

a-STEP

REPORT ON

BEST PRACTICES

Working Group 2
Carla Sousa and Alan H. Tkaczyk

Subgroup 2.2 Leader
Gerda Sula

D2.2 Report on Best Practices in Assistive Technologies for Social Inclusion of Individuals with ASD and/or ID

a-STEP Working Group 2: Carla Sousa, Alan H. Tkaczyk

Subgroup 2.2 Leader: Gerda Sula

Authors

Gerda Sula

Katerina Mavrou

Jo Daems

Merita Hoxha

Karolina Bolesta

Snezhana Kostova and Anna Lekova

Tali Heiman and Dorit Olenik-Shemesh

Alice Mandelli and Patricia Pérez-Fuster

Introduction

Computer Assistive Tecnology

Virtual Reality

Wearable Technologies

Artificial Intelligence (AI)

Robotic Devices

Apps

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1. Introduction

The pursuit of enhancing social inclusion for individuals with Autism and Intellectual Disabilities (ID) has prompted the development of various Assistive Technologies (AT). These technologies aim to provide personalized support, facilitating communication, social interaction, and skill development. The categories of AT explored in this document include computer AT, virtual reality technologies, wearable technologies, artificial intelligence (AI), robotics, and mobile applications (apps).

1.1. Good Practices

To facilitate the implementation of computer AT, we have identified good practices emphasizing individualization, collaboration, evidence-based approaches, training and support, accessibility, and ethical considerations. In the following sections, we will evaluate six recent practices in the last five years based on these principles.

1.2. Computer Assistive Technology

Computer AT holds significant potential in enhancing social interactions, learning experiences, and employment opportunities for individuals with ASD and/or ID. Various tools and software applications have been developed to address barriers and improve accessibility. Critical considerations include policy issues, funding, disability-related barriers, accessibility, usability, and person-centered design.



1.3. Virtual Reality Technologies

Virtual reality technologies offer immersive experiences tailored to support social skills development. Best practices involve designing environments with interactive features, natural language processing capabilities, and evidence-based therapeutic techniques to enhance learning and communication skills.

1.4. Wearable Technologies

Wearable technologies provide personalized support, offering reminders, emotion regulation, and physiological monitoring. Evaluation focuses on usability and effectiveness, with best practices including individualization, collaboration, and ensuring accessibility and comfort in design.

1.5. Artificial Intelligence (AI)

AI offers personalized support through data analysis and machine learning algorithms. Best practices include transparency, explainability, ethical considerations, and involving users and caregivers in co-design and development.

1.6. Mobile Applications (Apps)

Mobile apps cater to communication aids, social skills training, and behavior management. Best practices include involving users, caregivers, educators, and therapists in development, evidence-based techniques, and ensuring privacy and data security.



1.7. Augmented Reality (AR)

These interventions represent a promising approach for supporting individuals with Autism. By harnessing the interactive and immersive nature of AR technologies, practitioners and researchers can address the diverse needs of individuals with ASD in social, communicative, and cognitive domains. Despite challenges and limitations, AR interventions offer unique advantages, including high ecological validity, customization options, and increased engagement. Moving forward, continued research, collaboration, and innovation are essential for maximizing the potential of AR interventions and promoting better outcomes for individuals with ASD.

Concluding Remarks

The integration of various assistive technologies holds immense potential in enhancing social inclusion for individuals with ASD and/or ID. By adhering to best practices, including individualization, collaboration, evidence-based approaches, training and support, accessibility, and ethical considerations, we can develop effective and inclusive applications. These technologies empower individuals, fostering their social skills, communication, and overall participation in society.

Continual efforts to ensure sustainability and user-centered design will pave the way for a more inclusive and supportive environment for individuals with ASD and/or ID. The subsequent sections will delve into best practices across various AT categories, consistently highlighting the importance of these principles in successfully implementing AT for social inclusion. Integration of these principles into the development and evaluation of AT applications will create more inclusive environments and empower individuals with ASD and/or ID to participate fully in society.



2. Computer Assistive Technology

Executive Summary

Computer-assisted technology (AT) holds immense potential in improving the quality of life for individuals with Intellectual Disabilities (ID) and Autism. This report explores the role of computer AT in communication, learning, cognitive support, and daily tasks for individuals with ID and/or ASD. It highlights promising practices in the field, focusing on individualization, collaboration, evidence-based approaches, training and support, accessibility, and ethical considerations. The identified practices range from training programs to software applications and e-learning platforms, showcasing diverse applications of computer AT. However, sustainability remains a critical concern for non-commercial initiatives, emphasizing the need for continued support and updates beyond project completion.

Introduction

Computer-based assistive technology has emerged as a valuable tool in supporting individuals with Intellectual Disabilities (ID) and Autism. This chapter explores the potential of computer AT in enhancing communication, learning, cognitive support, and daily tasks for individuals with ID and/or ASD. It discusses the broad scope of computer AT, including embedded accessibility features, assistive input/output devices, and various software applications. The effectiveness of computer AT depends on factors such as policy, funding, awareness, accessibility, usability, and person-centered design. This report aims to present good practices relevant to the implementation of computer AT in education, employment, and everyday life for individuals with ASD and/or ID.




Good (Promising) Practices

ENTELIS+ Training Programme

- **Type of Practice:** Training Programme
- **Focus:** Computer and internet accessibility skills
- **Key Criteria:**
 - *Individualization:* Conducted a needs assessment before development, involving users.
 - *Collaboration:* Users, including persons with intellectual disabilities, were involved in needs assessment and development. Collaboration with an EU co-funded consortium.
 - *Evidence-based:* Developed based on existing good practices and literature review.
 - *Training and Support:* Comprehensive training involving users as trainers. Piloted and validated in multiple countries.
 - *Accessibility:* All material and information tested and validated for accessibility.
 - *Ethical Considerations:* Ethics approval and consents obtained.

C-Board Communication Software

- **Type of Practice:** ACC Software
- **Focus:** Augmentative and Alternative Communication
- **Key Criteria:**
 - *Individualization:* Provides flexibility for user customization. Involvement of persons with ASD and developmental disabilities in usability testing.
 - *Collaboration:* Open-source coding allows collaboration. Involvement of users during usability testing.


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- *Evidence-based*: Continuous development based on ongoing piloting and user feedback.
 - *Training and Support*: Evidence of professionals and families training and implementation.
 - *Accessibility*: Customizable display and alternative input methods.

Kolumba Software

- **Type of Practice:** Educational Software and Tools
- **Focus:** Email Communication
- **Key Criteria:**
 - *Individualization*: Allows translation of email messages to easy language and pictograms.
 - *Collaboration*: Developed through a collaborative EU-funded project involving end users.
 - *Evidence-based*: Validated with 62 users, considering accessibility, usability, and easy language.
 - *Training and Support*: No specific information available.
 - *Accessibility*: Emphasis on easy language and easy understanding.

IM IN TALES Toolkit (In Progress)

- **Type of Practice:** Educational Software and Tools
- **Focus:** Tangible User Interface (TUI) and Authoring tool for storytelling
- **Key Criteria:**
 - *Individualization*: Personal selection and customization of tangible objects for children with ASD and young children with disabilities.


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- *Collaboration*: Product of a collaborative EU-funded project involving end users and teachers.
 - *Evidence-based*: Methodological framework based on literature review and data from teachers.
 - *Training and Support*: Development of a MOOC for teachers.
 - *Accessibility*: Designed for accessibility for young learners, including children with ASD and/or ID.

Squizzly

- **Type of Practice:** Educational Software
- **Focus:** Cognitive Development
- **Key Criteria:**
 - *Individualization*: Needs analysis conducted before co-creation labs, considering literature and survey findings.
 - *Collaboration*: Followed user-centered design throughout design and development.
 - *Evidence-based*: Analysis of existing software and studies on frameworks and characteristics.
 - *Training and Support*: No specific information available.
 - *Accessibility*: Emphasis on portability, ease of use, and usefulness.

RTCN Learning Platform (Under Development)

- **Type of Practice:** E-Learning Platform
- **Focus:** E-Learning related to digital accessibility
- **Key Criteria:**
 - *Individualization*: User profiles for assessment and individual training.

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- *Collaboration*: A collaborative project involving 10 partners across Europe, with active involvement of persons with intellectual disabilities.
 - *Evidence-based*: Comprehensive literature review and evidence-based development.
 - *Training and Support*: Co-creation labs involved training and support.
 - *Accessibility*: Aimed at integrating accessibility features in e-learning experiences.
 - *Ethical Considerations*: Ethics approval obtained.

Conclusion

The identified practices demonstrate the diverse applications of computer AT for individuals with ID and/or ASD, ranging from training programs to software and e-learning platforms. These practices prioritize individualization, collaboration, evidence-based approaches, training and support, accessibility, and ethical considerations. However, sustainability remains a critical concern for non-commercial initiatives, emphasizing the need for continued support and updates beyond project completion. Future efforts should prioritize sustainability to ensure continued positive impacts on the lives of individuals with ID and ASD.

3. Virtual Reality

Executive Summary

This report delves into the utilization of Virtual Reality (VR) as a training tool for life skills development in individuals with Intellectual Disability (ID) and/or Autism. Authored by Jo Daems, the report explores the challenges faced by this demographic in learning daily living skills and cognitive concepts, highlighting VR's potential to address these challenges. It discusses the benefits, barriers, and facilitators associated with VR use and presents best practices based on current literature.

Introduction

Individuals with ID and/or ASD often struggle with learning daily living skills due to difficulties in processing information. Traditional training approaches face limitations, making VR an attractive option. This chapter aims to provide insights into the implementation, suitability, and effectiveness of VR training, focusing on immersive experiences tailored to support social and life skills development.

Best Practices

The report identifies benefits such as customizable programs and attention stimulation through interactive technology, along with barriers like cybersickness and motor skill challenges. Facilitators include customizable programs and visual similarities between virtual and real-world environments. Recommendations include conducting high-quality research, involving individuals with ID and ASD in application design, and prioritizing user safety and comfort. Examples of best practices are outlined, emphasizing the



importance of evidence-based therapeutic techniques and inclusive design.

Conclusion

While the use of VR in training individuals with ID and/or ASD holds promise, further research and refinement are needed. The identified benefits, barriers, and facilitators offer valuable insights for practitioners and researchers.

Collaboration with the target audience is crucial for designing effective and inclusive VR applications that meet the diverse needs of individuals with ID and ASD. Recommendations include prioritizing user safety, involving individuals with ID and ASD in design processes, and conducting high-quality research to determine effectiveness.

4. Wearable Technologies

Executive Summary

The report delves into the utilization of wearable technologies (WT) for individuals with Autism and Intellectual Disability (ID). It explores the significance, applications, and effectiveness of such technologies in enhancing daily functioning and promoting independence. The document examines five promising practices in this domain, encompassing prototypes, virtual reality (VR), smartwatches, heart rate variability (HRV) biofeedback, and vibrostimulatory wearable technology. Each practice is scrutinized against established criteria, emphasizing factors such as individual needs, personalization, safety, physiological monitoring, and integration with existing interventions. While acknowledging the efficacy and potential of wearable technologies, the report also highlights the need for further research to address limitations and ensure optimal design and implementation.

Introduction

The introduction outlines the growing importance of assistive technologies (AT) for individuals with disabilities, particularly focusing on the relevance of wearable technologies. It provides an overview of the definition, categorization, and functions of wearable technologies, emphasizing their role in supporting self-care and enhancing independence for individuals with ASD and ID. The section also highlights the increasing trend in digital health and wearables, as evidenced by research and industry reports.



Best Practices

This chapter presents five notable practices in the application of wearable technology for individuals with ASD and ID. Each practice is thoroughly described, including its focus, methodology, and outcomes. These practices encompass the development of prototypes like AutoSense for monitoring body signals, the use of VR such as Oculus Rift for social skill development, utilization of smartwatches to enhance independence and executive functioning, adoption of HRV biofeedback for anxiety management, and implementation of vibrostimulatory wearable technology to reduce stereotyped behavior. For each practice, the adherence to established criteria and its implications are analyzed.

Conclusion

The conclusion synthesizes the findings from the discussed practices and underscores the effectiveness of wearable technologies in improving the lives of individuals with ASD and ID. While acknowledging the successes and advancements in this field, the conclusion also addresses key limitations and challenges, such as sample size constraints, reliance on self-reported data, and the need for ongoing research and collaboration. The section emphasizes the importance of considering user needs, ensuring safety and comfort, and integrating wearable technologies with existing supports and interventions. Ultimately, the conclusion calls for further exploration and refinement of wearable technology solutions to maximize their benefits for individuals with ASD and ID.

5. Artificial Intelligence

Executive Summary

Artificial intelligence (AI) has emerged as a transformative force in the realm of assistive technologies, particularly benefiting individuals with Autism and Intellectual Disabilities (ID). This report explores the myriad ways in which AI can enhance the lives of individuals with ASD and/or ID, covering various aspects such as early detection and diagnosis, tailor-made therapy, communication enhancement, emotional support, social skill development, educational enrichment, sensory integration, caregiver support, remote assistance, and adaptive entertainment. Additionally, the report delves into the most popular assistive technologies across different categories, highlighting their significance in promoting independence and improving the quality of life for individuals with disabilities. Furthermore, it addresses the crucial aspect of training individuals to effectively utilize assistive technologies, emphasizing personalized approaches and ongoing support. Lastly, the report underscores the importance of social inclusion practices for individuals using assistive technologies, advocating for accessible communication channels, inclusive learning environments, accessible workplaces, universal design principles, community participation, collaboration with advocacy groups, awareness campaigns, accessible transportation, policy support, peer support networks, and regular accessibility audits. Overall, the integration of AI and assistive technologies holds immense potential in fostering inclusivity and empowerment for individuals with disabilities.



Introduction

Artificial intelligence (AI) has revolutionized the field of assistive technologies, offering innovative solutions to enhance the lives of individuals with Autism and Intellectual Disabilities (ID). This chapter provides an overview of AI's significance in improving accessibility, independence, and quality of life for individuals with disabilities. It highlights the distinction between strong AI and weak AI and explores the expanding role of AI across various disciplines. Furthermore, it emphasizes the importance of leveraging AI for the benefit of individuals with ASD and/or ID, particularly in areas such as early detection, tailor-made therapy, communication enhancement, emotional support, social skill development, educational enrichment, sensory integration, caregiver support, remote assistance, and adaptive entertainment.

Best Practices

This chapter elucidates the best practices for utilizing assistive technologies effectively in the context of individuals with ASD and/or ID. It encompasses a comprehensive analysis of various strategies, including early detection and diagnosis, tailor-made therapy, communication enhancement, emotional support, social skill development, educational enrichment, sensory integration, caregiver support, remote assistance, and adaptive entertainment. Each practice is meticulously examined, highlighting its significance, implementation strategies, and potential impact on the lives of individuals with disabilities. Additionally, the chapter emphasizes the importance of ongoing research, technological advancements, and collaborative efforts to enhance the efficacy and accessibility of assistive technologies for individuals with ASD and/or ID.



Conclusion

In conclusion, the integration of artificial intelligence (AI) and assistive technologies holds immense promise in empowering individuals with Autism and Intellectual Disabilities (ID) to lead more independent, fulfilling lives. By adhering to best practices and embracing innovative solutions, we can maximize the potential of assistive technologies to address the diverse needs and challenges faced by individuals with disabilities. Furthermore, fostering social inclusion, promoting awareness, and advocating for policy support are essential components of creating a more inclusive society that values diversity and accessibility. As we continue to advance in AI and assistive technologies, it is imperative to prioritize the needs and preferences of individuals with ASD and/or ID, ensuring that they remain at the forefront of technological innovation and societal inclusion efforts.

6.Apps

Executive Summary

The field of assistive technologies, particularly apps, holds immense promise for individuals with Autism by offering support in various areas such as communication, social skills, emotional regulation, and learning. This report synthesizes current research findings and best practices related to the use of apps for individuals with ASD. It highlights the importance of tailored, evidence-based interventions that involve collaboration among users, caregivers, educators, and therapists. Key findings include the effectiveness of apps in improving verbal communication, social skills, and academic abilities among children with ASD. However, challenges such as access, app quality, and generalization must be addressed. The report concludes with recommendations for future research focusing on comparative effectiveness studies, longitudinal studies, technology integration, and qualitative analysis to optimize app-based interventions for individuals with ASD.

Introduction

Assistive technologies, including apps, play a crucial role in supporting individuals with Autism by providing various forms of assistance. This chapter provides an overview of the diverse range of apps available for individuals with ASD, highlighting their potential benefits and challenges. It discusses the importance of individualization, collaboration, evidence-based practices, training and support, accessibility, and ethical considerations in app development and implementation. The chapter also reviews existing research on the effectiveness of apps in promoting academic skills, communication, and daily life skills among individuals with ASD.



Best Practices

This chapter explores best practices in the development and implementation of apps for individuals with ASD across different domains such as speech, reading, writing, vocabulary, social skills, and communication. It examines promising interventions and applications that have demonstrated effectiveness in improving various skills among children with ASD. The chapter emphasizes the importance of individualization, collaboration, evidence-based practices, training and support, accessibility, and ethical considerations in designing and delivering app-based interventions.

Conclusion

Effective interventions using apps for individuals with ASD require a comprehensive approach that considers the specific needs and preferences of each individual. This chapter summarizes key findings and recommendations from the report, emphasizing the importance of evidence-based practices, collaboration among stakeholders, and ongoing support and monitoring. It underscores the potential of app-based interventions to improve the quality of life for individuals with ASD but acknowledges the need for further research to address existing challenges and optimize intervention outcomes.

This report provides a comprehensive overview of the use of apps for individuals with Autism, addressing key aspects such as individualization, collaboration, evidence-based practices, training and support, accessibility, and ethical considerations. It synthesizes current research findings and best practices to guide the development and implementation of effective interventions for individuals with ASD.

7. Augmented Reality

Executive Summary

Augmented Reality (AR) interventions hold significant promise for supporting individuals with Autism in various aspects of social interaction, communication, and skill development. This report provides an overview of recent research findings and best practices in the use of AR technologies for individuals on the autism spectrum. It examines key studies, outlines successful interventions, discusses advantages and limitations, and proposes future directions for research and implementation. By leveraging AR technologies, practitioners and researchers can enhance social inclusion, improve communication skills, and promote better outcomes for individuals with ASD.

Introduction

Autism is a neurodevelopmental condition characterized by challenges in social interaction, communication, and restricted or repetitive behaviors. Traditional intervention approaches often face limitations in addressing the diverse needs of individuals with ASD. Augmented Reality (AR) offers a novel avenue for intervention, providing interactive and immersive experiences that can be tailored to individual needs. This report aims to explore the potential of AR interventions in supporting individuals with ASD, highlighting recent research findings, best practices, and future directions in the field.



Best Practices

The use of AR interventions in addressing the needs of individuals with ASD has gained traction in recent years. Several studies have demonstrated the effectiveness of AR technologies in improving social skills, communication, and other areas of development. Key best practices identified include:

1. **Individualization:** AR programs should be adaptable to the unique learning pace and preferences of each individual with ASD. Customization options allow for personalization of content and experiences.
2. **Collaboration:** Collaboration between researchers, practitioners, families, and technology developers is crucial for the design, evaluation, and implementation of AR interventions. Involving stakeholders ensures that interventions are relevant, practical, and effective.
3. **Evidence-Based Approach:** AR interventions should be grounded in empirical research and evidence-based practices. Rigorous studies, including randomized controlled trials, are essential for establishing the efficacy and validity of AR interventions for individuals with ASD.
4. **Training and Support:** Adequate training and support should be provided to caregivers, educators, and individuals with ASD to ensure effective use of AR technologies. Clear instructions, tutorials, and ongoing assistance can enhance user engagement and outcomes.
5. **Accessibility:** AR programs should be accessible to a wide range of individuals with ASD, including those with varying levels of intellectual ability and sensory sensitivities. Efforts should be made to ensure affordability, simplicity, and compatibility with different devices.



Conclusion

Augmented Reality (AR) interventions represent a promising approach for supporting individuals with Autism. By harnessing the interactive and immersive nature of AR technologies, practitioners and researchers can address the diverse needs of individuals with ASD in social, communicative, and cognitive domains. Despite challenges and limitations, AR interventions offer unique advantages, including high ecological validity, customization options, and increased engagement. Moving forward, continued research, collaboration, and innovation are essential for maximizing the potential of AR interventions and promoting better outcomes for individuals with ASD.

