SMART ACCESSIBILITY 2025, The Tenth International Conference on Universal Accessibility in the Internet of Things and Smart Environments

KEYNOTE

Assistive Technologies for Persons with Disabilities

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Speaker

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Personal Introduction

- Professor at Technical University of Middle Hesse, Germany
- Dean of Department of Management and Communication
- Managing Director of the Study Center for Blind and Disabled Students, BliZ
- Technical Advisor of the World Health Organizations for Assistive Technologies; Representative for Central and Eastern Europe

The WHO Technical Advisory Group for Assistive Technologies

World Health Organization

Who Needs Assistive Technologies?

people with disability

people with noncommunicable diseases

people with gradual functional decline

people with mental health conditions including dementia and autism

older people

What are Assistive Tools Essential for?

compensate for an impairment/ a loss of intrinsic capacity

help minimize the need for caregivers

reduce the consequences of gradual functional decline

prevent primary and secondary health conditions

lower health and welfare costs

The Task

- In First World countries, technical aids for disabled persons are relatively affordable.
- In the Second and Third World, lack of structures and scarcity of resources account for considerable challenges in inclusion of severely disabled persons.
- The World Health Organization recognize this gradient. They maintain a first, preliminary, list of desirable basic aids for the disabled set up in 2016. This list is currently law or quasi-regulation in 23 countries.
- A new, more scientific and rigorous, process is to devise a refined and updated list until 2026.
- For this, 24 experts were selected from 6 global regions, covering all areas of expertise.

The Framework

Disabilities are mainly related to

Self care

Cognition

Vision

Hearing

Mobility

Communication

Assistive Technologies help overcome these disabilities, enabling

Autonomy

Orientation and Mobility

Social interaction

Education

Professional lives

Leisure activities

Methodology: Description

Product: Toys

ISO 30 03 03 - Toys designed for therapeutic and educational purposes

- Sensory toys: Designed to stimulate the senses and improve sensory processing.

- Educational toys: Aimed at enhancing learning and cognitive skills.

- Therapeutic toys: Used in therapy to aid physical or emotional development.

World Health Organization

Methodology: Rating

Product: Toys

Need (Prevalence; Impact of Disability)

Benefit

Risks

Price

Acceptability

Rating based on scientific evidence only!

4. Global prevalence of related disabilities
Intellectual Disability
- Maulik et al (2013) pretend a systematic /metanalysis including 52 studies published between 1980 and 2009. The prevalence analysis was 10.37/1000 population. Studies on child/adolescent population showed the highest prevalence of 18.30/1000 (95% prevalence of 4.94/1000 (95%CI 3.66–6.22). Studies which reported on data on both child/adolescent and adult population had

Developmental disability
- Olusanya et al (2023) presented an umbrella review of 10 systematic reviews reporting prevalence estimates for attention-defi palsy, developmental intellectual disability, epilepsy, hearing loss, vision loss and developmental dyslexia from 3,456 identified impairments were the most prevalent disabilities (approximately 13%) and cerebral
palsy was the least prevalent disability (approximately 0.2–0.3%) based on the
eligible reviews. Specific prevalcnes were provided for a) Attention-deficit/hyperactivity disorder: Prevalences ranged from 3.7% studies in 11 countries, to 1.9% (95% UI: 1.3–2.6) in children 0–19 years from the Global Burden of disease (2019) data b) Cerebr approximately 0.2% (95% CI: 0.1–0.2) for HICs and 0.3% (95% CI: 0.3–0.4) for LMICs among children 0–18 years. The GBD estima children with moderate to severe motor impairment c) Developmental intellectual disability :The GBD global estimate was 3.1%

Autism spectrum disorder
- A comprehensive systematic review and meta-analysis of the global prevalence of autism spectrum disorder (ASD) (Salari et al The prevalence of ASD in the world was 0.6% (95% confidence interval: 0.4–1%). Subgroup analyses indicated that the prevalen (95% CI: 0.1–1), 1% (95% CI: 0.8–1.1), 0.5% (95% CI: 0.2–1), 1% (95% CI: 0.3–3.1), 1.7% (95% CI: 0.5–6.1) respectively.

- Talantseva et al (2023) divided the presentations into Autism spectrum disorder (ASD) Autistic Disorder (AD), Asperger Syndro Disorder - Not Otherwise Specified (PDD-NOS); Overall, 79 studies were included in the analysis of ASD and 59 in the analysis of Pooled prevalence estimates were 0.72% (95% CI = 0.61–0.85) for ASD, 0.25% (95% CI = 0.18–0.33) for AD, 0.13% (95% CI = 0.07– group of AA and PDD-NOS

Methodology: Scores

WHO Assistive Product Evaluation Tool

SUMMARY

Assistive product: Toys

WHO functional domain: Communication

ISO code: 30 03 03

In total, over 360 ISO codes are evaluated using this methodology

	NEED	BENEFITS	RISKS	PRICE
Score:	5	5	5	4
Highest level of evidence per indicator:	No level of evidence provided	Clinical trial	No level of evidence provided	

Total weighted score:	95.24

Results: Grouping of ISO Products – Example: Vision

Areas of everyday life:

Vision enhancement

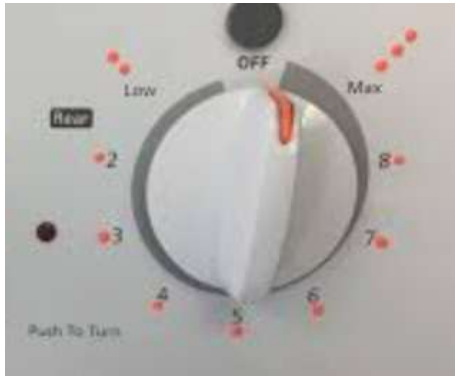
Independent living

Orientation and mobility

Communication

Learning and occupation

Leisure



Results: Grouping of ISO Products – Example: Vision

Priority product classifications:

Magnification devices

Spectacles,

Braille equipment and materials,

Guide canes,

DAISY* readers

*Digital Accessible Information System

Results: Grouping of ISO Products – Example: Vision

Less prioritized products

Contact lenses

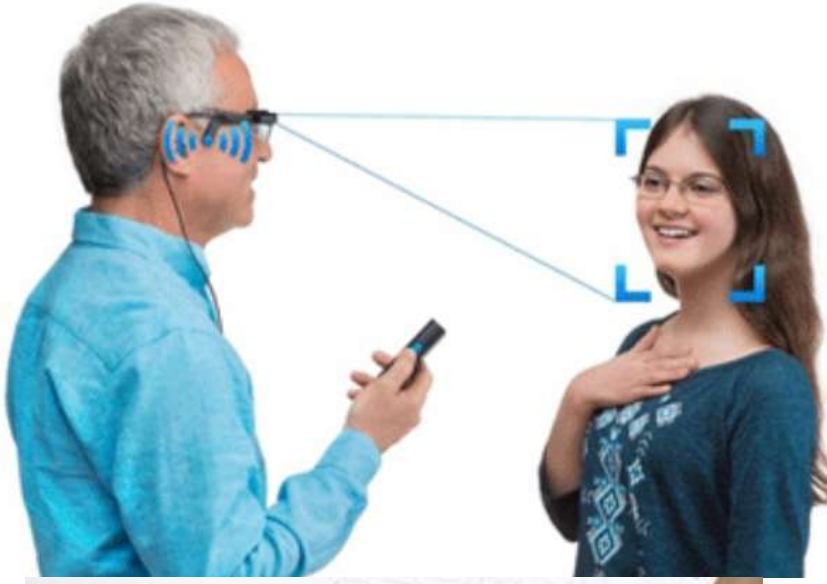
Printers and 3D-Printers

Smartphones*

AI-based speech or pattern recognition systems

Multimedia systems

Sports and leisure equipment

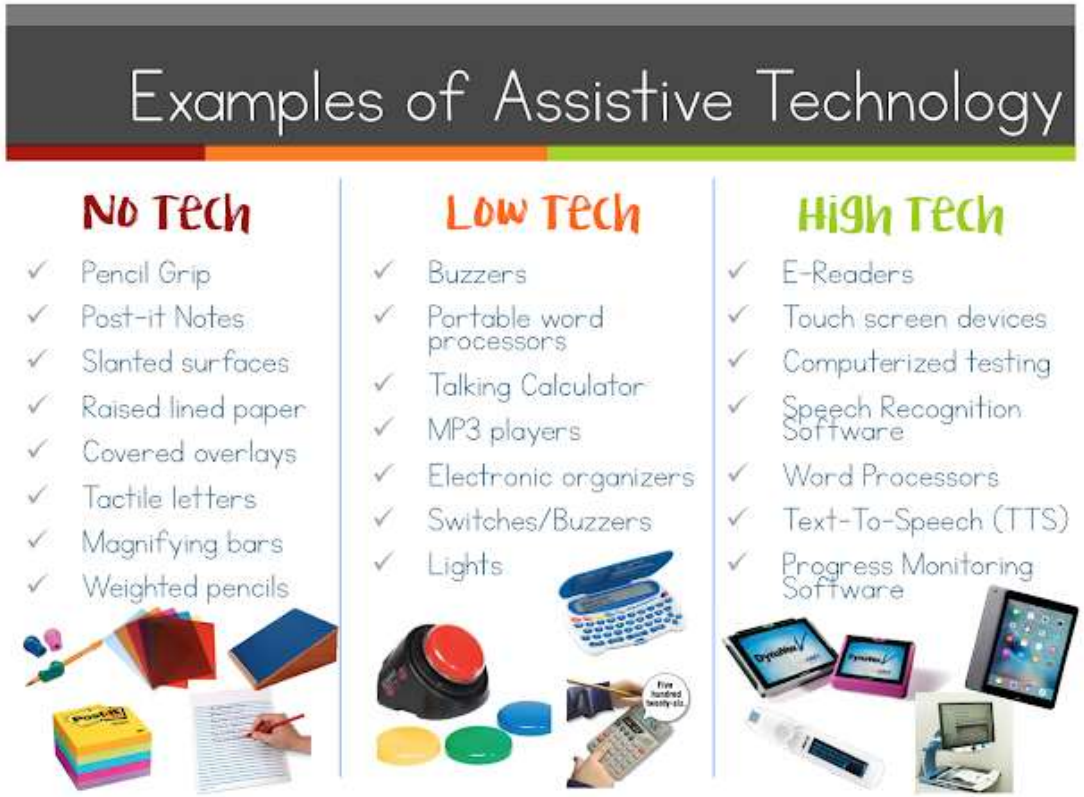


*politically problematic

Results: Grouping of ISO Products – other domains

Prioritized products
AAC – Augmentative and Alternative Communication Devices (High and Log Tech)
Hearing Aids, Implants, Bone Conduction Devices
Ortheses and Protheses; Wheelchairs, Walking Sticks
Absorbents, AT for eating and drinking
AT for reading and writing
AT for learning and rehabiitation

No Tech Versus High Tech



Credit: Shelby Mackey

- Low tech and high-tech ATs are generally available in high income countries.
- They require clean environments, electricity or batteries, and maintenance.
- In low-income countries, there may be political reluctance or inability to provide more than “no tech” tools. Solar power may be a future solution.
- This is even more the case for more versatile ATs that may also be sold or put to a different use by families.

No Tech Versus High Tech – Communication Devices

No Tech: Communication cards

Low Tech: Tobii Dynavox

High Tech: Alexa, Google Assistant, Text-to-Speech-Apps.

Perspective: Eye, head*, and muscle tracking, neuronal feedback

*e.g., Sesame Enable

No Tech Versus High Tech – Mobility

No Tech: Furniture rollers, walking sticks

Low Tech: Wheelchairs, rollators

High Tech: Electronic wheelchairs

Perspective: Autonomous wheelchairs and AI-supported exoskeletons

No Tech Versus High Tech – Protheses and Ortheses

No Tech: „Captain Ahab“

Low Tech: Standard simple

High Tech: Carbon protheses, customized

Perspective: Sensoric protheses and neuroprotheses (thought operated)

No Tech Versus High Tech – Hearing

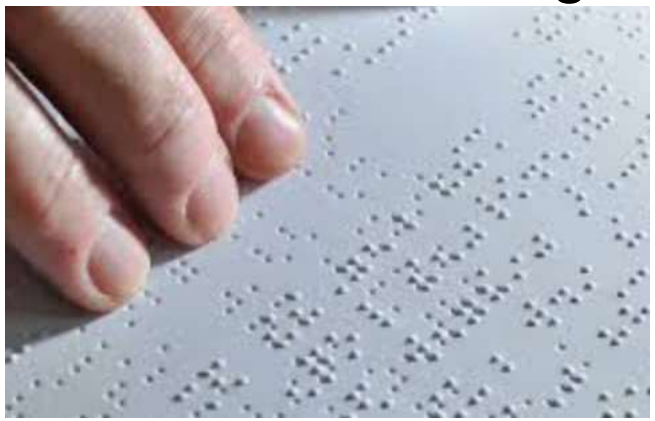
No Tech: Sign language

Low Tech: Augmentative hearing aids

High Tech: Intelligent electronic hearing aids; hearing loops; Cochlea implants; AI-based DNN „deep neural network“ Brain-Hearing

Perspective: Real-time translation

No Tech Versus High Tech – Vision



No Tech: Braille books and tactile materials

Low Tech: Braille printers, audio tools

High Tech: Braille lines, smartphones, text-to-speech and screenreader software, 3D-printer

Perspective: AI-based pattern recognition; Braille pads

Conclusion

- In ageing populations, but also in nations with low medical resources, assistive technologies for disabled persons are essential for socio-technological and economic inclusion.
- There is a considerable gradient from high-tech assistive technologies for persons with disabilities available in rich countries to possibilities in the Third World.
- To employ available means in poorer countries in the most efficient way, essential tools for various disabilities have to be prioritized.

Conclusion

- Assistive technologies are mainly needed to compensate for a lack of capacity, to reduce the consequences of functional decline, to minimize the need for caregivers, and to lower health and welfare costs.
- A technical advisory group of the WHO sets these priorities with in the categories of self care, cognition, vision, hearing, mobility, and communication.
- In the future, assistive tools for disabled persons will be increasingly highly technological. These developments will be driven in industrialized countries.

Assistive Tools are the First Step!

getting out of bed and out of one's house

accessing education, work and employment

escaping from poverty and hunger

greater mobility, freedom and independence

inclusion and participation

leading a dignified life

Thank you!

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