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Development of Methodology of Spatial Orientation Teaching in the Field of IT

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Abstract

At present, there is a huge development of information technologies, which are also being used to improve the quality of life of people with limited opportunities. This group also includes blind people. While much attention is paid, this aid does not reach the level they could achieve with the active use of IT. Teaching spatial orientation is often divided into two parts - micro orientation and macro orientation. The first part teaches them to orient themselves on the table and in the vicinity. And the second part - they teach movement around the building, near the place of residence or in the city. Such a learned orientation is less effective in the outside.

The aim of this work is to point out ways to develop spatial orientation teaching, which will take into account the great potential contribution of information technology. Therefore, the work is divided into three main parts: contemporary didactics of spatial orientation, some IT possibilities and possibilities of development of didactics of spatial orientation teaching. Authors Dušan Driensky and Roman Hrmo (2004, p.5) state: "Pedagogical-psychological research confirms that the effectiveness of perception and remembering is directly dependent on the number of sensors that are activated in the acquisition of knowledge." They also state that on average 83 % of the information perceives visually, 11 % audit and memorizes about 10 % of what he read, 20 % of what he has heard and 30 % of what he has seen. (Driensky - Hrmo, 2004) What is obvious for the sighted, it is very difficult or impossible for a weak-sighted person.

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Information technology
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Micro orientation, macro orientation
GPS for blind people
Aids for the blind

1 Introduction

The issue of preserving the healthy psyche, the overall mental and physical health of people with changed abilities, namely the visually impaired, is one of the main aspects of improving the quality of their lives. One of the main goals of working with visually impaired people is to help them integrate into ordinary life. The prerequisite for such integration is to improve the system of orientation in the space, to create not only a two-dimensional but also a three-dimensional image of the surrounding space. It is through the development of motor skills, sports skills and the use of modern technology that the limits of their ability to move further.

Reducing the spatial orientation of the blind citizen is one of the main problems of quality inclusion in life. The department dealing with the education, education and development of people with CP is called opthalmopedia (from Greek ophthalmos - eye and paidea - education). In the broader sense, it falls into the special pedagogy

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class classified by type of disability. Relatively often, it is also possible to meet the term typhlo-pédia (from Greek typhlos - blind and paidea - education). At present, both terms are considered to be synonymous (HAMADOVÁ, 2007), although some authors indicate that they have been dropped from this concept because they are terminologically related to the blind and do not contain any other visual impairments (KVĚTOŇOVÁ, 1993). Abroad, the name pedagogy of the visually impaired is used more often, ang. "Visual impairment". (HAMADOVÁ, 2007)
However, the possibilities of existing technical means and spatial orientation methods partially eliminates this problem, but the affected person has more or less his own notion of a small circle of space around himself. This is limited by the length of the stick, the possibilities to snap and reach to individual objects. The problem can be reduced by the use of sporting activities as well as the use of different technical means

2 Some issues of spatial orientation teaching

The blind, who come to the Rehabilitation Center for Visually Impaired Persons in Levoča (RSZP), have to go through various courses and courses to help them return to their normal lives. Therefore, it is also appropriate to address the basic theoretical knowledge of pedagogy and pedagogical sciences dealing with the education of the blind.
Vision is the most important sensory organ of man. People with visual impairment account for about 1.5% of the total population. We consider a person with visual impairment (aspect of typhlopedy) who, in the ordinary course of life, has a problem with obtaining and processing information through the visual path (reading, writing, visual, etc.) after an optimal correction (medial, surgical, orientation in space, etc.); (Vitásková, Ludíková Souralová, 2003, cited by Slowik, 2007). As a result, they have specific needs in education, movement and spatial orientation, in communication through spoken language, in a self-service, but also in the transformation of optical information into knowledge. Some knowledge will not be created at all (these are ones that are directly bound to receive optical information), for example, far-ba and the like. (Vašek, 2003, p. 172). According to the duration of visual impairment, we distinguish short, repetitive and long-term fluctuations (Lopúchová, 2007). In terms of the use of any remnant of sight, the age of the subject in which the disorder has occurred is important.
Visual impairment affects people in practical life in education (access to information, forms and methods) The teacher should be prepared to work with visually impaired in advance Preparation is not easy Preparing for teaching has many problems and the teacher has to deal with many tasks from a variety of areas, avoiding some types of non-verbal communication (hand gestures, head nods, etc.) because a visually impaired student does not register these instructions and does not respond to them.
The methods used in the work were based on an analysis of the differences in the movement of healthy people and people with visual impairment. The analysis included the processing of selected knowledge from the pedagogy of visually impaired people.
Another method was the analysis of basic types of motion. Some movement activities of the blind were elaborated, which were discussed in several publications Albertová B (2016), Albertová, B. (2017). Using this method, we have gained the knowledge and evidence of the benefits of an active approach to sport, physical education and other physical activities to improve the spatial orientation of the blind.
Other methods were methods of processing the data obtained by statistical processing.
Based on the analysis of the acquired data and knowledge, procedures for the realization of different types of sports exercises, starting from simple finger exercises, through a simple movement to running, were created using the synthesis of individual activities to create a comprehensive exercise to improve spatial orientation.
All observation, measurement and testing of the methodology of orientation as a method of increasing motivation in teaching physical education, improving the teaching of spatial orientation were carried out on the respondents of RSZP in Levoča.
The research was conducted over 2 years and more than 20 respondents participated in each section. They were the people who attended the courses at the Center and who had to undergo the basics of spatial orientation. These courses also included physical education lessons

2.1 Micro orientation

The navigation and spatial orientation system, which is focused on significantly smaller distances, is called micro-navigation. This type of spatial orientation does not have a well-defined operating radius or space used, it is just the systems used to navigate the route along its shortest route, with the emphasis on avoiding obstacles, collisions and dangers. One of the most used aids for the blind is a white gavel. With the help of the

blind, they try to avoid obstacles on the sidewalk, find the beginning of the stairs or their end, or determine where the doors are, and so on. This task is gradually being taken over by many electronic devices, for example, echo-locator, or special distance measuring programs that are found in modern phones.
Often different types of blind sticks (Figure 1) are used to warn the blind to the obstacle.

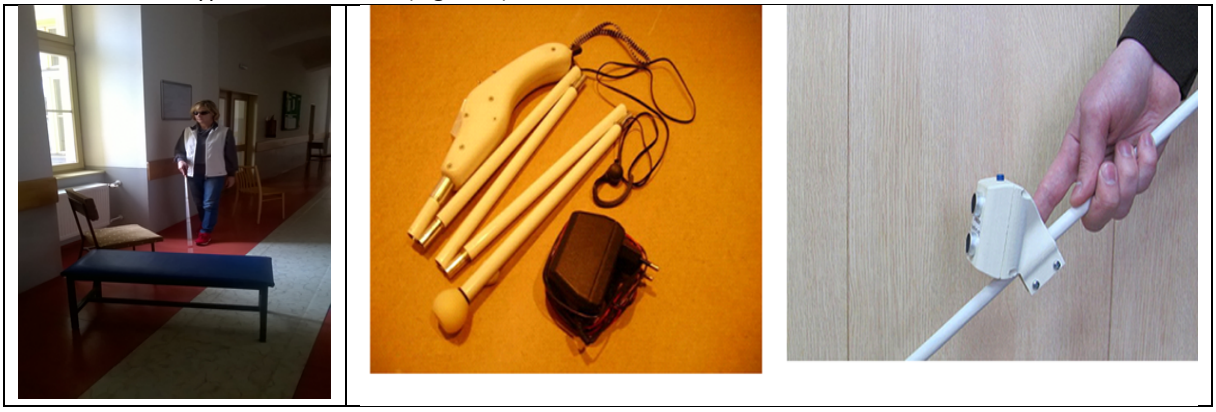

Fig. 1 Forms of a folding white stick

Various electrometers (Figure 2), (Figure 3) are devices that allow you to detect obstacles on the road or in the area before the blind. Their principle is based on the likes of whales or dolphins. Distance of obstacle detection 7 meters;

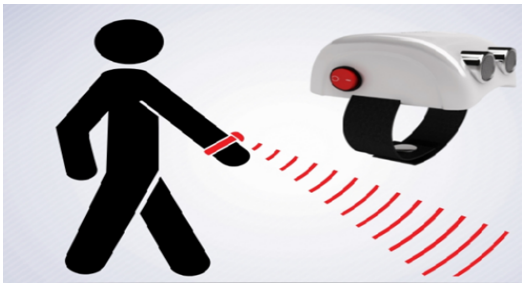

Fig. 2 Manual tyflosonar

Fig.3 Infrared locator

The second possibility of developing micro orientation is the use of various geometric formations and relief maps (Fig.4) and (Figure 5). These habits allow you to get an idea of various small or large objects.

Figure 4 Teaching the Use of Relief Maps

2.2 Macro orientation

This type of navigation and spatial orientation includes systems, practices and methodologies used to navigate in large areas, most often outside buildings and structures, ie open open spaces. We could compare it to the

commonly used maps mapping system to navigate the route to your destination within the city, country, state, continent, but also at sea-level.

At present, elements are often used to gain a sense of space or large objects. To work with these elements, you first need to create a relief map that allows you to explore the path, then teach the blind to working with the map. For a better idea of a particular location, it is possible to create an embossed image of an object.

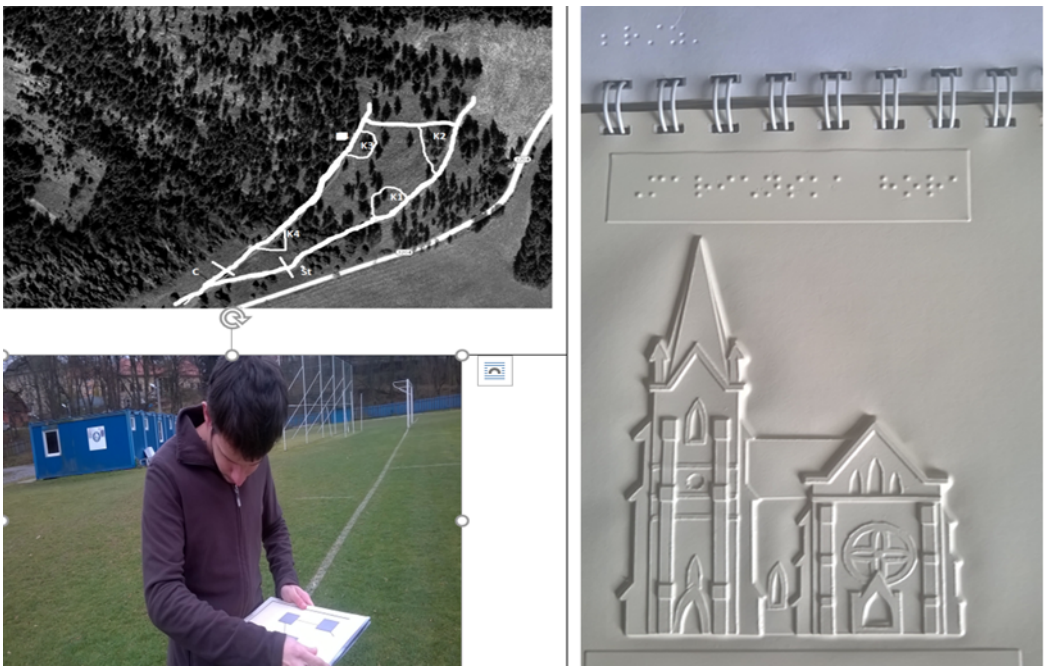

Figure 5 Teaching the Use of Relief Maps.

The embossed map function today has been largely represented by electronic systems equipped with large scale digitized maps and high detail, using data from GPS and GLONASS satellites, specified by GSM and Wi-Fi networks (within their availability) when determining the location of the most accurate location. Different graduation methods are used for exact positioning:

The data on the impact of physical exercise exercises on the practice of spatial orientation were obtained by direct measurements of individual exercises. From the methodology of spatial orientation teaching, basic elements were selected, which were trained according to the schedule of the subject.

During the past lessons, we conducted several measurements to compare the results achieved by individual respondents. During exercises, the following exercises were measured:

- Fine motoring
- Moving around the building with a guide
- Use of sliding technology
- Keeping straight ahead
- Estimate turn angle.

The results that were measured at the beginning of the individual exercises were recorded in the tables. Examples of exercises are shown in the figures (Figure 6). Subsequently, the possibilities and rules for the use of walking exercises were analyzed, not only in the building but also in the city.

Fig.6 Exercise of spatial orientation elements

3 Some IT for the blind

At present, we recognize many types of tyflotechnika. However, three aspects are important for the learning process: visual impairment, how to use typhl technology and how to help the visually impaired. We include eg. Correction technology; Reeducation technology; Compensation technology; Modern electronic tyflotechnika. All of these techniques help reduce information deficit, as one of the key factors, causes isolation of visually impaired people.

3.1 Modern technologies for micro-orientation

Another example of the use of micro navigation in practice is when parking a car. Ultrasonic sensors located on the periphery of the conveying means transmit pulses at a frequency of 40 kHz, which are reflected by objects and obstacles in the path of this wave. After subsequent deterrence, they are received in the receiver, the time between sending and receiving is captured in the control unit of the system itself, which further processes this information and informs the crew of the vehicle in some of the ways, most commonly the audio information, that is known as "beeping".

SonSat BatSuite is supposed to help the blind and the visually impaired. For normal people, ordinary activities are a matter of course. Well, for people with visual impairment, the movement in space is already difficult. BatSuite works as a sonar. This is also the connection with the bats in their name. The device has sensors in the front, monitoring the surroundings and using reflected waves recording the distance from any obstacle. The authors of BatSuite handheld Sonar, along with the ongoing tests, are working hard to minimize it.

LowViz Guide creates a digital map of the scanned environment and uses the voice synthesizer to navigate the application user within this space. When navigating it points to interesting places or rooms such as ATMs, meeting and conference rooms, toilets, hotel reception and. i.

In ***TapTapSee***, a user double-clicks on the screen to capture the visual appearance of a two or three-dimensional object in front of the camera at any angle. It is then precisely analyzed and defined within a few seconds. The voice analyzer then accurately describes the identifier of the captured object to the user.

IBeacon is a protocol developed by Apple. The technology is based on a "Bluetooth low energy" (BLE) broadcast signal with a unique identifier at 40 kHz that captures the application or operating system. The identifier and several additional bytes help determine the exact physical address of the transmitter (beacon), commercial customer tracking, or triggering the action associated with changing the location of the end device.

In addition, there are a large number of tools that allow unobtrusive orientation in the microsphere, or by the micro mechanics gaining an idea of the surrounding world.

3.2 IT for Macro-orientation

One of the possibilities of orientation in space is the use of modern technical means that use the principles of various navigation systems, GPS, GLOSAR and so on. For the purpose of this work we have selected some of the most famous systems.

BlindSquare It is the world's most popular mobile application for blind and visually impaired people. Describes surroundings, interesting points, and street junctions when traveling. BlindSquare uses a voice synthesizer to navigate and controls using the audio menu when using any headset or speaker, meaning that the user may not even touch the screen of the mobile device while traveling. The advantage is the ability to combine the application with another navigation application and a very large global usage. The downside is the iOS mobile operating system support.

DotWalker is an Android app that deals with the special needs of traveling visually impaired users. This app uses the Talkback screen reader. DotWalker itself uses direct speech output, audible alert, vibration, and high contrast text that can be expanded as needed. A GPS sensor is used to provide location information. Geomagnetic sensor is used for compass and accelerometer functions to trigger some user activities.

Kapsys SmartVision from the French company Kaspys, is the first Android smartphone designed specifically for people with visual impairments. SmartVision is the first truly affordable, assisted technology smartphone with a physical keyboard and touchscreen. The user interface and features have been fully customized to make SmartVision easy to use. Apps are organized in such a way as to allow easy access with the ability to adjust font size. Interesting features include color detection. You can select color notifications or select up to 15 colors from the list and let the device look for the specified color. Other useful applications of this smartphone are built-in optical character recognition from ABBY Finereader. So if a blind man wants to read the black-and-white text, it's enough if he uses this app and his phone reads it in syntax.

4 Some changes in spatial orientation teaching

Taking into account the possibilities of current IT-based technologies, it is necessary to change the way in which spatial orientation is taught. It is essential that the teaching of the blind is the active use of computing means, mobile phones. The disadvantage of the current education process is the partial separation of macro orientation and micro orientation. The demonstrated means mentioned above, electronic echolocators, navigation systems must work simultaneously. Otherwise, we will get the perfect orientation, for example, in the city, but on a walk along the sidewalk many times we find ourselves in a pillar, a trash bin, or the front of the people.

The development of such a system is dealt with by students of the University of Economics in Bratislava in cooperation with several companies in Bratislava. In cooperation with the EU in Bratislava, the preparation of a device for the spatial orientation of the blind, connecting the micro and macro orientation is under way. This device allows you to free your hands from a white stick, hand from a variety of additional micro-orientation devices, or macro orientation to let you unlock the phone for GPS orientation to determine the exact location. The system includes elements that direct proximity to nearby objects and also allows GPS to control city traffic based on GPS signals.

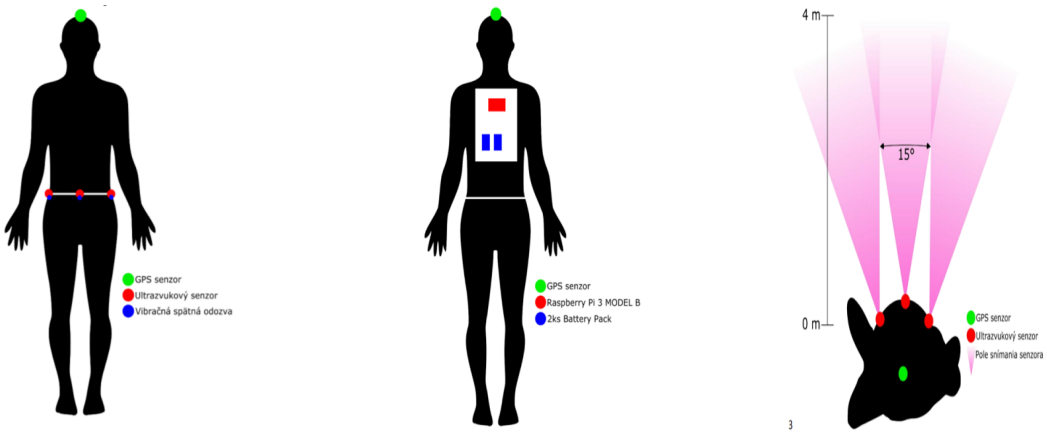

Fig.7 Control elements of the orientation system

The device (Figure 7) is in the process of minimizing the creation of a compact version. A further version that will be provided by the RSZP in Levoča for a practical test of activity should be completed during the year.

5 Conclusion

The basic manifestation of life is movement. Movement in our case is a manifestation of an active life approach to life. A key problem of total autonomy for the blind is just spatial orientation and separate movement. The blind is learning to orientate according to sound, to understand and control concepts such as: forward, backward, right and left. Of great importance for spatial orientation is sport activity of the visually impaired. Young blind people gained the necessary courage, somatic and aesthetic prerequisites for independent movement and spatial orientation, and, last but not least, the desire to move independently. Some visually impaired people often refuse to use a white stick. In the course of life, then, visual impairment has considerable difficulty in going to work, and it also manifests itself in their overall lack of movement, which is ultimately reflected in their psychosomatic image and health. We also know those who have given up work because they have not been able to solve the problem of attending the workplace. From the psychological point of view, the spatial orientation and the separate movement of the visually impaired as well as its total autonomy are really of great importance. It is, however, for most of the blind to master the spatial orientation, and this is only possible when special attention is paid to this problem. As we have already said, it is a necessity in current living conditions. From a biosomatic point of view, we emphasize the importance of spatial orientation and autonomous movement of visually impaired mainly because it is generally claimed that especially adult non-seeing individuals have a lack of movement. The adult blind, who has little movement, tends to have his or her free time to sit, respectively. and gradually develops a reluctance to move. The blind, who controls spatial orientation and movement, has a far wider range of leisure opportunities. A person who can divide his / her leisure time into family care, education, walks to nature, and to meet his / her other cultural needs, greatly enriches his personality.

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