

IEDA

INCLUSIVE EDUCATION: Ensuring participation
of persons with disabilities in non-formal adult
education

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Module 1: Introduction to Assistive Technology: Basics, Principles and Examples of Assistive Technology Tools

Curriculum on Education on implementation of assistive
technologies in adult education



Module 1: Introduction to Assistive Technology: Basics, Principles and Examples of Assistive Technology Tools

This module provides the basic understanding (what assistive technology is, how it works, etc.) and covers following areas:

- Definition of Assistive Technology (AT)
- Overview of AT for users with disabilities
- How AT works
- Examples from daily practice
- Myths around AT
- The importance of accessible environment (both digital and physical world)

Questions for Participants

- What are some of the challenges that user may face in accessing assistive technology?
- What are some of the benefits that user can experience from using assistive technology?
- What advice would you give to others who are considering using assistive technology?

Definition of Assistive Technology (AT)

Assistive technology is any tool, device, software, or product system that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. AT can help people with disabilities to perform everyday tasks, such as getting around, communicating, learning, and working.

The definition of AT is broad and can include a wide range of products and services. Some common examples of AT include:

- Mobility devices, such as wheelchairs, walkers, and canes

- Communication devices, such as speech-to-text software and augmentative and alternative communication (AAC) devices
- Visual aids, such as screen readers and large-print books
- Hearing aids and cochlear implants
- Environmental controls, such as remote controls for lights and appliances
- Computer assistive technology, such as screen magnification software and voice recognition software

AT can be used to address a wide range of disabilities, including:

- Physical disabilities, such as mobility impairments, visual impairments, and hearing impairments
- Cognitive disabilities, such as learning disabilities and attention deficit hyperactivity disorder (ADHD)
- Autism spectrum disorder (ASD)
- Mental health conditions, such as depression and anxiety

Overview of AT for users with disabilities

AT typology based on target user groups

- blind and visually impaired
- deaf/Deaf and hard of hearing
- people with mobility issues
- cognitive and learning difficulties
- people with difficulties on the production or comprehension of spoken or written language
- people with psychological disorders and other hidden disabilities
- people with chronic and acute diseases
- elderly people

AT typology based on “user-side”

- people with special needs – for their personal use
- providers of services for people with special needs

- technologies as a part of accessible design of premises

AT typology based on technical character

- software
- hardware
- other “non-computer” devices and aids (incl. “low-tech”)

Technologies developed originally for a mainstream purpose, later applied as AT, e.g.:

- OCR
- speech-to-text
- instant messaging applications
- language tools (dictionaries, proofing tools, thesauri, word prediction)
- video telephony
- artificial intelligence, machine learning, etc.

Here are **some examples of assistive technology that can be used in inclusive non-formal education:**

- **Screen readers:** Screen readers are software programs that read text aloud, allowing persons with visual impairments to access written content.
- **Braille displays:** Braille displays are hardware devices that convert digital text into Braille, enabling users to read and navigate digital materials using Braille output. Braille displays can be used in conjunction with screen readers or other assistive technologies to provide a comprehensive access solution for learners with visual impairments.
- **Magnification software:** Magnification software enlarges the text and graphics on the computer screen, making it easier for partially sighted users to read and navigate through digital materials. Many magnification programs also offer colour contrast and other customisation options.
- **Text-to-speech software:** Text-to-speech software can help persons with cognitive disabilities or learning differences to understand written content by reading it aloud.
- **Alternative keyboards and pointing devices:** alternative keyboards and pointing devices can help persons with physical disabilities to use computers and other technology.

- **Augmentative and alternative communication devices:** Augmentative and alternative communication devices can help persons with communication disabilities to express themselves.
- **Hearing aids and cochlear implants:** Hearing aids and cochlear implants can help persons with hearing impairments to hear and understand spoken content.

For more details, see the chapter **Assistive technologies for different types of disabilities** in Handbook.

How AT works?

Generally speaking, AT conveys information to the user that they could not otherwise have perceived (e.g. no usable vision), or that would otherwise be inaccurate, incomplete, or difficult to obtain in the first place. Even the non-ICT AT meets this principle - a white cane enables the user to feel their way when travelling, a Braille typewriter is still important at elementary schools in order for the user to learn the fundamental concepts of language and literacy (if born blind or unable to read written or printed materials for other reasons), a tactile clothing color marker or sock holder allows for greater everyday independence... Screen readers in particular read all textual information from the application, website or document that the user is currently working with and convey (read) it to them either via synthetic speech or via a connected Braille display.

As long as there is text to read and the app or document in question is structured with respect to all current accessibility standards, the user is usually able to work with it more or less independently and completely. The main issue of screen readers is currently any and all non-textual information. If a piece of information is provided only in the form of a picture or color indication, with no corresponding textual alternative, the user may be informed that there is a "graphic" or e.g. a change of color to dark green, but not much more than that, rendering that particular piece of information inaccessible and unusable in practice. Commonly inaccessible media formats that require either audio description (prepared by a human in advance) or further work in order to improve their accessibility include videos or movies (especially in scenes where there is little to no dialogue) or the so called untagged PDF documents (mere graphical scans - pictures - of a printed page).

Examples from daily practice

This chapter offers some examples of how assistive technologies can be used in non-formal adult education:

- **Text-to-speech software** can be used by people with visual impairments to read textbooks, articles, and other materials.
- **Screen magnification software** can be used by people with low vision to make text and images larger on the computer screen.
- **Speech-recognition software** can be used by people with physical disabilities to control the computer with their voice.
- **Augmentative and alternative communication (AAC) devices** can be used by people with speech impairments to communicate with others.
- **Accessible learning platforms** can be used by people with disabilities to access online courses and materials.
- **Accessible classrooms** can be designed to accommodate the needs of people with disabilities, such as providing wheelchair ramps, accessible bathrooms, and assistive listening devices.

Example 1

The user reads a document via a Braille display and a screen reader. The user can bring up a list of all chapters in the document and instantly move to any one of them and start reading it. They can also quickly move around the document by headings, skipping from one heading to the next, or bring up the document outline which essentially lists all the headings present in the document in a table of contents like structure. This effectively enables them, for instance, to quickly jump between chapters of a book. If the headings or tables are not properly marked up, the user either cannot read them at all, or the screen reader presents them just as static, ordinary text without any structure whatsoever. E.g. let's imagine a long table of company staff, listing the first name, last name, e-mail, mailing address, age, landline number, cell phone number, ID number and social security number for each employee in the accounting department. If the table is not properly marked up as an actual table, using the corresponding tools of the program the document was written in (table formatting tools and text styles in Microsoft Word etc), they have no way of knowing whether the information for a single employee is listed across the columns of a single row, or the other way round, across the rows of a single column. If the table doesn't contain the information about header cells, telling screen readers which cell is the starting cell of a row or column and what kind of data it's supposed to contain, the user will have no idea which long unintelligible number is which, and they could potentially attempt to call the person at work using their social security number instead of the landline number. In the worst case scenario, such as in a PDF document that's missing any text layer and the PDF reader software has to use OCR

(optical character recognition) to convey its contents to the user, the screen reader may even misinterpret spaces between words and line endings, uttering an endless 20-digit number, again, without the user knowing where one number ends and where the next one begins.

Example 2

If an e-book is not yet properly structured and equipped with all the accessibility mechanisms, such as textual descriptions of photographs, it should be improved in such a way as to support the accessibility guidelines (e.g. a printed book has to be narrated into audio or digitized via OCR), again, marking up actual semantic structure (headings, lists, links, tables) as such, including textual descriptions for images and graphics where relevant, which will enable the user to navigate the book consciously and efficiently, always reaching the exact part they are interested in at the moment. If the book in question is a textbook, reference guide or manual, it's especially important to be able to make use of its structural features for navigation. There can often be a very thin line between providing too little or too much alternative text for graphics, especially for a person who has not had prior experience with this kind of thing. A couple rules of thumb are useful to follow here:

Do not use words such as "image of"; the screen reader already informs the user that this is an image by itself.

On the other hand, if the image is scanned text, an useful description would be something like "Text that says: Nothing about us without us"

For logos and the like, simply writing "Microsoft logo" would suffice in most cases. If a longer description is relevant, you can proceed to verbalize what objects, shapes and colours the logo contains.

Avoid descriptions like "a blue arrow pointing downward". Instead, use expressions such as "next month" (in a calendar app) or "next page" in website pagination, etc.

In an appliance manual such as a washing machine, it can sometimes be useful for the user to know what the button in question looks like, either because they still have some useful vision left and use magnification to look at displays, or because they are learning how to set up and control the appliance for the first time with sighted assistance. So, for example, if the button to start the cycle looks like a filled circle, it would be advisable to describe it as such on the page that shows the device's display and control panel. Later on in the text, simply use a description of "the start cycle button".

Example 3

A screen reader user attempts to use an app to download a video off YouTube. However, the app was not built with keyboard focus in mind at all. This means that all its buttons and controls are only accessible with the mouse - there is no actual focus control programmed in the app. After a lot of effort, this advanced screen reader user manages to move the mouse around by issuing screen reader commands to simulate its movement. This only leads to them discovering yet another accessibility barrier: The button to initiate the download has finally been located, but again, it's just a graphical button with no textual label whatsoever. The screen reader, upon locating the button, just says "graphic button". The user invokes the OCR feature built into the screen reader to finally hear that the picture next to the button says "Start download". However, in many real world scenarios, it's impossible to reach this stage with a screen reader even after so much effort. In many instances, the user ends up so frustrated that they simply uninstall the app altogether and try to look for an alternative solution. However, this is often not possible or feasible at all for various reasons, such as the user's lack of awareness about other solutions existing in the first place.

Myths around AT

There are many myths surrounding assistive technology (AT). Here are some of the most common:

- **AT is only for people with severe disabilities.** This is not true. AT can be used by people with a wide range of disabilities, from mild to severe. In fact, many people with mild disabilities use AT to help them perform everyday tasks more easily.
- **AT is expensive.** This can be true, but there are often financial assistance programs available to help people pay for AT. In addition, many AT devices are covered by insurance. Moreover, many AT are open source (e.g. screen reader NVDA) or built-in (Magnifier in Windows, VoiceOver in MacOS).
- **AT is complicated to use.** This is not always true. There are many AT devices that are easy to use, even for people with complex disabilities. In addition, there are many resources available to help people learn how to use AT.
- **AT is a crutch.** This is a myth that can be very harmful. AT is not a crutch. It is a tool that can help people with disabilities live more independently and participate more fully in society.

- **AT is not necessary.** This is simply not true. AT can be essential for people with disabilities to perform everyday tasks. Without AT, many people with disabilities would be unable to live independently or participate in school, work, or social activities.

It is important to remember that AT is a personal decision. What works for one person may not work for another. The best way to find out if AT is right for you is to talk to a doctor, rehabilitation specialist, or AT provider. They can help you assess your individual needs and recommend the right AT for you.

The importance of accessible environment (both digital and physical world)

Creating an accessible environment, both in the digital and physical worlds, is crucial for promoting inclusive non-formal education for people with disabilities. Such an environment ensures that individuals with disabilities have equal opportunities to access educational resources, participate in learning activities, and fully engage in the educational process. Here's why accessibility is important for inclusive non-formal education:

1. **Equal Opportunity:** Accessibility ensures that people with disabilities have the same opportunities as their peers without disabilities to access education and information. This promotes fairness and prevents discrimination based on physical or cognitive abilities.
2. **Diverse Learning Styles:** People with disabilities have diverse learning styles and needs. An accessible environment accommodates various learning preferences by providing multiple formats for content consumption, such as text, audio, and visual options.
3. **Inclusive Participation:** Accessible environments allow all individuals to participate fully in educational activities, discussions, and collaborative projects, fostering a sense of belonging and community among learners.
4. **Personalized Learning:** Accessibility tools and technologies enable personalized learning experiences. Individuals can adapt content to suit their specific needs, helping them grasp concepts more effectively.
5. **Empowerment:** Accessible environments empower people with disabilities by enabling them to take control of their learning journey. They can access resources independently, enhancing their confidence and self-reliance.

6. **Skill Development:** Inclusive education prepares individuals with disabilities for real-world scenarios where they need to interact with both accessible and inaccessible environments. Learning in an inclusive setting equips them with skills to navigate various situations.
7. **Enhanced Creativity:** Accessibility often requires innovative solutions, which can stimulate creativity in curriculum design, teaching methods, and technology integration. These innovations can benefit all learners.
8. **Social Integration:** Inclusive education promotes social interactions between individuals with and without disabilities. This fosters understanding, empathy, and acceptance among all learners.
9. **Broader Perspective:** An accessible environment encourages the inclusion of diverse perspectives, including those of people with disabilities. This enriches discussions and enhances the overall learning experience.
10. **Legal and Ethical Responsibility:** Many countries have legal frameworks that mandate accessibility in education, as it aligns with the principles of equal rights and non-discrimination. Creating an accessible environment is an ethical obligation to ensure equal access to educational opportunities.
11. **Employment Opportunities:** A strong educational foundation is critical for future employment opportunities. Inclusive education prepares individuals with disabilities to enter the workforce with skills and knowledge that are relevant and valuable.
12. **Technological Advancements:** An emphasis on accessibility in education drives technological advancements that benefit everyone. Innovations in assistive technology often find applications beyond the disability community.

In conclusion, an accessible environment—both in terms of digital content and physical spaces—is essential for promoting inclusive non-formal education for people with disabilities. It facilitates equal access, participation, and empowerment, fostering an environment where all learners can thrive and contribute meaningfully to society.

Some key tips how to create digital accessible environment

Follow established accessibility guidelines such as the Web Content Accessibility Guidelines (WCAG). These guidelines provide a framework for making web content more accessible to people with disabilities.

1. **Provide Alternative Text for Images:**

- Use descriptive alternative text (alt text) for images to convey their content to individuals who cannot see them. Alt text should be concise and convey the purpose of the image.

2. **Ensure Proper Headings and Structure:**

- Use heading tags (H1, H2, H3, etc.) to organize content hierarchically. This helps screen readers and users navigate through the content more easily.

3. **Create Descriptive Links:**

- Use clear and descriptive link text that provides context about the destination of the link. Avoid using generic phrases like "click here."

4. **Provide Captions and Transcripts:**

- Include captions for videos to make them accessible to individuals who are deaf or hard of hearing. Also, provide transcripts for audio content to ensure that it's accessible to all.

5. **Choose Accessible Colour Contrast:**

- Ensure a sufficient contrast between text and background colours to make the content readable for users with low vision or colour blindness.

6. **Use Keyboard Navigation:**

- Ensure that all interactive elements and content can be navigated using a keyboard alone. This is crucial for individuals who cannot use a mouse.

7. **Avoid Flashing or Flickering Content:**

- Avoid using content that flashes or flickers rapidly, as it can trigger seizures in individuals with photosensitive epilepsy.

8. **Implement Semantic HTML:**

- Use semantic HTML elements (e.g., <nav>, <article>, <main>) to provide a clear structure to the content, improving both accessibility and search engine optimization.

9. **Test with Screen Readers:**

- Use screen reader software to test your website's accessibility. This will help you identify any issues that users relying on screen readers might encounter.

10. Provide Adjustable Text Sizes:

- Allow users to adjust text sizes without breaking the layout or functionality of the website.

11. Ensure Compatibility with Assistive Technologies:

- Test your website's compatibility with various assistive technologies, such as screen readers and speech recognition software.

12. Regularly Update and Maintain Accessibility:

- As you update and add content, make sure to maintain accessibility standards to ensure that your digital environment remains inclusive.

13. Provide Contact Information for Assistance:

- Offer a way for users to contact you if they encounter accessibility issues. Show that you're open to feedback and improvements.

Some key tips how to create built accessible environment

1. Follow Accessibility Codes and Standards:

- Familiarize yourself with local building codes, accessibility standards, or relevant guidelines in your country.

2. Provide Accessible Entrances:

- Ensure that entrances to buildings are wheelchair accessible, with ramps or slopes that have appropriate slopes and handrails.

3. Install Elevators and Lifts:

- If your building has multiple levels, install elevators or lifts that provide access to all floors. Make sure they are wide enough to accommodate wheelchairs.

4. Widen Doorways and Hallways:

- Ensure that doorways and hallways are wide enough to accommodate wheelchairs and other mobility devices.

5. Create Accessible Restrooms:

- Design restrooms that are wheelchair accessible and have appropriate grab bars, sinks, and space to manoeuvre.

6. Provide Accessible Parking Spaces:

- Designate accessible parking spaces close to entrances and ensure they have proper signage and markings.

7. Use Non-Slip Flooring:

- Choose flooring materials that are non-slip to prevent accidents, especially for individuals using mobility aids.

8. Install Visual and Tactile Signage:

- Use clear signage with both visual and tactile elements to assist individuals with visual impairments.

9. Ensure Proper Lighting:

- Maintain adequate lighting throughout the environment to help people with low vision navigate safely.

10. Incorporate Reachable Controls:

- Design controls, switches, and buttons at heights and locations that can be easily reached by individuals using wheelchairs or other mobility devices.

11. Offer Seating and Rest Areas:

- Provide seating and rest areas throughout the environment to accommodate individuals who may need to take breaks.

12. Design Accessible Outdoor Spaces:

- Extend accessibility considerations to outdoor areas by providing accessible paths, seating, and recreational facilities.

13. Include Braille and Large Print Information:

- Include Braille signage and information in large print to aid people with visual impairments in navigating the environment.

14. Train Staff on Accessibility:

- Ensure that staff members are trained on how to assist individuals with disabilities and are knowledgeable about the accessible features of the environment.

15. Promote Universal Design:

- Incorporate universal design principles from the start, aiming to create spaces that are functional and usable by people of all abilities.

16. Engage with the Disability Community:

- Seek input and feedback from individuals with disabilities during the design and planning stages to identify potential barriers and solutions.

17. Regular Accessibility Audits:

- Conduct regular accessibility audits to identify any issues or areas that might need improvement.

18. Create Multisensory Experiences:

- Consider incorporating multisensory elements that cater to a diverse range of sensory preferences and needs.