

IEDA

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

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# **Module 6: Using New Technologies for Supporting the Needs of Persons with Disabilities**

Curriculum on Education on implementation of assistive  
technologies in adult education



# Module 6: Using New Technologies for Supporting the Needs of Persons with Disabilities

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## UNIVERSAL DESIGN (UD) AND THE NEW TECHNOLOGIES

### Participants...

- what advanced technologies, products and applications are you currently using?
- how can you improve your training activities using technology?

Share your own experiences and your general impressions about real or imagined adult training experiences.

### UD AND TECHNOLOGY

UD aims at designing technologies that can be used by as many people as possible: mainstream technology for everyone, including the elderly and people with disabilities. The focus is on avoiding unnecessary special solutions and accommodations.

### NEW TECHNOLOGIES

In this training we are defining the new technologies as the advanced or new developments within the field of Assistive Technologies, expressed in specific applications and products. They are also known as emerging technologies, emerging assistive technologies or advanced assistive technologies.

New technology tends to be "smart", connected, interactive, and to include body-integrated solutions or components.

### ENABLING TECHNOLOGIES

The advanced assistive technologies are made possible by enabling technologies such as Artificial Intelligence (AI), Augmented and Virtual Reality (AR/VR), robotics, Internet of Things, etc.

The development of advanced assistive products and applications is facilitated by one or a combination of several enabling technologies.

## EXAMPLE OF NEW TECHNOLOGIES

One good example of new technologies is the companion robot, a robot that offers real or apparent companionship for human beings. It is supported by several enabling technologies: Artificial Intelligence, Robotics, IoT, and Advanced sensors.

Its main functions are to support independent living through different features and to offer cognitive, emotional and social support.

## INTERNET OF THINGS (IoT)

IoT is the network of connected objects (things) able to collect and exchange data using embedded sensors, software, and other technologies.

A thing in the IoT can be any object capable to connect to Internet and able to transfer data over the network. For example:

- a connected car
- an appliance (refrigerators, HVAC systems, coffee makers, etc.)
- a wearable (ID card, health monitor, fitness tracker, watch)
- a smart device (whiteboard, security camera, thermostat, door lock, lights, etc.)
- a medical sensor

## ARTIFICIAL INTELLIGENCE (AI)

AI is the ability of a machine to mimic functions commonly associated with intelligent beings, such as:

- learning
- problem solving
- decision making
- ability to reason
- ability to discover meaning
- ability to generalize
- learning from past experience

## 3D PRINTING (3DP)

3DP is an umbrella term for a set of technologies that build 3D physical objects from a digital file by adding successive layers of material using a 3D printer, until the object is created.

There are many 3DP technologies, using various forms of materials and energy sources. The different 3DP technologies are using various types of materials, including plastics, metals, concrete, ceramics, etc.

There is a wide range of 3D printers' types, capabilities, prices, etc.

## VIRTUAL REALITY (VR)

VR is a computer-generated environment that can be interacted, in a seemingly physical way, by a person using special equipment, such as a VR headset or smart glasses.

A person using VR equipment is able to look around the artificial world, move around in it, and interact with virtual features or items.

## AUGMENTED REALITY (AR)

AR is an enhanced version of the real world achieved through the use of computer-generated objects that appear to coexist in the same space as the real world.

An AR system has 3 basic features:

- it combines real and virtual objects in a real environment
- it aligns real and virtual objects
- it runs interactively, in 3D, and in real time

## ROBOTICS

Robotics deals with the conception, design, construction, operation, and use of robots.

A robot is a type of automated machine that can execute specific tasks with little or no human intervention, with speed and precision.

## BRAIN - COMPUTER INTERFACE (BCI)

Brain - Computer Interface (BCI) is a computer-based system that acquires brain signals and converts them into commands that are transmitted to an external device, such as computers, robotic limbs, wheelchair, etc.

BCI allows to control devices without verbal or physical interaction.

## ADVANCED MATERIALS

The advanced materials enable the production of more robust, comfortable and sometimes more inexpensive AT products. They also make possible certain advancements in AT applications, such as prosthetics, orthotics and vision-related AT.

# THE ASSISTIVE POTENTIAL OF THE NEW TECHNOLOGIES

## Participants...

- What advanced assistive technologies (ATs), products and applications are you currently using?
- How can you improve your training activities using advanced ATs?

Share your own experiences and your general impressions about real or imagined adult training experiences.

## THE ASSISTIVE POTENTIAL OF IoT-BASED TECHNOLOGIES

IoT enables the data generation, processing, and storing on a large scale, thus supporting many advanced assistive technologies.

IoT technologies, such as environmental sensors, smart objects, and wearables, can provide inclusive and assistive information services in near real-time and improve PWDs access to learning.

## SMARTPHONES

IoT devices can be interacted with smartphones. As smartphones generally include AT features and are widely available, the IoT potential applications for improving PWDs access to learning is huge.

## SMART CLASSROOM

One good example of IoT applications that increase accessibility is the smart classroom, a classroom that makes use of modern technologies, IoT devices, tools and applications to facilitate learning. It integrates various learning technology, such as:

- computers
- smartboard
- specialized software
- assistive devices
- audio/visual capabilities
- smart objects

## IoT & THE LEARNING ACCESSIBILITY

IoT can provide an inclusive learning environment where learners with special needs can learn at their own pace. Examples of IoT-enabled assistive technologies:

- voice assistants
- speech-to-text tools
- smart devices to assist PWDs and provide disability specific monitoring
- smart sound and light adjustment
- IoT wearables to collect data to help customizing the learning environment

## THE ASSISTIVE POTENTIAL OF AI-BASED TECHNOLOGIES

AI enables countless educational tools aimed at improving PWDs access to learning.

AI-enabled tools are already helping people with vision, hearing, mobility and learning disabilities.

Many of the apps we are currently using have AI capabilities which increase their accessibility.

## AI & THE LEARNING ACCESSIBILITY

AI can remove learning barriers through different solutions:

- image recognition and facial recognition for visually impaired learners
- lip-reading recognition and sign language translation for learners with a hearing impairment
- text summarization for learners with reading difficulties
- real-time captioning or translations for learners with a hearing impairment or even those who don't speak the language
- Optical character recognition (OCR) to digitalize text from a paper format

## SMART ASSISTANT

One good example of IoT applications that increase accessibility is the smart assistant, a software that uses AI to:

- monitor user's activities and behaviour
- understand user's requirements to perform customized tasks
- provide contextual information or recommendations
- help user navigate or carry out daily tasks

The smart assistant is usually located on mobile devices. It can use social networks as resource and can self-learn.

AI-powered robots can be used as smart assistants.

## THE ASSISTIVE POTENTIAL OF 3DP

3D printing can be used to produce a wide variety of assistive devices, including ones that improves PWDs access to learning. The 3D printed devices are usually more affordable and more customizable than manufactured versions.

### 3DP & LEARNING ACCESSIBILITY

The applications of 3DP in AT are typically related to the manufacturing of prostheses and other AT products. Examples of 3DP applications in education:

- tactile learning aids for visually impaired learners
- various learning artefacts
- customized AT devices
- AT for students with special learning needs

## THE ASSISTIVE POTENTIAL OF AR/VR

AR and VR have many potential applications as AT to support the needs of PWDs. VR can provide a safe environment for practicing various skills while AR can make physical environments more accessible by adding virtual elements.

### VR & LEARNING ACCESSIBILITY

Educational VR experiences can help learners that are struggling to master content from a textbook or lecture. Also, learners with autism or intellectual disabilities can practice new skills in real world situations, in a safe environment.

### AR & LEARNING ACCESSIBILITY

One of the benefits of AR is its ability to catch the interest of students with disabilities or with special educational needs. It can also provide assistance for each level of visual impairment.

Thanks to the wide availability of AR-capable devices (smartphones, tablets, computers) and apps, implementing AR in the classroom is relatively inexpensive.

## THE ASSISTIVE POTENTIAL OF ROBOTICS

Robotics is driving the development of various assistive products to help increase users' independence. Among these, the assistive robots (which can sense, process sensory information, and perform actions that benefit PWDs) and the educational robots can help increasing the accessibility of learning.

## ROBOTICS & LEARNING ACCESSIBILITY

Robots can help teach social and educational skills to all learners. They can provide individualized education programs for learners with disabilities such as autism, emotional and behavioral disorders.



# IMPLEMENTATION OF NEW TECHNOLOGIES IN ADULT EDUCATION

## Participants...

- What advanced technologies, products and applications are currently used in Adult Education?
- How the Adult Education training activities can be improved using new technologies?

Share your own experiences and your general impressions about real or imagined adult training experiences.

## IoT & AE

IoT can enhance AE by changing how data is gathered and interfaced with users and automated processes. It allows trainers to create an environment that supports the acquisition of knowledge in a natural and efficient manner. It can impact the training but also other processes, from administration to building maintenance.

## IoT USES

IoT enables AE institutions to:

- Create new ways to learn
- Improve training delivery and learners' evaluation
- Simplify administrative operations
- Provide a safe environment

## IoT FOR TRAINERS

IoT can support adult trainers in multiple ways:

- Allows for autonomous attendance systems
- Enables advanced pedagogies to cater for face-to-face, online and hybrid learning
- Supports assessment, evaluation, and feedback systems

## IoT FOR LEARNERS

IoT can support adult learners in multiple ways:

- Enhances online learning
- Improves productivity and interaction
- Allows for customized learning environments
- Supports school and home management

## AI & AE

AI has immense potential to increase the inclusiveness of AE, at relatively affordable cost. It may pose significant ethical, legal and economic concerns, as well as risks relating to human rights.

## 3DP & AE

3DP can help increasing the inclusiveness of AE by creating affordable unique, complex and customized objects, such as:

- personalized assistive devices
- learning aids adapted for various disabilities

## USING 3DP

3DP is now an accessible technology that can be used by educators for creating objects to support training. Trainers can learn how to use 3DP from some free resources, available thanks to Erasmus+ programme.

Many useful 3D printing files are freely available online, for example on [www.thingiverse.com](http://www.thingiverse.com). The assistive devices library available on <https://makersmakingchange.com/> includes an open source collection of AT solutions.

Objects can be also 3D printed by a makerspace or a 3D printing services provider.

## AR/VR & AE

- Allows PWD learners to take part in learning tasks relatively free from the constraints imposed by their disability, and safe.
- Helps create empathy for PWDs in others by supporting them to experience disabilities via simulated environments.
- Helps overcoming physical limitations
- Creates safe spaces where PWD learners can develop their knowledge, skills, and attitudes
- Supplies new and formerly impossible experiences, in a safe environment
- Enables personalized and distraction-free learning
- Supports learners with special needs

## AR/VR LEARNING RESOURCES

There are many VR apps that can be used in AE, for examples:

- Google Expeditions App - over 600 expeditions, with panoramic scenes, curriculum connections, notes, and discussion questions.
- Discovery VR - a collection of documentaries
- Google Arts & Culture - a collection of art and cultural content, including AR and 360-degrees videos.
- YouTube – include also useful VR resources