

Selected assistive technologies as support for people with disabilities in education

Wybrane technologie asystujące jako wsparcie osób z niepełnosprawnością w edukacji

Słowa kluczowe: niepełnosprawność, technologie asystujące, inkluzja, wykluczenie, edukacja.

Streszczenie: Artykuł prezentuje inkluzyjny charakter wybranych technologii asystujących dla osób z niepełnosprawnościami oraz ich ogromny potencjał w usamodzielnianiu i upodmiotowieniu osób z niepełnosprawnościami. Celem artykułu jest również zwrócenie uwagi na potencjał technologii asystujących i ich znaczenie, ponieważ coraz częściej mogą być kluczem do samodzielności, niezależności i pełnego uczestnictwa w życiu społecznym.

Key words: disability, assistive technologies, inclusion, exclusion, education.

Summary: The article presents the inclusive nature of selected assistive technology for people with lack of qualifications and their powerful potential in independence and empowerment of people with disabilities. The aim of the articles is also to note the potential of assistive technology and its importance, which can increasingly be the key to independence, the effect and the real effect in life.

“Disability is a multifaceted phenomenon that requires looking at it from the perspective of both the structural features of society and the characteristics of the economic and political system, as well as the rules of social organization and broadly understood culture at a given time. These factors shape the position of disabled people in the social structure, which results in their greater or lesser exclusion or inclusion in the mainstream of society” [Dorota Żuchowska-Skiba, 2016, s. 7].

In the resolution of the Sejm of the Republic of Poland of 1 August 1997, the “Charter of Rights for Disabled Persons” – it was recognized that disabled persons, i.e. persons whose physical, psychological or intellectual abilities permanently or periodically impede, limit or prevent everyday life, education, work and the performance of roles, in accordance with legal and customary standards, have the right to an independent, autonomous and active life and cannot be subject to discrimination. This means the right of persons with disabilities to:

- a) access to goods and services enabling full participation in social life;
- b) access to medical treatment and care, early diagnostics, rehabilitation and medical education, as well as to health services taking into account the type and

- degree of disability, including the provision of orthopedic items, aids, rehabilitation equipment;
- c) access to comprehensive rehabilitation aimed at social adaptation;
 - d) study in schools together with their able-bodied peers, as well as to use special education or individual education;
 - e) psychological, pedagogical and other specialist assistance enabling development, acquisition or improvement of general and professional qualifications;
 - f) work on the open labour market in accordance with qualifications, education and opportunities and use of career counselling and mediation, and when disability and health condition require it – the right to work in conditions adapted to the needs of disabled people;
 - g) social security taking into account the need to bear increased costs resulting from disability, as well as including these costs in the tax system;
 - h) living in an environment free from functional barriers, including: access to offices, polling stations and public utility facilities, free movement and universal use of means of transport, access to information, possibilities of interpersonal communication;
 - i) having a self-governing representation of their environment and to consult with it all draft legal acts concerning disabled people; full participation in public, social, cultural, artistic, sports life as well as recreation and tourism according to their interests and needs.

Based on the results of the 2021 National Census of Population and Housing, the total number of disabled people as of March 31, 2021 was 5.4 million and constituted 14.3% of the country's population, compared to 12.2% in 2011. Compared to the results from 2011, the number of people with disabilities increased by 750.5 thousand, i.e. by 16.0%. In addition, it should be noted that there are currently almost 9 million people over 60 years of age in Poland. In 2030, this group will constitute about 30% of our society. Demographic phenomena indicate an increase in the life expectancy of the population, while accelerating the aging process of the population in many countries, including Poland. The frequency of problems related to limitations in performing ordinary activities increases with age, and the process of society aging is a multi-faceted, multi-dimensional process that causes implications in many aspects of life.

The perception of disability has undergone significant changes over the years, resulting from the evolution of social norms, values and growing awareness of the needs of people with disabilities. In the past, disability was often viewed from a medical perspective, which focused on individual dysfunctions and health problems. People with disabilities were usually isolated from the rest of society and viewed as individuals requiring care, treatment or specialist rehabilitation. A fundamental change in the perception of disability occurred in the second half of the 20th century. Disability began to be understood more as a result of social, cultural, economic and architectural barriers, rather than solely as the effect of individual

deficits. Attention was also paid to discrimination, marginalisation and systemic problems that make it difficult for people with disabilities to fully participate in social, professional and cultural life.¹

The term assistive technology (AT) refers to devices, equipment, systems, software, applications that improve learning, work and everyday life of people with disabilities, help them maintain or increase functional capabilities and independence in accessing the environment². Due to their capabilities, modern technologies play a significant role in the everyday functioning of both able-bodied and disabled people. However, in the case of the latter group of people, they are the key to full participation in social and professional life. When we talk about the latest educational directions in the modern world that use the potential of modern technologies, we do not only mean the possibility of using better and more efficient computers or networks, but also and above all increasingly perfect tools in the form of applications, software, devices and equipment today called assistive technologies, covering the range from tools facilitating communication and enabling education to modern solutions supporting mobility and accessibility.

Assistive technologies and their inclusive nature, which can be seen on two mutually complementary levels – technological and social. Both of these perspectives influence the perception and use of technology by people with disabilities, offering them new possibilities and opportunities, and at the same time changing the way they are perceived and treated in society. On the technological level, modern technologies act as tools that equalize opportunities and eliminate barriers resulting from various types of deficits – both sensory (e.g. visual, auditory), as well as mental or motor. On the social level, they enable “bypassing the limitations existing in the physical environment, opening up opportunities for people with disabilities to fully participate in social life. People with disabilities can carry out activities similar to those undertaken by able-bodied people (of similar social status and education and of similar age) on the Internet and independently perform everyday activities, without having to struggle with barriers that prevent such activities in physical reality”³. Thanks to their capabilities, technologies facilitate the participation of disabled people in building relationships and social life.

Disabled people unfortunately constitute one of the groups most at risk of social exclusion. This is primarily due to numerous barriers (including architectural, infrastructural, communication, economic) that make it difficult, and often even impos-

¹ Gąciarz, B (213). *Przemysłuć niepełnosprawność na nowo. Od instytucji państwa opiekuńczego do integracji i aktywizacji społecznej. Studia Socjologiczne, 2, s. 25–26.*

² *World report on disability*, World Health Organization 201, s. 101.

³ G. Williams (1993). *Chronic illness and the pursuit of virtue in everyday life*. W: A. Radley (ed.), *Worlds of Illness: Biographical and Cultural Perspectives on Health and Disease*. Nowy York–London: Routled, s. 92–103.

sible, for them to function in social and professional life.⁴ *The final report of the study on the needs of disabled people in Poland* indicates that in terms of meeting the need for education, only less than 19.5% of disabled people declare that they use modern technologies. They most often indicate such experiences, taking into account:

- people with visual impairments (38.5%);
- people with hearing impairments (22.7%);
- people with movement impairments (20.6%),
- people with intellectual disabilities (14.1%);
- people with significant disabilities (22.8%);
- people with moderate disabilities (16.0%)⁵.

It should also be noted that among the group people with disabilities, modern technologies are mentioned as those tools that "generally do not meet the conditions specified in the research question, i.e. do not currently have an innovative character and have been available to people with disabilities for many years, and moreover, are in common use in the entire society"⁶. In the this group of people who use them, the most commonly identified are: „laptop/computer (including, among others, a sound computer), (18.2%) Internet (17.3%), applications (13.1%), smartphone (12.1%), screen reader (7.5%). In turn, among solutions in the field of modern technologies that could significantly facilitate functioning, only 14.5% see them. The most frequently indicated are: computer (21.0% of respondents indicating modern solutions that could potentially improve functioning), applications (13.4%), smart home (10.9%), smartphone (6.7%), platform (6.7%)⁷.

Currently, there are many types of modern assistive technologies available on the market dedicated to people with specific types of disabilities or difficulties. However, two important facts should be emphasized: firstly, the dynamics of changes in the technological field means that equipment, devices and software for people with disabilities that are currently considered very modern and useful "age" extremely quickly and are replaced by newer solutions, which, with their high price, is a significant barrier in the possibility of obtaining them. Secondly, "Only about 1/3 of disabled people declare that there are modern technological solutions that are applicable to their dysfunctions. In this respect, there are large differences between people with different types of disabilities – such solutions are most often indicated by people with visual impairments, and also, although less often, people with hearing and movement impairments." Nevertheless, in the face of the irreversibility

⁴ M. Papiernik, *Sytuacja życiowa osób niepełnosprawnych mieszkających w Polsce i czynniki ją determinujące*, <http://ogrodynauk.pl/Content/Issues/2011/01/Articles/Sytuacja%20życiowa.pdf> (14.10.2024).

⁵ *Końcowy raport badania potrzeb osób niepełnosprawnych w Polsce*, Państwowy Fundusz Rehabilitacji Osób Niepełnosprawnych, 2024, s. 160.

⁶ Ibidem.

⁷ Ibidem.

of various diseases and events, modern technologies are the key to supporting people with disabilities, their families and carers.

Below, for the purposes of this article, I present selected assistive technologies divided into three main groups, relating to specific disabilities or difficulties. The first of the described groups are assistive technologies for people with visual disabilities, i.e. people with limited or lost vision, which causes limitations, among others, in access to information, independent movement or sometimes even in everyday activities.

Examples of assistive technologies that are dedicated to the blind and visually impaired and deafblind are:

1. Navigation audio systems – which use GPS technology and sound to provide information about the location and direction of movement.
2. Screen readers – software that converts text and other content displayed on the screen into sounds. The way readers work can be adjusted in many areas, such as the pace, volume of the reader, type of voice or reading language.
3. Digital book and music players with many additional functions such as a dictaphone, FM radio or talking watch, etc. Advanced technology allows for reading text documents using speech synthesizers in Polish and foreign languages. These devices have the ability to play audiobooks in various formats.
4. Braille rulers are specially designed devices for reading and writing text in the Braille alphabet, which uses raised dots in a six-dot arrangement to represent letters, numbers and characters. Modern Braille rulers can support many devices, allowing immediate access to all devices with a single keystroke. Braille rulers have a number of additional functions such as: notepad, calendar, alarm, calculator, watch, stopwatch, timer, DAISY player and support, among others, the following formats: DOC, DOCX, BRF, TXT, RTF, PDF.
5. Portable electronic magnifiers with different screen diagonals, offer a wide range of magnifications from several times magnification to, for example, 30 times and, among others: 20 high-contrast color modes, adjustable reading lines, built-in LED lighting, a special stand. Magnifying glasses can be connected to a TV or monitor via the HDMI port to obtain an image on a large screen.
6. Mobile phones dedicated to visually impaired and blind people with a fully voiced interface, with a dictation function and voice recognition. The advantages of such phones include the ability to adjust the text size and contrast, a voice recognition function enabling text dictation, a color detector function, assistance in making emergency calls and sending SMS messages using the built-in SOS button.
7. Portable magnifiers, including modern devices with two screens enabling simultaneous tracking of, for example, a board and a textbook or notebook. Comfort and speed of work are provided by two cameras with 10.5-inch screens and, importantly, there is no need to switch between individual modes because they work independently. Magnifiers allow you to obtain, among others, 25x mag-

nification for close-up and 30x magnification for distance. They also have OCR functions and the TalkBack function.

8. HD stationary magnifiers with LCD monitor – they have, among others: movable desktops with full lock, easy-to-use control panel, image switching function, thanks to which they can be used as a computer monitor and magnification up to a hundred times and e.g. 10 high-contrast modes as well as LED desktop lighting.

The second group of assistive technologies are those dedicated to people who are deaf, hard of hearing and have problems communicating:

1. FM systems are wireless hearing aid systems that provide clear sound. They are designed for people with hearing loss who use hearing aids or a speech processor, or for people who would like to improve speech understanding, e.g. in a noisy environment. The sender is equipped with a device with a transmitter and a microphone. The recipient (hearing aid user) has a receiver and a microphone. The sound from the sender's microphone is sent to the receiver connected to the recipient's hearing aid via radio, and the signal is transmitted from the transmitter to the receiver, which is tuned to a specific frequency. As a result, the sender's speech is heard very well, sounds and interference from the environment are eliminated, because the system suppresses unnecessary sounds. The receiver has an audio output, it can be connected to other devices, such as a computer, TV, dictaphone or mobile phone.
2. Software including MÓWik operating on the basis of the Android system (tablets, smartphones), with Ivona speech synthesis (male voice, female voice), is intended for alternative and supportive communication for people who have serious problems with communicating by speech. Software equipped with over 10,000 thousand symbols (pictograms). The user can create whole sentences and statements from symbols, which are read by speech synthesis. Words can be declined. Users using letters can write information using the on-screen keyboard and read it using speech synthesis.
3. Alternative communication devices that enable recording of messages of a specified length, which are then activated by extremely sensitive and large membrane buttons. This is a device designed for people with difficulties in communicating but also, due to its construction, for people who have difficulties in performing precise movements in the field of fine motor skills.
4. Induction loops (also known as magnetic loops) are systems that convert sounds into electromagnetic waves that can be received using a hearing aid or cochlear implant. The induction loop transmits to the recipient an amplified and directed electromagnetic signal from a built-in or external microphone, which is received by the induction coil in the hearing aid, cochlear implant or headset. Induction loops and induction loop amplifiers, depending on their type and construction, can serve from 1m² (so-called portable – station loops) to the sound reinforcement of entire rooms and lecture halls and other large areas.

The third group of assistive technologies are devices for people with musculoskeletal dysfunctions, which include:

1. Specialized computer mice made of durable material, equipped with comfortable buttons and large trackballs. The ergonomic shape of these devices has been designed to match the contour of the hand. These specialized mice have a lock that allows you to use the drag and drop function without having to hold the button, and the use of large trackballs in them significantly speeds up navigation and minimizes wrist movements.
2. Eye tracking devices, compatible with most tablets, laptops and desktop monitors with commonly used operating systems. This is a technology that allows users to control computers and other devices equipped with a screen using eye movements. These devices can be used both indoors and outdoors, even in bright light.
3. Rehabilitation chairs are designed for children and adolescents with significant deficits in the musculoskeletal system, who have not acquired the ability to sit independently or have significant difficulties in adopting and maintaining a sitting position. They have features such as: adjustable headrest height, adjustable headrest angle and depth, adjustable backrest with a pillow, special point vests, adjustable chest supports, hip belts, adjustable thigh wedges or footrests with feet with foot stabilizing straps.
4. Specialized joysticks designed for people with mobility disabilities of the upper limbs to operate a computer. The cursor of such a device moves under the influence of a light touch (0.5 Newtons) in a precise manner, which allows for free navigation and selection of objects on the computer monitor. These devices are profiled in a way that ensures a natural hand position and comfort of work and work with computers via both PS2 and USB connections.

It should also be emphasized that specialist keyboards play an important role in increasing the accessibility of technology for people with limited movement, including:

- a) keyboards with enlarged keys and characters – designed for people with impaired vision or limited precision of movement. Thanks to larger and clearer keys, it is easier to press the right button without errors.
- b) profiled keyboards for one hand – designed for people who can only use one hand. Thanks to the special layout of the keys, effective writing is possible, which minimizes the need to move the hand.
- c) keyboards for operation with feet, mouth or pointers – such solutions are particularly useful for people with limited hand movement. Users can control the computer using special pointers that operate on touch or movement.
- d) keyboards for children – they are distinguished by colorful keys that not only encourage learning and play, but also facilitate the recognition of letters and

numbers. The layout of the keys is adapted to children's needs, which simplifies the use of the computer for educational and entertainment purposes.

Specialized keyboards allow you to adjust your typing style to the individual needs of users with different types of disabilities, which increases their comfort and independence in using computers. Keyboard protection frames are also available for keyboards – They allow users to rest their hands freely without the risk of accidentally pressing an unwanted key.

All of the above-mentioned assistive technologies have enormous potential to reduce barriers and improve the quality of life of people with disabilities, which makes their development and availability extremely important for society. Despite the opportunities and threats caused by the ongoing technological revolution, it seems necessary that the network and assistive technologies should be an indispensable tool in the process of rehabilitation and education of the disabled, "understood as a complex, multi-stage and multi-dimensional process (...) taking place through many professional activities of a therapeutic, psychological, pedagogical, social and vocational nature. The final effect of this process should be achieving the highest possible level of independence and self-reliance of a person with a disability, moving from the position of a client to the position of an actor – a productive person who creates valuable social values"⁸.

Literature

1. Gąciarz, B. (2014). Przemysłość niepełnosprawność na nowo. Od instytucji państwa opiekuńczego do integracji i aktywizacji społecznej. *Studia Socjologiczne*, 213, 2, s. 15–42.
2. *Końcowy raport badania potrzeb osób niepełnosprawnych w Polsce*, (2024). Warszawa: Państwowy Fundusz Rehabilitacji Osób Niepełnosprawnych.
3. Masłyk T., Migaczewska E. (2014). Portret aktywnego, niepełnosprawnego użytkownika sieci internetowej. *Niepełnosprawność – zagadnienia, problemy, rozwiązania*, nr III (12).
4. Williams, G. (1993). *Chronic illness and the pursuit of virtue in everyday life*. W: A. Radley (ed.), *Worlds of Illness: Biographical and Cultural Perspectives on Health and Disease*. Nowy York–London: Routled, s. 92–108.
5. *World report on disability*, World Health Organization 2011, s. 101.

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⁸ Masłyk T., Migaczewska E. (2014). Portret aktywnego, niepełnosprawnego użytkownika sieci internetowej. *Niepełnosprawność – zagadnienia, problemy, rozwiązania*, nr III, (12), s. 28.