, 2019). Finally, the Technology Readiness Level (TRL; European Commission, 2014) of the digital technology should be compatible with the research questions formulated, with the setting where it will be tested and with the research design to be followed (see the next step: '3. Research design').

3. ***Research design.*** To evaluate the effect of a TMI, a wide range of research designs can be applied. Traditionally, randomised controlled trials (RCT) have been considered the gold standard for effectiveness research as it allows for establishing a cause-effect relation between the intervention and outcomes of interest. However, a high-quality RCT requires many resources including samples of sizes that in the context of autism intervention research are not always feasible. For example, in a simple experiment with an experimental treatment group and a control group in which participants undergo individual intervention and have one outcome measurement at the end of the study, to have an 80% chance of detecting a moderate effect, one would need a total of $N = 128$ participants equally divided over the two groups (Leppink, 2019). One can considerably reduce the number of participants in an experiment by increasing the number of measurements per participant (Leppink, 2019, 2020). Besides, designs that include series of measurements both before and after intervention, can help to establish trends in outcome variables of interest prior to intervention (e.g., practice effects) and after intervention (Maric & Van der Werff, 2020) and can help researchers to study non-linear trajectories in skill development (Leppink & Pérez-Fuster, 2019). For these and other reasons, single-subject designs (SSDs, also called single-case designs, SCDs; Parker & Brossart, 2003; Tanious & Onghena, 2021; Van de Schoot & Miocevic, 2020), such as reversal or multiple baseline designs, have become more and more popular in the field as an alternative to traditional group-based experiments with one or two measurements per participant (Leppink, 2020, 2022; Maric &

Van der Werff, 2020). SSDs allow for analysing data both at group level (as in traditional experiments with larger groups but fewer measurements) as well as individually, and the latter is highly desirable in many TMI studies. If well conducted, applying all possible controls, SSDs do not necessarily offer less methodological rigor than traditional experiments and can still contribute to the establishment of evidence-based practices (Reichow, Volkmar, & Cicchetti, 2008). In any case, it is the research question that should guide the selection of the research design, and what constitutes the 'gold standard' method should be the one that reliably provides the information needed, and what can be done in the context and individual situation at hand (Cartwright, 2007).

4. ***Autistic participants.*** To select the autistic individuals who are participating in the study, it is necessary to establish inclusion and exclusion criteria. These criteria, which in our field often include aspects related to age, sex, a specific diagnosis, the lack of a skill and the presence or absence of previous technology use, should be carefully selected according to the research question and then applied to the potential participants to get the final sample. For the criteria to be adequately applied, it is fundamental to previously gather information from participants directly, using standardised assessments, for instance, and/or indirectly interviewing the people who know them best, such as their family or the professionals who work with them. Obtaining information with regard to their strengths and weaknesses, desires and fears, interests and needs, sensory issues and communication system, among others, is important not only for sample description purposes but also to make all the necessary adaptations, especially when using highly adaptable or customised technologies.

5. ***Other study participants.*** In line with the previous and based on the Person Centred Planning (PCP) approach (Sanderson, 2000), the intervention study should consider the participation of all the agents who can positively contribute to the success of the intervention, including family and community members, professionals and/or peers. For example, it is very common to include teachers as participants in TMI studies aimed at improving skills in schools. This is because the children's teachers are the ones who most likely know how to teach them best so they first get trained by the researchers on how to deliver the intervention and then

the teachers implement the study sessions to the children (Pérez-Fuster, Herrera, Kossyvaki, & Ferrer, 2022). This situation can be facilitated by implementing the intervention in natural settings such as a school where teaching-learning situations generally take place rather than in non-natural settings such as a university laboratory, which generally require a familiarization process and can make generalization more difficult.

6. ***Study materials.*** A part from the digital technology formed of hardware (e.g., smartphone, personal computer) and software (e.g., mobile app, augmented reality technology game) that is used to deliver the intervention, there are many other materials that can be used in this type of intervention study. For instance, a social validity questionnaire can be addressed to families and professionals to evaluate the importance of the target skill as mentioned previously. In addition, a procedural fidelity protocol (Ledford, & Gast, 2014) and a study calendar can be created to help the interventionists to meticulously follow the study sessions as planned. When neither standardised nor non-standardised assessments are available for what we aim to measure, ad hoc assessments can also be created, although the associated limitations also need to be considered. A satisfaction questionnaire addressed to participants can be a valuable tool for the researchers to learn about their experience interacting with the technology beyond the effects of the intervention on the target skill. All these materials, together with the participant inclusion and exclusion criteria discussed in step 4, the intervention procedures and the consent forms that participants – or legal guardians in case of children or individuals with disability – need to sign, should be submitted to acquire approval from an official Ethics Committee or Institutional Review Board, which may be part of the institution at which the study is to be carried out.

7. Interventionist training. To aim for the highest ecological validity, the intervention is best delivered by someone who knows the autistic participant well, such as the teacher in a school setting. For this, researchers need to implement specific training to teach the interventionist (e.g., teacher) how to use the study materials, including the procedural fidelity protocol, how to conduct the sessions with the technology, as well as how data should be collected (e.g., video recording, written notes) and safely stored according to official standards typically required for the corresponding ethical

approval and including laws and regulations such as the European Union's *General Data Protection Regulation* (2016).

8. ***Technology experience.*** Previous exposure to technology in general and to the particular technology used in the intervention should be documented and accounted for. Technology safety is also important and some technologies (e.g., immersive virtual reality) may require some exclusion criteria to avoid possible side-effects (e.g., not including participants with a personal or family history of epilepsy, migraines, or vertigo). In any case, safety should always be top priority and can be guaranteed with the close supervision of those who know the autistic participant well, with the support of after-session safety questionnaires and interviews via which possible adverse effects can be easily identified and reported.

9. ***Effective communication.*** In intervention studies, many agents are generally involved, including the autistic participants, the interventionists, other professionals from the centres where the studies are being conducted, and families. For an intervention study to be successful, it is necessary to establish a communication system that allows all stakeholders involved to effectively communicate throughout its implementation. Special attention needs to be given to autistic participants who use alternative communication systems (e.g., Picture Exchange Communication System) as they should be able to communicate at all times during the study sessions. Having a continuous information exchange across all agents allows for faster solutions when there are implementation issues. Also, facilitating a communication channel, the researcher gets valuable information which can complement other data collected and inform future studies.

10. ***Dissemination.*** The researchers should communicate the results obtained to all stakeholders involved in the study. This can be done in different modalities, from a written research report to an oral presentation with visual aids, but preferably using plain language and as accessible as possible. They should also be informed of other publications such as scientific conference papers or journal articles that have been created as a result of the study in which they have participated. When the TMI results are positive because there has been an improvement in the target skill, this practice allows teachers and other professionals to spread the work done

among other colleagues and facilitate its replication with other participants in other places, increasing the chances for the establishment of evidence-based practices in the field (Reichow et al., 2008).

To conclude, although the ten steps in the above guide need not be followed in the exact order presented in this chapter, it can help researchers to design effective TMIs for autistic people. This guide is especially valid for studies aimed at autistic people who also have intellectual disability, as in every step, the needs of this vulnerable collective are considered. Finally, it is recommended that researchers who design TMIs to improve a given skill in autistic people do so considering the life cycle perspective prioritizing their empowerment and what can help to promote their independence and wellbeing.

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Building an Inclusive Future: Empowering Through Assistive Technologies

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Abstract

This chapter explores the pivotal role of assistive technologies in advancing empowerment and inclusion for individuals with disabilities. With over 1.3 billion people globally living with disabilities, this chapter emphasizes the urgency of breaking down historical barriers and enabling equal participation. Assistive technologies, ranging from basic aids to advanced innovations, are powerful equalizers that enhance functional capabilities and promote independence. They play a transformative role in education, employment, and social engagement, ensuring that individuals with disabilities can access quality education, join the workforce, and connect with their communities.The chapter underscores key best practices, including user-centered design, adherence to accessibility standards, continuous improvement, training and support, and fostering collaborations among stakeholders. These practices are essential in realizing the full potential of assistive technologies and ensuring they become an integral part of an inclusive society. Embracing these best practices unlocks the unique abilities of individuals with disabilities, empowering them to contribute meaningfully to their communities and create a better world for all. Policymakers, educators, employers, and society at large must recognize the significance of assistive technologies and invest in their development and widespread adoption to build a truly inclusive future.

Keywords: Assistive Technologies; Inclusion; Empowerment; Disabilities; Best Practices.

The World Health Organization (WHO) estimates that over 1.3 billion people worldwide live with some form of disability, making up approximately 16% of the global population (WHO, 2023). Historically, individuals with disabilities have faced numerous obstacles in their quest for equal participation and opportunities. Social stigmatization, lack of accessibility, and limited access to education and employment opportunities have hindered their journey towards empowerment and inclusion.

Assistive technologies act as a powerful equalizer, breaking down barriers and providing tailored solutions to meet the specific needs of individuals with disabilities (WHO, 2023). These technologies encompass a wide range of devices, software applications, and support systems designed to augment and improve functional capabilities. From simple aids like wheelchairs and hearing aids to sophisticated innovations such as speech-to-text software and brain-computer interfaces, assistive technologies cater to diverse needs, promoting independence and autonomy.

The importance of embracing assistive technologies as a means of fostering empowerment and inclusion cannot be overstated. When individuals with disabilities gain access to the right assistive tools, they can unleash their talents, pursue education, join the workforce, and contribute to society in meaningful ways. Moreover, an inclusive society that values and accommodates the diverse abilities of all its members benefits from the collective potential and unique perspectives of its citizens (EPRS, 2018)

This chapter delves into the significance of assistive technologies in driving empowerment and inclusion for individuals with disabilities. It explores the transformative impact of these technologies and emphasizes the best practices that can lead to positive outcomes in their development, implementation, and adoption. By understanding and implementing these effective strategies, we can build a more inclusive future where every individual, regardless of their abilities, can thrive and participate fully in society.

Importance of Assistive Technologies

Assistive technologies are transformative tools that empower individuals with disabilities to lead more independent, fulfilling lives. These technologies encompass a diverse array of devices, software, and support systems designed to address the unique challenges faced by people with disabilities. By leveraging the power of innovation, assistive technologies

enhance functional capabilities and bridge the gap between abilities and challenges, ultimately fostering empowerment and inclusion (Zapata, et al, 2023). This section explores the multifaceted importance of assistive technologies in driving positive outcomes for individuals with disabilities and references their impact on education, employmnt, and social engagement.

Education

Access to quality education is a fundamental right for every individual, regardless of their abilities. Assistive technologies play a pivotal role in ensuring that students with disabilities can participate fully in the learning process. For example, screen readers and text-to-speech software enable individuals with visual impairments to access digital content, including textbooks, research articles, and online resources (Matraf et al., 2023). Similarly, speech-to-text software facilitates communication and learning for those with motor impairments or learning disabilities (Thapliyal, et al. 2023).

Assistive technologies also enhance classroom interactions, enabling students with hearing impairments to follow lectures through real-time captioning or sign language interpretation. Moreover, specialized educational software can cater to different learning styles, providing personalized learning experiences for students with cognitive challenges. By promoting equal access to education and tailoring learning experiences, assistive technologies empower students with disabilities to reach their full potential academically and intellectually (UNESCO, 2017).

Employment

Meaningful employment is a crucial factor in promoting the social and economic integration of individuals with disabilities. However, many face barriers in accessing the job market due to the mismatch between their abilities and the demands of traditional work environments. Assistive technologies bridge this gap by enabling individuals with disabilities to perform a wide range of tasks and contribute effectively to the workforce (Roth, et al., 2023).

For instance, adaptive keyboards and voice recognition software empower individuals with physical disabilities to type and operate computers with ease (Malalasekara, 2023). Virtual reality (VR) applications and haptic feedback devices can facilitate skill training and enhance the employability

of individuals with mobility impairments (Fu & Ji, 2023). Additionally, assistive technologies, such as communication aids and assistive listening devices, promote effective communication between employees with hearing impairments and their colleagues, facilitating teamwork and cooperation (le May & Elbourne, 2023).

By creating inclusive work environments and fostering the adoption of assistive technologies, employers can tap into the diverse talent pool of individuals with disabilities, leading to enhanced productivity and innovative problem-solving (WHO & ILO, 2020).

Social Engagement

Social connections are vital for well-being and a sense of belonging. Unfortunately, individuals with disabilities often face isolation and limited opportunities for social participation. Assistive technologies break down these barriers by facilitating communication, social interactions, and community engagement.

Social media platforms, accessible video conferencing tools, and captioned online content enable individuals with disabilities to connect with friends, family, and like-minded communities, regardless of physical distance (Erskine, 2023). Mobile apps and GPS-enabled devices provide navigational support and facilitate independent travel for those with visual impairments or mobility challenges.

Furthermore, assistive technologies enhance recreational and cultural experiences, allowing individuals with sensory disabilities to enjoy music, art, and entertainment. As a result, individuals with disabilities can actively participate in social activities, fostering a sense of belonging and reducing feelings of isolation (United Nations, 2006).

Key best practices

Assistive technologies are indispensable tools that empower individuals with disabilities, enabling them to overcome challenges and participate actively in society. By removing barriers to education, employment, and social engagement, these technologies promote empowerment and foster a more inclusive future. Embracing and advancing assistive technologies is not just a matter of providing accommodations; it is a commitment to creating a society where diversity is celebrated, and the unique abilities of every individual are harnessed to drive positive change.

Assistive technologies empower individuals with disabilities by enabling them to perform tasks that might otherwise be challenging or impossible. These technologies range from simple tools like hearing aids and magnifiers to complex devices such as screen readers and brain-computer interfaces. By removing barriers and providing tailored solutions, assistive technologies open doors to education, employment, and social engagement.

User-Centered Design

One of the key best practices in the development of assistive technologies is a user-centered design approach. It involves actively involving people with disabilities in the design process, from the conceptualization stage to final product testing. By including end-users in the development process, designers gain valuable insights into the specific needs and preferences of the target audience. This collaborative approach ensures that the technologies are truly effective, intuitive to use, and relevant to the users' needs (Torrens & Asghar2023).

Accessibility Standards and Guidelines

Another vital aspect of fostering inclusion through assistive technologies is adhering to accessibility standards and guidelines. These guidelines, such as the Web Content Accessibility Guidelines (WCAG) and the Universal Design principles, ensure that digital platforms and physical environments are designed to be accessible to all, including those with disabilities. By adhering to these standards, developers can create technologies that are usable by a wide range of individuals, promoting equal access to information and services (de Witte, et al.,2018).

Continuous Feedback and Improvement

To ensure that assistive technologies remain effective and relevant, it is essential to establish mechanisms for continuous feedback and improvement. Regularly seeking input from users and stakeholders allows for the identification of potential issues and areas for enhancement. This iterative process of feedback and improvement ensures that assistive technologies adapt to the evolving needs of users and continue to deliver positive outcomes (Cowan, et al., 2012).

Training and Support

Adopting assistive technologies successfully requires appropriate training and ongoing support. Users need to be equipped with the necessary knowledge and skills to operate these technologies effectively. Moreover, providing accessible training materials and technical support can enhance users' confidence and overall experience with assistive technologies. Training initiatives should extend not only to the users but also to educators, employers, and service providers to foster a more inclusive environment (Mavrou, 2011).

Collaboration and Partnerships

Building an inclusive future through assistive technologies demands collaboration and partnerships among various stakeholders. Governments, non-governmental organizations, academic institutions, industry leaders, and disability advocacy groups can all play pivotal roles in creating an ecosystem that promotes the development, implementation, and adoption of assistive technologies. Collaboration fosters knowledge sharing, resource pooling, and the creation of innovative solutions that address diverse needs (Boger, et al., 2017).

Conclusion

Assistive technologies hold immense potential in creating an inclusive future where individuals with disabilities can thrive, participate fully in society, and lead empowered lives. The importance of adopting user-centered design, adhering to accessibility standards, continuous improvement, training and support, and fostering collaborations cannot be overstated. By embracing these best practices, we can drive positive outcomes and ensure that assistive technologies become an integral part of an inclusive society, where the unique abilities of every individual are celebrated and leveraged to create a better world for all.

Assistive technologies stand as a beacon of hope in building an inclusive future, where the barriers that once marginalized individuals with disabilities are dismantled, and empowerment and inclusion become the norm. The transformative impact of these technologies cannot be understated, as they serve as powerful tools to bridge the gap between abilities and challenges, fostering independence, and enabling individuals with disabilities to lead fulfilling lives.

To unlock the full potential of assistive technologies, it is essential to adopt best practices that align with the principles of empowerment and inclusion. User-centered design ensures that the technologies are purpose-built to address the specific needs and preferences of the end-users, empowering them to fully engage with the technology and enhance their quality of life. By actively involving individuals with disabilities in the design process, developers gain valuable insights, ensuring that the technologies are not only effective but also user-friendly.

Moreover, adhering to accessibility standards and guidelines is crucial in creating a society that values diversity and equal access for all. By incorporating principles like Universal Design and complying with WCAG, digital platforms, and physical environments become inclusive spaces, ensuring that individuals with disabilities can participate fully in all aspects of life.

Continuous feedback and improvement are fundamental in keeping assistive technologies relevant and effective. By seeking input from users and stakeholders, developers can identify areas for enhancement and iterate on the technologies to better meet evolving needs. This ongoing process of improvement guarantees that assistive technologies remain cutting-edge, supporting the diverse requirements of individuals with disabilities.

However, the successful adoption of assistive technologies extends beyond just providing the tools; it requires comprehensive training and support. Empowering users, educators, employers, and service providers with the necessary knowledge and skills ensures the seamless integration of assistive technologies into various contexts. Accessible training materials and technical support bolster users' confidence, encouraging them to embrace these technologies fully.

Fostering collaboration and partnerships across various sectors is equally vital in realizing the full potential of assistive technologies. Governments, non-governmental organizations, academic institutions, industry leaders, and disability advocacy groups must work together to create a synergistic ecosystem that facilitates innovation, resource-sharing, and the development of sustainable solutions. Collaboration fuels progress, helping accelerate the adoption and integration of assistive technologies into society.

By embracing these best practices, we can pave the way towards an

inclusive society where the unique abilities of every individual are celebrated, valued, and harnessed to drive positive change. Assistive technologies are not just tools for accommodation; they are catalysts for transformation. When individuals with disabilities are empowered through these technologies, they become active contributors to their communities, enriching society with their talents and perspectives.

As we move forward, it is crucial for policymakers, educators, employers, and communities at large to recognize the significance of assistive technologies and invest in their development and widespread adoption. Only then can we create a truly inclusive future where every individual, regardless of their abilities, can thrive, participate fully in society, and lead empowered lives.

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