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INFORMATICS IN THE SERVICE OF VISUALLY DISABLED CHILDREN

INFORMATYKA W SŁUŻBIE DZIECIOM Z USZKODZONYM ANALIZATOREM WZROKU

Abstract

The progress in modern technologies in the area of information and communication has an influence on institutions and individuals. At schools, informatics may be helpful to blind children in the form of numerous teaching aids. For blind children, the computer is an excellent didactic aid which stimulates their development. Computer programs create a natural potential for individualization of the learning process, diversified depending on the child's predispositions and degree of development, and the type and degree of sight damage.

Keywords: *blindness, the Braille alphabet, a speech synthesizer, medical informatics*

Streszczenie

Postęp nowoczesnych technologii w obszarze informatyki i komunikacji ma wpływ na instytucje i jednostki. W szkole informatyka może być pomocna niewidomym dzieciom poprzez różnego rodzaju środki dydaktyczne. Dla niewidomych dzieci komputer jest doskonałym środkiem dydaktycznym, który stymuluje ich rozwój. Programy komputerowe tworzą naturalne możliwości dla indywidualizacji procesu nauczania, dostosowują zakres do poziomu rozwoju dziecka i stopnia utraty wzroku.

Słowa kluczowe: *ślepota, alfabet Braille'a, syntetyzator mowy, informatyka medyczna*

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1. Introduction

> *Statistics is the field of organizing and conducting statistical research of all social-economic phenomena. However, no statistics, regardless of the quantity, can reflect the magnitude of the suffering of a single human being* [1] (see Fig. 1)

Children learn since the day of their birth. The first years of life decide about their future life and their future development. The lack of parental care, gaps in education in this life period cannot be completely compensated. There is a general opinion that mistakes which were reinforced in childhood cause difficulties. These mistakes cause bigger difficulties in the learning process of a normal child than in case of poor-sighted or blind children. Normal progress in the development of children is needed especially in the beginning period of their lives. Children have a natural tendency to look for something and then they make a good use of their senses. They are born with an ability to react to stimuli, to experience many sensations by their senses (the sense of sight, the sense of hearing, the sense of smell, the sense of balance) to get to know the natural environment. The learning process of blind children or of those who lost their eyesight is running slowly, however it runs in harmony with the stages of normal development. While working with blind children we notice that they make use of all of their senses. A child who receives correct stimuli is curious about the world and becomes interested in its environment. Its intelligence increases. It is necessary to continuously look for new solutions which help the blind children in making good progress in their studying (in learning to read and write, or for example, in learning how to play the piano, and finally in their school performance).

1.1. Sight defects

A person with a considerable nystagmus strains their eyes quickly. The higher the tiredness of the reader or the tiredness connected with the act of reading the more the oscillating movements of the eye intensify, which leads to the decreasing of the effectiveness of reading (losing letters, words, losing lines, decrease of sight sharpness). The accommodation of the eye (an accommodation eye) is the eye's ability to adjust to looking at objects which are at different distances. This is of considerable importance when it comes to copying a text from a blackboard into a notebook, during observations of physical, chemical or biological experiments. The next group of disorders concerns adaptation. Adaptation is the ability of the sight to adjust to variable lighting. Some children with poor sight have serious adaptation disorders called "night blindness". Other problems are experienced by children with nervomuscular disorders. This concerns children with binocular vision disorders, commonly known as squint. Binocular vision enables the human being to perceive the surrounding world in a spatial, three-dimensional way. Among congenital developmental disorders, often occurring is the childhood cataract. Cataract can also occur in an acquired form as a result of another condition or an injury of the eyeball [3, 4].

2. Teaching aids which are used by the blind

Living in the 21st century we are dealing with the introduction of mass information technologies into the process of learning. Dynamic cultural, economic, and scientific-technical changes of the end of the second millennium result in IT coming to the fore as part of the global Latin civilization. A few hundred million personal computers function in various fields of our lives as aids at work and at home. Millions of software packages have been produced to ensure their proper functioning. This has an essential impact on technologizing of the modern world. As mentioned above, the Internet brings people closer together. The global web covers the whole world. For the Internet borders between countries, cultural or worship differences there are no obstacles; on the contrary, they provide a foundation for its development. Thanks to advanced techniques the Internet uses, the modern man can get to know people and cultures, with which he would never get acquainted with or even come across them with the use of conventional methods. The internet reaches everywhere, from the Polar Circle to the Amazonian forests. Thanks to this type of multimedia people of different races, religions and outlooks on life can share their experiences and views. There are a lot of people in the world who have made acquaintances and friendships through the Internet and, although they sometimes know each other for years, have never met in person because the distance does not allow them to [5–8].

Loss of sight creates two main problems: trouble with moving on one's own and the inability to use written texts and visual information. The blind person may overcome the first difficulty through practice, however overcoming the second one does not depend on him. The first crucial event in this field was the invention of a simple, convex dot writing system by Ludwik Braille in 1825 (Fig. 2). From that moment on the blind have been able to write and read independently, however very expensive and thick books have to be printed for them. It took 150 years for the next crucial event in the field to occur. In the 70s an American professor John Linvill constructed for his blind daughter an electronic device for reading black printed texts, called optacon. It consists of two parts: a small camera and the main device (size: 15×21×5 cm) with a piezoelectric displayer. The blind person moves the camera over the text and places their left index finger on the displayer where a convex, enlarged image of what is under the camera is projected. The camera is able to show only one sign at a time, however due to its constant transferring, the sequence of signs felt under the finger is the same as that which the camera comes across. It seems that only personal computers, equipped with additional programs like Screen Reader, as well as speech synthesizers, Braille monitors and scanners with OCR programs, give the blind an unlimited access to information. You can correspond on your own on paper or via the Internet, read books and newspapers in their digital as well as scanned versions [9].

Informatics is a field of technology whose development is very fast but which is created on the basis of standards. I would like to talk about numerous teaching aids which are used by blind and partially disabled children and about a computer program operating with a speech synthesizer or Braille monitors. The speech synthesizer was recommended by the Ministry of Education as a teaching aid. The speech synthesizer such as e.g. Auto-Lector is a device which is used to read printed texts with the synthesizer's voice. This modern device for reading printed texts with the synthesizer's voice enables the reading of any print (poor quality newspapers and even fax) with a very clear and pleasant voice of the synthesizer. It is intended for blind and poor-sighted people. It replaced lectors who until now

provided the only possibility to access many literature titles, most recent newspapers and correspondence (it can be discreet). Auto-Lector is very handy during work in a specialist library. This appliance is easy to operate (the commands which are given with the use of a keyboard are followed by voice. The device acts very quickly and efficiently. It first identifies a sentence and then pronounces it twenty seconds after the scanning is complete. The device reads printed texts with the synthesizer's voice. Always at hand. Quick (time for reading the first sentence is twenty seconds). Easy to use. First quality identification and voice. It reads poor quality newspapers on a low quality paper as well as faxes. It allows to save the effect of text identification on a data carrier (for example on a floppy disc). It was an interesting idea to create a device for reading books which is easily operated (by means of no more than three keys) by people with no experience, another idea which was a result of the demands of blind people. Auto-Lector helps to read any print (poor quality newspapers or even fax) with a very clear and pleasant voice. It is intended for blind and poor--sighted children and replaces a lector who until now provided the only possibility to access many literature titles, press and correspondence. It is very handy in a library, especially in a specialist library. It is user-friendly (commands are given with the use of keyboard; they are announced by voice). Auto-Lector opens a new possibility before the blind. A blind manager gains access to printed documents and literature which he needs at work. Specialists (for example lawyers) can read their professional literature. Blind students may look at any book if there is an Auto-Lector in the library. Finally, all blind people can read for pleasure and development. All this with the use of a simple method and without experiments. Auto-Lector is operated by keyboard and serves all purposes and aims in reading printed texts. An important point is that it provides the possibility to maintain discretion and privacy. Auto-Lector will be used to rehabilitate blind people and will ensure acceleration and improvement of this process. The speech synthesizer is assigned to the Polish language. It offers a high quality and a pleasant sound of the synthesized speech, as well as a chance for autonomous work – without being connected to the computer. The speech synthesizer for the blind, functioning with the aid of the computer's sound card, enables the blind to function without the necessity of installing further devices [10–13].

Screen reading programs are published by Access Group (e.g. outSPOKEN). After the installment of Syntalka and, for example, outSPOKEN version Windows 2.0, any multimedia computer may be operated by a blind person! outSPOKEN enables the blind person to hear and read in Braille everything that is projected on the screen. outSPOKEN makes Windows obey. After installing outSPOKEN you can begin your work – without additional software or configuration. With outSPOKEN you work in your own language. It works with Windows naturally! A reliable, elastic program for reading off of the computer screen using synthesized speech (Solo version), and synthesized speech and Braille (Ensemble version). It enables the blind to quickly acquire full comfort in working with Windows 95 and Windows 98. Easy controlling of Windows. outSPOKEN 2.01 is easy to learn. Windows' shortcut keys do not change their meaning when you use outSPOKEN. All of outSPOKEN's commands may be issued using the numeric keyboard and, if necessary, through inoculent keys (SHIFT, CTRL, or ALT). The commands often used in Windows are accessible also through the keys of the Braille monitor. With the Ensemble version, the Braille monitors with double touch cursors give even more options. The mentioned possibilities result in a huge elasticity in working with Windows. outSPOKEN 2.01 gives an easy possibility of moving around the whole screen. The search function makes it possible

to immediately locate a fragment of a text, bold and other elements of Windows – e.g. buttons or icons. Voice commands may be given to Windows directly from the Braille monitor and you can jump right to the task bar, application menu or to the upper or lower edge of the window screen. It is the user who decides what information appears on the Braille monitor. A unique property of outSPOKEN is the command enabling the reading of a status line any moment. outSPOKEN 2.01 informs exactly what is going on on the screen. It is easy to switch between windows, and you can place the cursor in the inner window in any place. The reading of the screen takes place in four different voices, which gives the option of easily differentiating the text in the window from graphic specification and information directly from Windows. The amount of information that outSPOKEN conveys either through Braille or speech, as well as the language, volume, etc. depends on the user. All options regarding configuration are grouped in one preferences menu, always easily accessible. In this menu one can choose the language, in which one wants to work in, the way of following the cursor, punctuation, and other. The scope of options set in the preferences allows outSPOKEN to be adjusted to work for a beginner, as well as an advanced user [1, 10–13].

The multilanguage speech synthesizer Apollo 2 is a "text–speech" type synthesizer, powered from an electric grid. It may be used with many computers. It is the only synthesizer which speaks in over forty languages. You can install up to four languages in one device. It works with almost every computer program (screen-readers), transmitting the text into the synthesizer. It serves as a standard and is the most popular synthesizer in the world. Apollo 2 has a variable speed, pitch, intonation, and other parameters of speech. At this time it is the most popular speech synthesizer in our country. This is due to its incredible effectiveness and to the option of installing in it many languages. Other speech synthesizers sold in Poland are able to speak Polish better or worse. Apollo also has the good quality of working with every program intended for the blind. Juno is a speech synthesizer for notebooks. It fulfills the same functions as Apollo 2, but is a bit smaller. In addition, it is equipped with a battery which lasts for 10 hours of work. PC 2 – CARD is a speech synthesizer on a card. It does not take up additional space because it is installed inside of the computer. It works with he same special software as Apollo II. Alva 544 Satellite (a Braille line used for operating computers via the use of Braille) is the most ergonomic device in its category. It broadens the possibilities of actions and navigation in computer programs by working perfectly with the newest software which reads off of the screen. Two sets of navigation keys, double touch cursor keys, three status cells and an activation of the synthesized speech by use of the Braille line double the productivity, creativity and pleasure of working with a computer. The most delightful new function of the Alva 544 Satellite line are the two sets of navigation keys. Using them you can, for example, easily navigate among complicated graphic screens and influence the speech synthesizer's way of operation without moving your hands away from the Braille line. This in an obvious way influences the effectiveness of work. The silicone keys of the touch cursor above each Braille cell result in a full integration of the voice with Braille. The first line of the touch cursor's keys summons the screen cursor to the area represented by an appropriate Braille cell. The second line of keys makes it possible to obtain voice information about the text's and graphics' attributes in the area responding to the current cell (if the speech synthesizer is used simultaneously) [10–12].

People with smaller vision impairment are presented with programs which enlarge the elements appearing on the monitor screen. Special methods are proposed to people with considerable vision impairment. Voice and touch constitute the fundamental elements of supporting the vision impaired person's communication with the computer. The blind person communicates with the computer using Braille's keyboard. The basic devices which supplement the computer are speech synthesizers, which generate sounds similar to natural speech, changing the written text into distinct speech. The blind person's computer should also be equipped with a Braille monitor often called Braille's line. It reproduces in a mechanical way the line of the monitor using Braille letters and it enables to read data from the hard drive or floppy disk. For people with kinetic impairment, special keyboard layouts should be constructed, comprising of two or three parts, with the option to regulate the connections according to their needs. The IntelliKeys keyboard is meant for people incapable of typewriting, but at the same time able to move their hand. The surface of the device is a smooth, colored board, showing a set of colorful fields marked with descriptions. It is a very sensitive device, where touching of a given field results in the computer's reaction. There are also various other models of keyboards to be used by people with kinetic impairment [10, 12].

3. Conclusion

There is no panacea. Most blind people live in developing countries, and 1,5 million are children under the age of 15 [9].

A computer with proper software may be used for diagnostic, prophylactic and therapeutic purposes. It is a stimulating aid and it facilitates the integrating complex psychological activities, thus facilitating those functions, on which the child's readiness to learn how to read and write depends. Computer techniques are useful in preventive activities, as well as in diagnostics and pedagogical therapy for children who have trouble in reading and writing. A virtue of therapeutic computer programs is their broad and diversified graphic possibilities which can, to a large extent, strengthen the stimulation of children's psychomotor development and can enhance the potential to individualize help for a given child, that is, to abandon the group learning of reading and writing in favor of a diversified start depending on the child's predispositions and their level of development. This means that using computer programs together in connection with classic methods of working with children who have problems with reading and writing is a very successful therapy. The rule stating that the attractiveness of lessons increases their effectiveness will surely work here too. Working with computers fascinates children, enhances their activeness, imagination, releases emotional strains, fears, and worries which often disturb the learning process. The second factor that influenced children's results, next to attractiveness, was the fact that computer – connected activities are linked with an increased speed of performing exercises, the variety of their forms, the chance to memorize and check in a short period of time. This method is the most beneficial one for children and brings the best results. Summing up, it may be said that as a result of researches conducted at psychological-pedagogical clinics it has been proved, that a computer equipped with proper educational and speech-therapy software may be successfully used for prophylactic and diagnostic purposes, as well as for work with children having communication disorders. The computer has proved to be an aid

which stimulates and facilitates complex integrating psychological activities, and thus stimulates those functions, on which the child's readiness to learn how to read and write depends. Computer programs, used in a proper way by special pedagogues have strengthened the stimulation of children's psychomotor development and have created a natural potential for individualizing the therapeutic process, diversified on the basis of the child's predispositions and degree of development. Working with disabled people, pedagogues are constantly in search of new forms of educating and facilitating, in order to guarantee the best possible thorough development, and to trigger in the disabled activeness and commitment, initiative and creative thinking, persistence and inquisitiveness in learning about the world. These aims may be accomplished by an integrated education of disabled teenagers together with healthy people, and through the inclusion of the process of modern didactic media's revalidation [4–6, 12, 14].

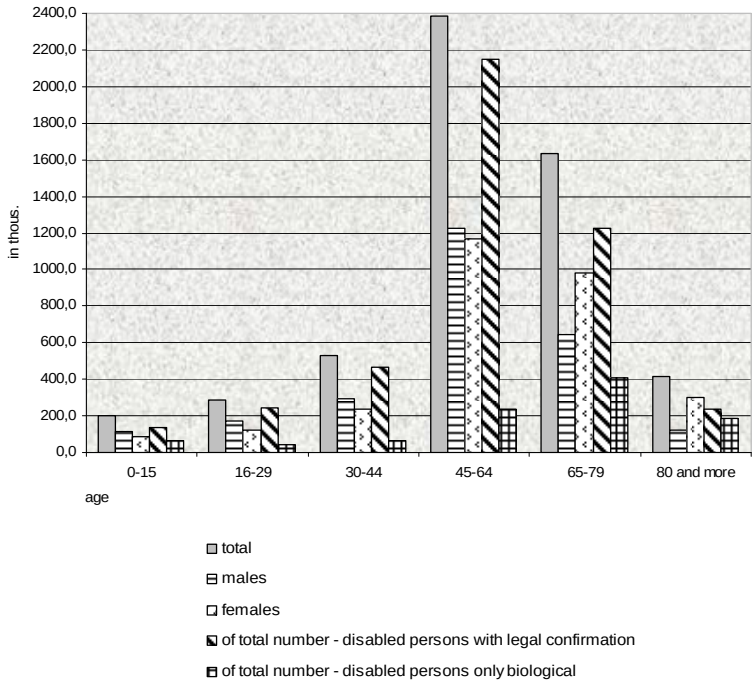

Fig. 1. Disabled persons by age groups and category of disability – for 2002 year [2]

Rys. 1. Niepełnosprawni według grup wieku i kategorii niepełnosprawności – 2002 r. [2]

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