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Multimedia in life and education of visually impaired and blind people

Introduction

Sight is a sense that enables the integration of information received by other senses, provides continuous, simultaneous and comprehensive information about the surrounding world. Proper and consistent development of the entire visual system is important for the proper development of a child in various developmental spheres. The basic conditions for the development of sight are both properly built and functioning visual system as well as adequate light and the presence of observation objects. Early detection of any abnormalities in the development of vision can prevent the deepening of visual impairments through the use of proper treatment and therapy of vision as the sense of sight in visually impaired children can and should be trained. The need for close cooperation between parents, ophthalmologists, therapists and teachers in the process of improving vision is also highly emphasized, mostly due to the fact that:

> seeing is a cerebral process that develops with age and is subject to exercise. Physicians must take care of the peripheral perception segment of the human eye, but the work on the development of the visual analyzer belongs to teachers. An ophthalmologist enables vision, teacher and educator – understanding and interpretation of the viewed images. (Galewska, 1984, p. 53)

Therefore, the response to the needs of visually impaired people is – in addition to interdisciplinary cooperation – equalizing opportunities not only in the aspect of access to information (educational) but also to services. The answer to these needs may be technological innovations that can be used in the medical and educational environment, which may contribute to the increase in the independence of visually impaired people. The definitions and classifications of visually impaired people are an approximation of the above issues[1].

ICT (information and communication technologies) support for blind and visually impaired students

Functioning of visually impaired people is associated with overcoming barriers and limitations on a daily basis. Lack of sight is compensated by better developed senses of touch, hearing, smell or taste. Yet without an appropriate support, therapeutic or revalidation activities, a blind or visually impaired person would not be able to function well in the world around them. Ossowski (1998) distinguished the following rehabilitation goals aimed at increasing the number of information that can be received and processed: acceptance of sight loss or dysfunction; development of motivation for undertaking efforts to learn life using the remaining senses; tactile writing; learning to orientate and move independently; shaping pro-health attitudes – therefore,

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[1] The definition of visually impaired people depends on the applied criterion. D. Pojda-Wilczek takes into account: 1. Visual acuity – "a person whose visual acuity in the stronger eye with the best possible eyeglass correction is greater than the movement of the hand before the eye, but not greater than 0.3, or its central field of vision does not exceed 30º. 2. Functionality (the extent of the use of eyes in everyday life, professional work or for other specific needs): a person whose eye condition prevents the fulfillment of their specific needs" (Pojda-Wilczek, 2002, p. 273). Considering the social definition: a visually impaired person is perceived as having serious problems in everyday life, moving around in unfamiliar territory, reading, writing etc. People who have not seen from birth or have lost their sight before the fifth year of life, are referred to as blind. In relation to those who lost their sight after the age of 5, the term "darkened" (Polish: ociemniały) is used (Pojda-Wilczek, 2002, p. 273). The pedagogical (educational) definition, in turn, takes into account the possibilities of using the preserved visual capability in the implementation of the school curriculum. In this case, children who are poorly sighted are children "who, despite their eye damage, have retained their ability to learn by visual means. They can read flat font texts although sometimes they have to use special optical aids (magnifying or corrective glasses) or the read text must be written in an appropriately enlarged font. They can also use visual methods in the teaching process, that is, demonstrations or observations, just like normally sighted children but with certain modifications and adaptations of teaching aids" (Majewski, 2001, p. 233).

in addition to the traditional exercises, the use of the media may considerably facilitate the functioning of people with special educational needs.

Equalizing educational opportunities for children with special educational needs requires adaptation of services, products, items and access to information that is accessible to all people.

> Despite the fact that the number of children with visual disability is increasing in mainstream schools, especially visually impaired students, actions aimed at equalizing their educational opportunities are insufficient. Lack of or limited support for students with visual disabilities in mainstream schools results mainly from the teachers' lack of knowledge, inefficient use of ICT and supportive technologies dedicated to blind and visually impaired people. (Paplińska, 2017, p. 119)

One can wonder whether technology can be more effective than the tools used so far. Information and communication technologies are to be an addition to good teaching methods and not their substitute. They can greatly help teachers conduct classes and support students in the independent acquisition of knowledge and skills. ICT tools (technology and communication) should not replace practising skills which, due to the specific nature of the subject, require traditional methods, e.g. handwriting (grapho-motor exercises), drawing, painting, counting, and making graphs. ICT tools are designed to help students learn. Their goal is to increase learning effectiveness in both school and home environments.

ICT tools can be used in many ways, e.g.: the teacher prepares materials for students who are recipients; students (individually or in groups) prepare specific content and present it to the teacher; during the didactic process a model of the so-called reverse lesson is used, which assumes that the teacher provides information for students to learn at home, while the students develop the element of classes on the basis of the material prepared by the teacher and the acquired knowledge is transferred to classmates using ICT; the last way is to create a portfolio considered a set of works – in this case, ICT accompanies the process of learning in both the school and home environment by all members of the educational process (teacher, student) – the teacher prepares material for the lesson on the Internet and students keep electronic records that teachers and, if necessary, other students have access to.

The work of a teacher with a visually impaired student requires a specific content-related preparation and awareness that the limitations resulting from

damaged sight affect the access to information, and such students are not always able to use specific teaching aids. Educational technologies provide support in development, communication and education. K. Czykier (2013) stresses that the use of computers by students, as well as broadly understood media, requires proper preparation, which is a challenge for both the education system, teachers, parents, creators of media messages, as well as the recipients. Hence, it is justified to pay attention to the role of the teacher, who should use the means and tools of information technology during self-education and learning process, increasing their pedagogical and IT skills. In reference to the abovementioned competencies "the most important in their formation is to master the ability to design the teaching process with the use of multimedia, methodology of using ICT in the educational process, principles of designing, implementation and use of multimedia presentations, rules of creating, perception and impact of multimedia messages and the use of new forms of communication via electronic educational media" (Osmańska-Furmanek & Furmanek, 2001, p. 68).

Information and communication technologies (ICT) are improving the quality of teaching and learning. Modern technologies (tools and materials) are more effective when used in reference to a specific activity (mathematical, linguistic, artistic). "Modern teaching aids based on electronic technologies can support teachers, but this can only happen with a properly structured and provided technological and methodological support". Paplińska (2017, p. 118) in pilot studies on the use of education and communication technologies by teachers indicates that 60 of the 71 surveyed teachers use the computer, audio-video recordings are used by 52 respondents, and websites by 44 respondents. Such aids are more often used by teachers working in special education facilities, and over half of the interviewed teachers (38 respondents) use multimedia educational programs. The fact that six teachers do not use any ICT solutions is particularly worrying here.

> In the area of education, typhlopedagogy of the future will play an important role in the field of education of children and youth with the use of new technologies (notebooks and books will be replaced by computers and tablets). The likelihood of minimizing and even completely eliminating the traditional way of reading and writing by children (requiring a certain level of manual efficiency, motor coordination, and at the same time efficient visual and visual-motor skills) suggests the possible disappearance of the braille writing system and the dominance of the auditory canal in mastering given

skills. In view of these changes, children with visual disabilities, learning to read and write directly on the computer, will need additional specialized classes stimulating the development of these motor, sensory and sensory-motor skills that were previously developed while acquiring the ability to read and write in a traditional way. (Zaorska, 2017, p. 20–21)

The computer as a means of overcoming barriers in the functioning of blind and visually impaired people

Dynamically developing electronic media have enormous significance, not only of cultural but above all of educational character. The computer as a quick, clever/intelligent tool that systematizes, stores and transmits knowledge, is the subject of everyday use as a link with the surrounding world. Computers have become an inseparable element of human functioning – their motivation, inspiration, search, self-development. The attractiveness of computers results from the following features:

> multisensory character (impact on various human senses), multimedia character (the capability to combine in terms of hardware and software multiple media and their functions in one device), interactivity (the capability to establish dialog between a human being and computer), simulation (the capability to imitate real phenomena, processes, devices), communication (the capability to provide communication with another person, computer, device through the network) and virtualization (the capability to create fictitious reality – virtual, cyberspace). (Walter, 2007, p. 45)

Among the ways of application of computers in the field of special needs education, we distinguish not only the diagnosis of disorders, but also rehabilitation as a:

> combined and coordinated therapeutic, psychological, pedagogical, socio-vocational impact, aimed at developing or restoring a physical efficiency and ability to live independently in society in a person affected by health problems. Rehabilitation is a process that combines interactions of a different nature and scope so that the restoration of lost abilities is as complete as possible, possibly early and long-lasting. (Dykcik, 1998, p. 64)

Rehabilitation, therapy and support can concern every area of life of a visually impaired person. In the case of school-aged children, the inability to

visually master the educational material does not mean that visual potential cannot be used in other areas of life. One can practice without the help of optical aids, as well as with the use of magnifying glasses, telescopes and electronic aids (TV magnifiers, electronic magnifying glass, computer equipment and appropriate software).

Rehabilitation activities for visually impaired children aim to stimulate cognitive processes, improve multisensory compensation, improve visual and auditory analysis and synthesis, exercise in manual dexterity, to provide compensatory (tactile and auditory) exercises, develop directional and spatial orientation, and finally to improve computer skills and master computer software dedicated to the visually impaired, e.g. Jaws, SuperNowa, Window – Eyes, OutSpoken. In order to be able to work with Windows software, in addition to the appropriate system settings a specialized program is needed, which reads the displayed text using a speech synthesizer and emits it on a braille display or, in the case of visually impaired, enlarges the graphic elements on the screen enabling viewing the enlarged content in proper color and contrast.

The programs are equipped with control panels that give the possibility to set parameters such as speed, volume, and the amount of information read. A properly equipped computer with selected programs for speech synthesis allows the blind to use the majority of computer applications as well as the Internet. In her research on information and communication technologies in inclusive education of blind and visually impaired students, Paplińska proves that blind and visually impaired students mostly use specialized software (dedicated to people with visual disabilities) to obtain information from the Internet and communicate with people via chat, social networks or e-mail, less frequently for the hobby's purposes, and even less often for writing homework on a computer, taking notes on a computer during classes, preparing presentations for classes, for writing tests at school. They also extremely rarely use computer for playing computer games and writing tests in an electronic version (Palińska & Wiazowski, 2016, p. 131).

The rapid development of science and technology makes us more willingly and boldly use information technology, whose element is the Internet. The Internet has become a means in the process of education and upbringing, mainly due to the fact that it is a multimedia tool – it provides information using verbal, pictorial and action code, thanks to which the

cognition process is interesting and individualized. In addition, it allows people to interact with each other, activates them and stimulates, facilitates and introduces different ways of contacts, blurs the boundaries between the sender and the recipient. Thus, various initiatives are created to develop standards for building websites, so that they are legible for blind people. The Internet in the aspect of educational use can be a source of information and teaching aids, as well as a technical medium in the process of distance education, an example of which can be a virtual school offering various forms of self-education.

The interactive whiteboard – an excellent didactic tool used during the educational process – is a combination of the computer and the Internet. This whiteboard is an effective form of education dedicated to all students in inclusive education departments. It is a device that combines computer components, a screen for displaying a presentation and a self-copy table. The interactive whiteboard and the right software, interesting lesson scenarios that include additional photos, posters, charts, videos, songs, pieces of art, puzzles, didactic games, stories, poems read by the teacher all together make the capabilities of the interactive whiteboard unlimited.

The assumption upon which its use is built is to maximize the teaching process, activate students, break the psychological and social barriers of visually impaired students and revive broadly understood integration. The traditional whiteboard is a barrier in the education of children suffering sight dysfunction – the information written on it does not reach the blind or visually impaired child. A local computer network may be a good alternative here. It may be a method to improve communication between the teacher and students. The learning stand of the visually impaired student consists of a desktop equipped with a program magnifying the characters on the screen and a speech synthesizer. Blind students may additionally have a braille display. Visually impaired children see the text clearly, the blind child reads the information written by the teacher on a braille display or receives it via a speech synthesizer – this way the teacher can control the course of each student's activities. The functions of the computer network are conducive to the active participation of students in the classes and, above all, enable checking their effectiveness.

The development of technology has caused the emergence of a huge number of "gadgets" and multifunctional devices, which may but not necessarily has to affect the students' IT skills. M. Paplińska believes that:

the modern digital generation has a problem with using technological inno-
vations for purposes other than communication via text messages or social
media, i.e., for example, education or work. This shows that young people
use new technologies, but only at a very basic level, without full use for
non-entertainment purposes, including more extensive possibilities offered
by the computer and the Internet. (Paplińska, 2017, p. 117)

Students with sight dysfunction need a variety of educational aids, from
traditional non-electronic to the modern computer and information systems
that support development and education, access to information and broadly
understood culture.

The use of computers makes it possible to leave the traditional model of
education, as the media performs a cognitive, educative, emotional, motiva-
tional and interactive function in the teaching process. Education is keeping
up with the times, adapting to the changes taking place in the modern world,
"these changes relate to, among others: ways of communication, means and
tools used in learning and working, as well as storage and ways of using in-
formation. It is mainly due to the Internet that education has gained a new
dimension – many people have been enabled to access infinite resources of
information as well as tools facilitating their search and acquisition" (Tadeu-
siewicz, 2004, p. 144). Assuming that a computer becomes the blind stu-
dent's work tool, it is a bridge between blind and visually impaired children
and other people and an important element in the integration process.

People with visual impairments need devices and messages that affect all
the senses, stimulate their own activity, break down barriers, and evoke posi-
tive emotions, commitment and creative thinking. Blind and visually im-
paired people, using their hearing and touch, can efficiently communicate
using a computer. With the appropriate use of speech synthesizers, braille
displays, screen readers, Internet – a blind person is an active recipient, the
creator of media messages, readable by all Internet users. People with visual
disabilities increasingly use technical help that minimizes the negative effects
of their disability. Common conveniences in the form of telephone, phono-
graph, books with large fonts, computerized books, CD books, computers
allow for a more independent participation in the life of modern society.
Blind and visually impaired people are equipped with additional devices and
software enabling communication between the user and the computer. All
technical innovations allow them for an extended and more independent
participation in the life of modern society.

Objects and devices useful in the functioning of people with sight dysfunction

Technical measures dedicated to people with visual disability have been classified according to their intended purpose, Jakubowski (2001) proposes the following systematization:

Aids supporting movement: white cane (various types); obstacle detection devices, e.g. the Caya apparatus: sound signalling devices, direction-guiding: sound informers guiding the direction and informing about the nature of the object; compasses.

Optical and electrooptical aids supporting defective eyesight: magnifiers, telescopes, optical rulers, optical films, monoculars, binoculars, turmonmonoculars, binocular glasses, special sets of lenses, color filters, contrast filters, filters on glasses, image magnifying systems including cameras, control units and screens for reading enlarged text, including: stationary, television, portable and computer magnification system. Lubawa points to the advantages of the modern MyReader magnification system. The first difference is the lack of a movable X / Y table in which traditional document magnifiers are equipped. On this table, one puts a read document that must first be read into the device. Instead, this reading is made by the device's camera. At this stage of operation, you do not have to move the document mechanically. The loaded image is prepared by the device for further processing – it is recognized. The user is informed about the completion of this process by an audible signal and a message displayed on the monitor screen. All functions are performed using the appropriate button or switch on the magnifier control panel. Thanks to the earlier electronic preparation of the image to be displayed, the scrolling letters of the read text are always equally well visible at each speed of their display, and their movement is uniform. There is no effect of smudging, often encountered in the classic magnification system (Lubawy, 2010, p. 76).

Devices used by the blind for reading through the use of other senses than the eyesight, including:
- devices transforming a printed letter into a touch-sensitive form (Optacon, Delta),
- devices for reading using synthetic speech (Autolektor, Multilektor),
- devices transforming pictures into the form read by the blind (microelectrode implants).

Devices enabling computer use:
- output devices, e.g. with speech synthesis,
- specialized keyboards for people with disabled hands,
- braille displays,
- black printers and braille printers,
- scanners with OCR software,
- braille and voice notepads,
- speech synthesizers,
- devices and programs allowing to communicate with a computer by means of a voice,
- text-to-speech computer software and computer software that can be used to magnify a picture on the screen and perform a rehabilitation role by using other devices listed here.

Typewriters and text editing devices: standard or braille typewriters, braille typewriters for editing text. Counting devices: abacus, cubarythms, electronic calculators adapted in such a way that blind and visually impaired people can read information from them, computer programs acting as calculators. Drawing and writing can be supported by the graphics-to-speech devices (Intellikey board with software). Devices used to record and reproduce information via sound: tape recorders, dictation machines, electronic sound recorders, radios, compact players, radio, cable TV, computer programs that perform the functions of these devices or adapt them to the needs of visually impaired people. Telecommunications devices: telephones (landline and mobile phones), telecommunications specialized equipment, modems and their software. And watches, timepieces adapted for the blind and visually impaired; devices and aids for making measurements; signalers; devices for controlling health parameters; aids useful in the household; aids enabling rest and recreation (Jakubowski, 2001, p. 75–78).

The development of technology brings a new approach to the visually impaired, an example of which can be the RoboBraille Service (Śmiechowska-Petrovskij, 2013), which has been operating in Poland since 2009. RoboBraille is a text conversion system based on exchanging email messages. It allows you to process text into synthetic speech or braille characters by using electronic mail. Thanks to this, it offers an easy and fast way to learn the content of the printed text, enabling access to articles, books or websites without the need for having or operating expensive hardware or software. Access to the website is free of charge, the only condition one should meet is to

have a computer with the Internet access and the ability to send and receive e-mails with attachments. The service allows you to convert documents into MP3 audio files or to prepare audiobooks in DAISY format.

According to the cognitive concept, man obtains information through individual experience and through the external environment, that is in the family, school, cultural institutions or the media environment. Thanks to the technical progress, blind people have increasingly better access to information and, consequently, to education and rehabilitation. The development of computers and the Internet has contributed to the fact that distance education has gained a new face, becoming a very attractive form of modern education.

> This is possible due to specific technological features, such as:
>
> 1. unrestricted time and place of learning (management of education through educational platforms).
> 2. flexibility of the content of education, the possibility of negotiating it.
> 3. easy access to information, visualization of content.
> 4. ability to communicate and interact.
> 5. individualization of methods and content.
> 6. wide range of the possibilities of self-control and self-assessment.
> 7. integrating professional and private activity. (Sysło, 2005, p. 37–38)

E-learning, e-education or distance learning using computers and an IT network make it possible to implement the teaching-learning process regardless of the place and time through the involvement of the emotional and volitional sphere. Bednarek assumes that the blind people who use computers efficiently, can find tele-education an excellent form of further education, professional training, because it does not require a direct meeting with a teacher, allows to work in conditions conducive to action, minimizing obstacles that would practically make it impossible to acquire education in a traditional way (Bednarek, 2002). The individual's own activity is important because it manages the development of man, whereas the developing ICT dedicated to blind and visually impaired people, allowing blind people to create their own media messages, gives them the chance to overcome barriers related to their disability. New or improved devices, technologies and programs are created to provide the visually impaired with better access to broadly understood perception of the world around them.

Conclusions

Computers and other aids are just means, not the goal. Hence, we should keep in mind that "cyberspace cannot replace the real world, just like the Internet, which, among others, is an intermediary tool of communication, should not replace direct contact between people" (John Paul II, 2002). Everyone who works with visually impaired or blind people has a common concern: so that to make these people make broadly understood progress. The results of education and their effectiveness in coping with the use of damaged sight depends to a large extent on the cooperation of people involved in the process of educational support, therapy, rehabilitation, as well as on the formation of positive socio-moral attitudes. Whether or not an adaptation is made in an environment in which a child learns and resides, or the peers of a child with limited vision can tolerate and accept them as a partner in learning and play, depends largely on the positive attitudes of people involved in school interaction. Acceptance of variability in the visual functioning is an inseparable part of the cooperation between parents, teachers, physiotherapists, therapists, physicians and visually impaired and blind people.

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Multimedia in life and education of visually impaired and blind people

Summary: The process of learning about the world is conditioned by our senses, the more senses are involved in the act of cognition, the greater our knowledge is. The limited perception of stimuli resulting from eye damage has a fundamental impact on the cognitive, emotional, social, motor and communication spheres. It is difficult to imagine how limited the ability of visually impaired people to satisfy all their personal needs is. The use of multimedia for support and educational work can contribute greatly to the improvement of the quality of the general functioning of visually impaired people, not only in the aspect of teaching and learning.

Keywords: technology and communication, computer, visual impairment, visual aids

Multimedia w życiu i edukacji osoby słabowidzącej i niewidomej

Streszczenie: Proces poznawania świata jest warunkowany pracą naszych zmysłów, im więcej zmysłów zostaje zaangażowanych w akt poznania, tym większa jest nasza wiedza. Wynikający z uszkodzenia wzroku ograniczony odbiór bodźców ma fundamentalny wpływ na sfery poznawcze, emocjonalne, społeczne, motoryczne i komunikacyjne. Trudno sobie wyobrazić, jak bardzo ograniczona zostaje możliwość zaspokojenia wszystkich potrzeb osobistych osób z dysfunkcjami wzroku. Wykorzystanie multimediów do wsparcia i pracy edukacyjnej może przyczynić się do poprawy jakości ogólnego funkcjonowania nie tylko w aspekcie nauczania i uczenia się.

Słowa kluczowe: technologia i komunikacja, komputer, dysfunkcja wzroku, pomoce optyczne