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Influence of motion activity on spatial orientation

(Teaching spatial orientation blind using the new method)

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Abstract

One of the basic prerequisites for the integration of the visually impaired in life is the improvement of the system of orientation in the space, the creation of not only a two-dimensional but also a three-dimensional concept of the surrounding space. Affected people have the opportunity to engage not only in normal life, but also in more sporting activities. Due to the high development of modern technologies, these borders can be shifted in order to increase the confidentiality of the people affected and improve their lives. With physical activities, one of which can also be an orientation course using modern technologies simulating different sounds from ordinary life, it is possible to improve the learning outcomes of spatial orientation.
The main contribution of this article is to provide the results of measuring the impact of sporting activities on improving spatial orientation elements

Keywords:
Spatial orientation.
Quality of teaching
Sports activities of the blind
Differences between the sports activity of the blind
and healthy.
Modern technologies. Information Technology (ICT).

1 Introduction

Movement is the first and very important means of communicating to man from early childhood. Through the movement, he recognizes and discovers the world, acquires information about where he is, develops awareness of his own body, and learns to coordinate his eyes and body with each other. His body is also the first tool for expression - holding the body, and gestures have a noticeable value even before the child begins to talk fluently. The speech of the body remains with us for the remainder of our lives (STOKLASOVÁ, V.(2007)). Movement and speech are very interconnected in the early stages of speech development. Only when the moves become automatic and the child is able to control them sufficiently can speech become an independent skill (LOPÚCHOVÁ, J. (2010)). It is precisely such a great influence of physical activity that is one of the main assumptions of active teaching of the spatial orientation of the blind. In teaching the spatial orientation of blind people, we are trying to find new methods and approaches that can improve the performance of the activity.
Orientation in space we do not see at all has many pitfalls. From those prosaic that we can not navigate through sight, to serious psychological barriers when a blind person does not want to learn. Losing motivation and wanting to do something, he thinks life has ended for him. These conditions are common among people who have lost sight during their lifetime. This is even more striking if this loss occurred during an active life due to an accident or sudden illness.
The possibilities of existing technical means and spatial orientation methods partially eliminate this problem, but the affected person has more or less his idea of only a small circle of space around himself. This concept is limited by the length of the stick, the possibilities to snap and reach to individual subjects. However, this problem can be further reduced by the use of various sporting activities that will enable them to practice their skills, improve the orientation habits through active training and the use of different technical means. The introduction of various sports activities, orienteering, etc., will allow you to practice the soundtrack selection,

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improve distance estimation, practice faster movement, allowing easier orientation in ordinary life. It is clear that the fulfillment of the tasks related to independent mobility and the implementation of day-to-day activities requires a great deal of effort and effort in acquiring skills (WIENER, P. (1986)).
The present article deals with the analysis of the impact of physical activities on spatial orientation, the development of new sports activities, and we place emphasis on creating a new methodology for the spatial orientation of the blind and blind citizens. At the same time, it is the basis for further joint research with departments of physical education, special pedagogy, andragogy, training and others, which deal with the research and development of sports activities not only of healthy people, but also with the application of results obtained and knowledge for various groups of people with disabilities.

2 Measuring the impact of physical activity on the outcome of spatial orientation teaching

The main part of the contribution is concerned with the impact of sporting activities on achieving better results in spatial orientation. However, it should be noted that better results are achieved with the use of modern and information technologies

2.1 Motion Activity and IT

In previous contributions, an analysis of the use of Information Technology (IT) (Kultan, J. (2016)) has been developed to support not only the ordinary life of the blind, but also to develop their spatial orientation (Albertova B., (2015)). The most prominent technological element being analyzed were typhlossaries, color indicators, distance measuring devices, ultrasonic or infrared locators, various computer programs (Albertová B., (2016)). Great benefits for blind people and their spatial orientation include embossed printers, modern 3D printers. With these printers and the appropriate software, it is possible to create a map of the surroundings, a space where the blinds most often move.
Modern technologies make it easier for visually impaired people to work, but also a variety of exercise exercises with spatial orientation elements also have a major impact on improving spatial orientation. These are mainly the initial exercises, eg. moving fingers on a map, moving along a straight line, turning at a certain angle, estimating distances, and so on. Even in this activity, except for sport, the already mentioned technical and program resources (Nedorost P., Albertova B.(2016)).

2.2 Description of individual measurements and display of measurement results

Throughout this year and in the past year, 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
- Keep the direction straight
- Estimate turn angle.

2.2.1 Micro-orientation - fine motoring

In this exercise, we try to teach clients to read geometric formats printed on special paper using embossed printers. This is a practice of reading a map or other geometric formations. Based on the experience gained, the blind can not only navigate through special maps but also gains additional experience for other activities - recognition of subjects, basics of reading, and so on.
The task:
Use the motion on individual papers to determine which geometric shapes are displayed on individual papers.
Measured values and their significance
In conducting the experiment, we will focus on measuring the total time needed to locate all the geometric formations found on the paper. Respondents had to find all the objects in the given time after training the given task. We watched the time in seconds, and recorded the results in the tables. After several weeks and a short training session, we again took measurements. Measured papers have already been used and new papers have been used to remove the use of memory. The results were recorded in tables (Table 1) and displayed graphically (Figure 1).

Tab.1 Fine hand movement

Type of measurement	Micro-orientation -gentle hand movement / dots, lines, geom. shapes /				
Period / date	/ measuring at the beginning/				
IČ	M 1	M 2	M 3	M 4	average
1	269	293	221	245	257
2	273	297	225	249	262
3	278	302	230	254	266
4	281	305	233	257	270
5	284	308	236	260	273
6	286	310	238	262	276
7	288	312	240	264	277
8	288	312	240	264	278
9	287	311	239	263	278
10	286	310	238	262	276
11	283	307	235	259	274
12	280	304	232	256	271
13	276	300	228	252	268
14	272	296	224	248	264
15	267	291	219	243	259

Micro-orientation -gentle hand movement / dots, lines, geom. shapes / / measurement at the end/				
M 1	M 2	M 3	M 4	average
191	209	173	155	730
202	220	184	166	772
211	229	193	175	810
218	236	200	182	839
223	241	205	187	860
225	243	207	189	870
224	242	206	188	868
221	239	203	185	856
154	167	142	129	601
156	169	144	131	610
158	171	145	133	618
160	172	147	134	625
161	173	148	135	631
161	174	149	136	635
162	175	149	137	637

Processing results

From the measured results presented in the individual tables (Table 1) and the output graph (), it is clear that after a certain period of training, time improvements were achieved in the total sample of respondents. At the same time it can be seen that at the beginning of the training, the individual times were bigger, but their scattering was smaller than after the training. It was in these results that there appeared signs of an unequal group.

For the purposes of displaying graph and table results, we will use the label:

kz - the control group at the beginning of each exercise,

kk – control group at the end of the main exercises of each exercise,

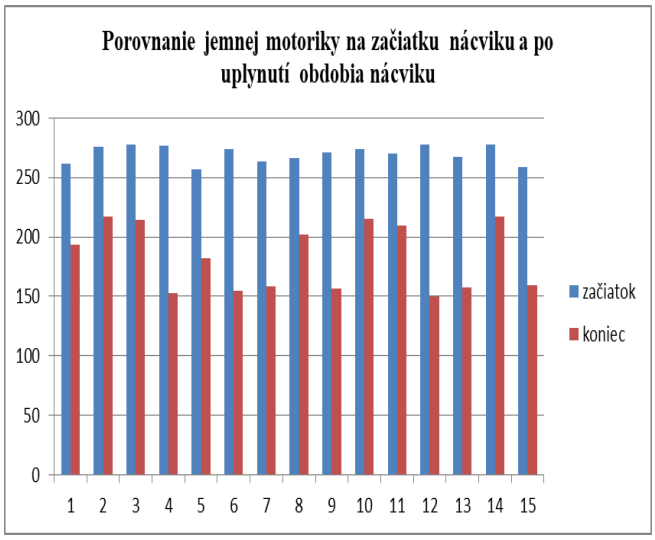
sz – tracked group at the beginning of the training,

sk – tracked group at the end of the training.

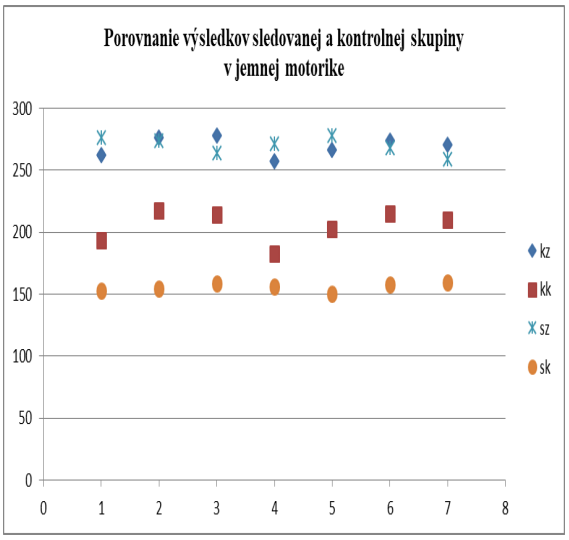
Table 2 Processing value of measurements, Average P, Range R

	Fine motoring		Movement in the building		Sliding finger technique		Keeping straight ahead		Estimate angle	
	P	R	P	R	P	R	P	R	P	R
the beginning	269	46	**375**	104	390	478	283	1454	284	1454
the end	18	723	279	2664	221	2987	225	2685	225	2685
SZ	270	40	**375**	95	409	7	248	726	248	725

SK	156	10	229	492	165	241	171	241	170	241
KZ	270	52	**376**	110	374	323	314	51	314	51
KK	206	143	324	379	271	163	272	5	272	5



Comparison of fine motoring at the beginning of the training and after the training period has elapsed



Comparison of the results of the track and control group in the fine motoring

Fig. 1 Track group results in fine motorcycle

Part of the respondents are engaged in active physical activity outside of physical education hours, the second part is not. Therefore, we have divided the results into two groups: the monitoring group and the control group. The results obtained are presented not only in tables but also graphically. For all measurements, it could be seen that at the beginning of each exercise the results of the respondents were approximately the same and their scattering was relatively small (Table 2). After finishing the training, there was a large scatter in the results obtained. After splitting the chart into two groups - tracked and controlling, it was seen that respondents who were engaged in additional sports activities had better results than the control group.
By analyzing the data obtained, we can assume that the use of spatial maps on sporting rings helps to better manage the activity, better training of the subtle motorcycle of the blind.

2.2.2 Moving around the building with a guide

Contact with the assistant is holding the forearm. The assistant has a hand slightly elongated in the elbow. Holding must not be crunching, but each other must feel that they are holding each other. The blind halfway behind a guide never goes ahead. Walking down and down the stairs is indicated in time for the blind to be able to respond properly. The guide's hand is lifted either upward, or walking up the stairs or down, or walking down the stairs. In the beginning, he will always inform you of all the wizard. For the training, the main goal is to get acquainted with the building's clients. Teach them to walk through individual corridors, go to individual floors and find the exit of the building. In addition to moving around the building, we try to remember the basic principles of motion in the building.

The task:

In cooperation with a guide, try to find a way from a certain room in the building to the outside door. During a given exercise, a blind person determines where he / she wants to go, he / she consults his / her wizard with his / her guide, and enters the building path.

Measured values and their significance

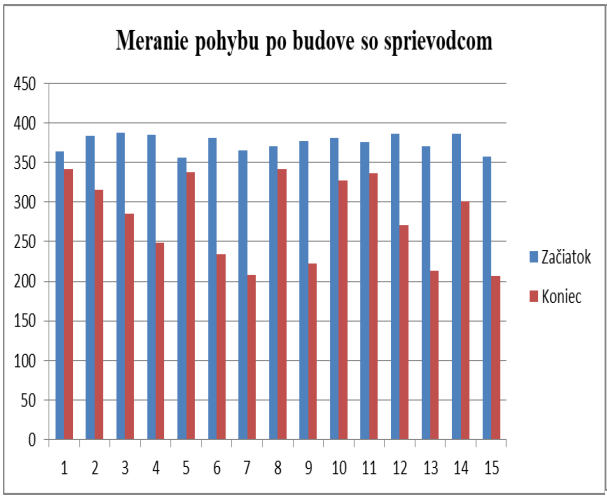
When performing the experiment, we will focus on the total time required to complete the specified route. The measured quantity is the time it takes for that route. During the experiment, we chose several starting points, approximately equally distant from the exit of the building. During the exercise, respondents could use the fact that some of the routes were memorized after a while. The results are shown in the tables (Table 3 Moving with a guide to the building).

Table 3 Moving around the building with a guide

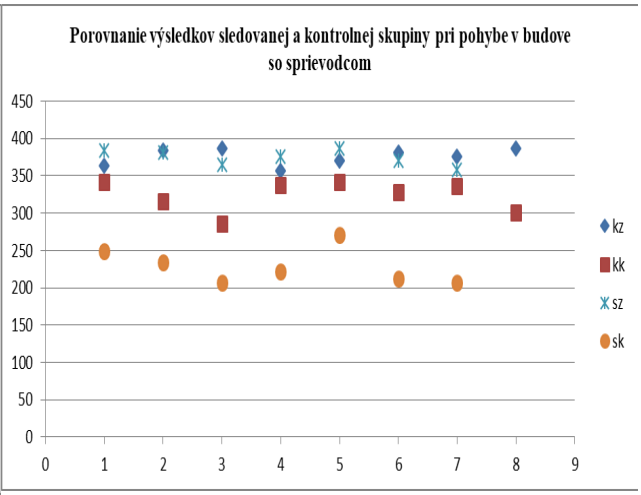
Type of measurement	With a guide to the building				
Period / date	/ measuring at the beginning/				
IČ	M 1	M 2	M 3	M 4	average
1	367	346	410	302	357
2	374	352	417	309	364
3	380	359	424	316	370
4	386	364	429	321	376
5	390	369	433	325	381
6	394	372	437	329	384
7	395	374	439	331	386
8	396	374	439	331	387
9	395	373	438	330	387
10	393	371	436	328	384
11	389	368	432	324	381
12	384	363	428	320	377
13	379	357	422	314	371
14	372	350	415	307	365
15	365	343	408	300	358

With a guide to the building				
/ measurement at the end/				
M 1	M 2	M 3	M 4	average
348	353	329	323	338
351	356	332	327	342
350	355	331	326	341
345	350	326	321	336
336	341	317	312	328
324	329	305	300	316
309	315	290	285	302
293	298	274	269	286
285	263	263	263	271
246	246	246	246	249
231	231	231	231	234
219	219	219	219	222
210	210	210	210	213
204	204	204	204	208
203	203	203	203	206

Many training participants have achieved a relatively greater improvement compared to others. We made a more detailed analysis after dividing the results for each group.



Measuring movement cross the building with a guide /start, end/



Comparing the results of groups when moving cross the building with a guide

Fig. 2 Move around the building

Processing results

On the basis of the measured data (Table 3) we can say that during the past period, the orientation of the blind was improved in the building. The graphical view is displayed in the graph (Figure 1). During the practice of the procedure, the times in both groups were approximately the same at the beginning. Differences occurred at the end of the main training period. The monitored group achieved an average result at the end of the 229 period and the control group 324. This is also one of the confirmations of the positive influence of the additional physical activity. The better orientation was not only a longer movement on the building but also a lighter communication with the coach.

2.2.3 Sliding fingers (trailing) + upper safety position

The hand is held at the height of the belt, forward to the front. The fingers are slightly bent and slid over the surface of the wall. When a blind man comes to the door, he puts his palms at the height of his shoulders and moves horizontally to find out which door he's going to be - one wing or two-wing. With a simple door, not seeing a horizontal movement from the center to the edge, he finds the door of the shoulders and vertically locates the door, and on which side the door and the height of the handle are located.

Safety attitudes

Their mastery leads to a more peaceful walk. It is very important for a blind person not to be caught. Safety attitudes are divided into top and bottom. Upper stance protects his face and head, the elbow is lifted to the height of the shoulders, the elbows bend. The palm is turned forward and out of her face slightly distant from her. The attitude must not be rigid. The lower posture is used to guard against obstacles at the height of the belt. The hand runs along the body, with the fingers of the hand roughly in front of the thigh of the other foot.

When training a given type of movement, we try to teach our clients basic mobility skills aimed at faster movement around the building. They also have to learn to stand in such a way that no unforeseen contact with, or crash by, another person leads to dangerous situations.

The task:

The blind will try to pass the building, its individual corridors so that it does not last long in those parts it knows. But you also have to control your movement near the wall and try to move safely.

Measured values and their significance

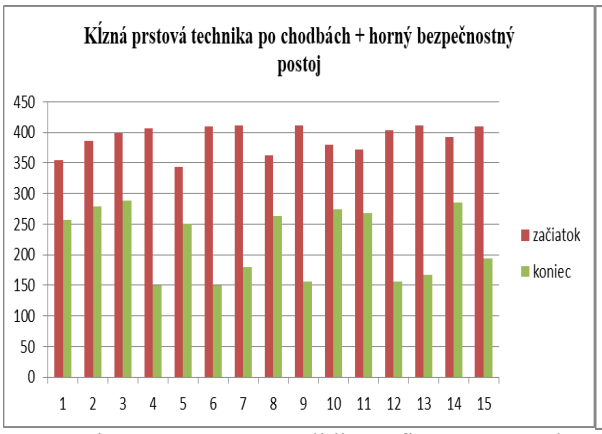
When performing the experiment, we will focus on the total time required to complete the specified route. Respondents try to move around the corridor as quickly as possible but safely along the corridor, trying to control their distance from the wall with a slight touch on the wall. The measured quantity is the time it takes for that route. During the experiment, we chose a number of starting and ending points, approximately equidistant from each other. During the exercise, respondents could use the fact that some of the routes were memorized after a while. The results are shown in the tables (Table 4).

Table 4 Sliding technique

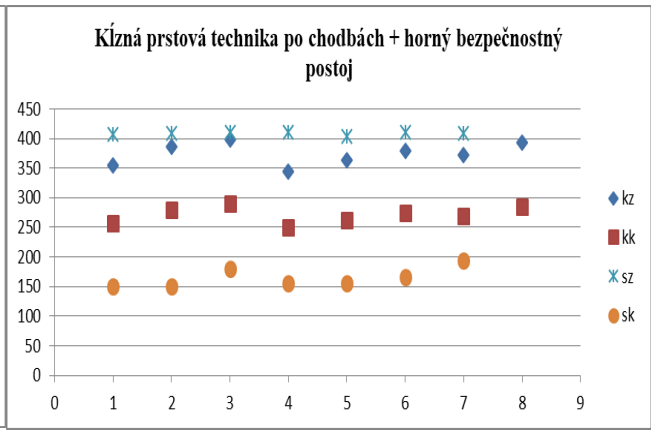
Type of measurement	**Sliding fingers around the corridors + upper safety position**					**Sliding fingers around the corridors + upper safety position**				
Period / date	**/ measuring at the beginning /**					**/ measurement at the end/**				
IČ	**M 1**	**M 2**	**M 3**	**M 4**	**average**	**M 1**	**M 2**	**M 3**	**M 4**	**average**
1	353	347	341	335	344	260	248	251	241	250
2	362	356	350	344	354	266	254	257	247	257
3	371	365	359	353	363	272	260	263	253	263
4	380	374	368	362	372	278	266	268	259	269
5	387	381	375	369	380	283	271	274	264	274
6	394	388	382	376	387	288	276	279	269	280
7	400	394	388	382	393	293	281	283	274	285

8	406	400	394	388	399	297	285	288	278	289
9	410	404	398	392	403	161	152	154	147	156
10	413	407	401	395	407	156	147	148	141	150
11	415	409	403	397	409	155	146	148	141	151
12	417	411	405	399	411	161	152	154	146	156
13	417	411	405	399	411	171	162	164	157	167
14	416	410	404	398	411	184	175	177	170	180
15	414	408	402	396	409	199	190	191	184	195

Similarly, we made measurements after training



Measuring movement -sliding fingers on the corridors, upper safety position



Comparing the results-sliding fingers on the corridors, upper safety position

Obr. 1 Sliding technique

Processing results

From the above results (Figure 3) it is possible to see a large difference between the results obtained at the beginning and at the end of practicing the given spatial motion activity. Obviously the results from the previous exercises are evident. In addition, there are large differences between the results of individual respondents at the end of the period.

By comparing the results of individual groups (Table 2), it can be seen that the monitored group achieves much shorter times (165) per passage than the control group (271). During training sessions and short competitions, blind people try to overcome a route as quickly as possible. For their orientation they use short touchs on the surrounding walls, when moving around the building. They also have a simpler step and therefore achieve even better results.

2.2.4 Direct walking along the corridor - Keeping straight ahead

One of the important movement and orientation skills is to maintain a straightforward direction. The blinds often turn to the left / sometimes right / side, or walk very tedious when walking. Such movement is very dangerous not only for them, but also for the people around. Learning to move them directly is therefore very necessary. This makes it easier to navigate when moving not only in the known but also unknown terrain. All you have to do is just say that it should be 20-30 meters.

The direct direction - is very important and we must constantly practice and consolidate this activity.

Practice: walking between soft obstacles, walking behind the sound signal, walking along the gum, on which the belt of another rubber is glued**.**

Estimating Distance - Managing this activity is for the unseeing good sense of security on the route. Visually impaired tend to shorten walking routes as estimated. The training takes place first at small distances from 1m to 3m. Gradually extend the distance to 20 m**.**

The task:

The blind will try to cross the building, its individual corridors, or a few meters in the gym. We practice this exercise several times and we measure the result.

Measured values and their significance

Measured magnitude in the given case is the time needed to pass the specified distance in the direct direction. While practicing and measuring the result, we can turn a blind man in any direction, in gym. Another form is to build a blind one at the beginning of the corridor and then go straight ahead along the given corridor without holding on to the wall. When performing the experiment, we will focus on the total time required to complete the specified route. Respondents try to move as quickly as possible, but especially safely.

Table 5 Time measurement when moving in the direct direction

Type of measurement	**Direct walking along the corridor - Keeping straight ahead**					**Direct walking along the corridor - Keeping straight ahead**				
Period / date	**/ measuring at the beginningnácviku /**					**/ measurement at the end/**				
IČ	**M 1**	**M 2**	**M 3**	**M 4**	**average**	**M 1**	**M 2**	**M 3**	**M 4**	**average**
1	289	313	325	313	310	278	257	236	299	268
2	295	319	331	319	317	280	259	238	301	270
3	299	323	335	323	321	282	261	240	303	272
4	300	324	336	324	322	283	262	241	304	273
5	298	322	334	322	320	283	262	241	304	274
6	293	317	329	317	316	283	262	241	304	274
7	286	310	322	310	309	283	262	241	304	274
8	277	301	313	301	300	282	261	240	303	274
9	265	289	301	289	288	169	151	133	187	162
10	252	276	288	276	276	163	145	127	181	156
11	238	262	274	262	262	163	145	127	181	156
12	224	248	260	248	248	168	150	132	186	162
13	210	234	246	234	234	178	160	142	196	172
14	196	220	232	220	221	191	173	155	209	186
15	184	208	220	208	209	206	188	170	224	200

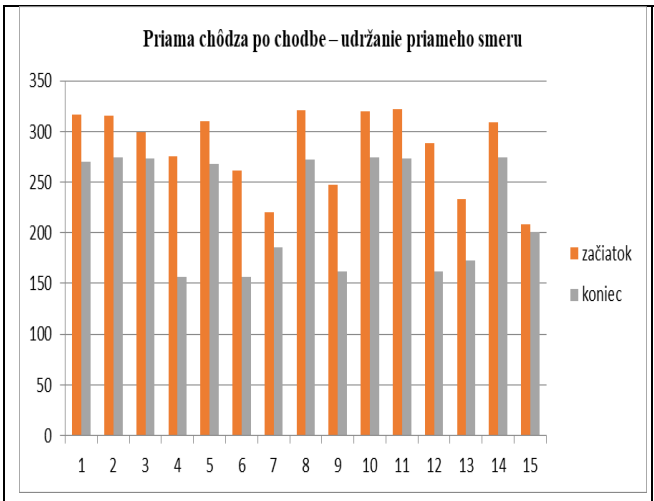
In a similar way, we also carried out follow-up measurements to keep the direction straight. After the direct training and the subsequent training during the lessons and other activities as well as the usual life in the center, we again measured the time to reach the direct direction at a certain distance. The results obtained (Table 5) are also displayed in graphical form (Figure 4). In some cases, we obtained relatively large differences between the time at the beginning of the training and at the end after 3-4 weeks.

Processing results

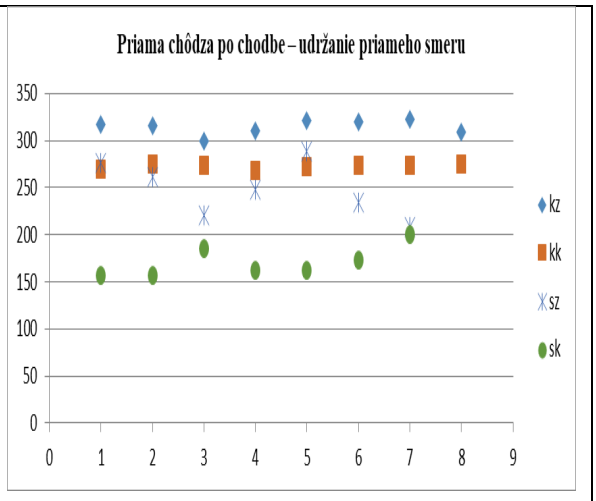
Based on the analysis of the results of the comparison of the monitored group and the control group, we found that in some cases the members of the monitored group at the beginning of the experiment had relatively low times.

This paradox is due to the fact that they have been engaged for a long time in sport activity, in which movements - the moves in the given direction are a common matter. Very often, for example, during an orienteering run, they have to go a few meters in the direction they read from the map, or when the ball plays a ball or shoots at the gate. The trainer gives instructions like: go right now, the goal is straight, and so on. Such

exercises then find their reflection in the overall spatial orientation as well as when moving within or outside the building.



Measure motion while walking directly



Compare group results when moving directly

Fig. 4 Direct Direction

Based on the data on the graph (Figure 4), it is possible to monitor the overall improvement of all respondents, but the differences between the monitored and the control group become larger..

2.2.5 Restraints in the rest position

Another form of orientation in the space is to estimate the angle of rotation. When moving, the non-seeing wizard must be able to turn the required angle. This action can be used to move around the room, obstruct obstacles, search for certain items, and so on. It is proven that the rotation is more accurate in one direction. For one person, it's right at the other on the left. It is important for an individual to know which side is more accurate when rotating. There is a tendency to rotate to turn at individual angles. It is important to know the right and left sides. It must be a correct and understandable instruction. There must be many attempts to find personal disposition during training. We make sure that there are no disturbing sounds during training.

The task

The goal of the training is to teach the blind to correctly estimate the angle he must turn.

Measured values and their significance

There were two ways to implement this experiment. In the first case, we wanted to measure the angle that the blind spot turns to when entering the angle. The second method we chose was the measurement of the time it takes to estimate the entered angle. This way seemed to us better in terms of implementation and also from a practical point of view. Easier we can measure time as a spatial angle.

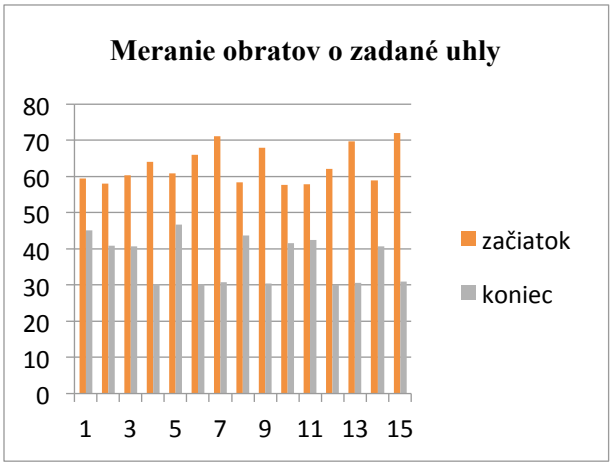
For a blind person standing in the corridor, in the gym or outside, type the command: the house is located at an angle of 90 ° to the right. He starts to rotate in that direction. When it stops, we evaluate whether it is about the given angle. If the deviation is very large, the blind is instructed to try again - to turn around the angle - from the position he is in. We measure the total time for which we can estimate the correct angle.

The results of the individual measurements at the beginning of the training are shown in the table (Table 6). The table shows measurements after about 4 weeks. The graphical representation of the individuals at the beginning and at the end of the measurement is shown in the graph (Figure 5) and the results of the monitored and control group are displayed and their mutual comparison is in the following picture.

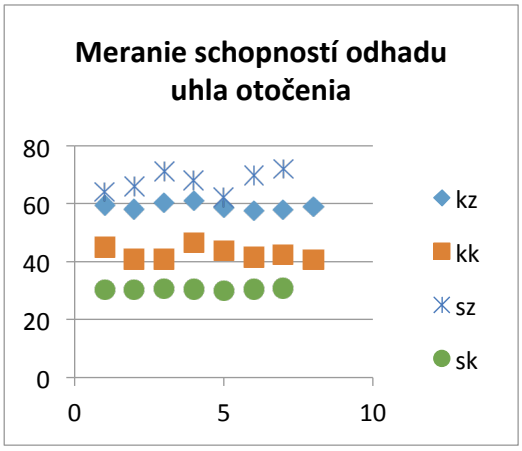
Table 6 Turns without moving

Type of measurement	Turns in a quiet position 45 °, 180 °, 360 ° to the right and to the left	Turns in a quiet position 45 °, 180 °, 360 ° to the right and to the left
Period / date	/ measuring at the beginningnácviku /	/ measurement at the end/

IČ	M 1	M 2	M 3	M 4	average	M 1	M 2	M 3	M 4	average
1	64	59	61	58	61	48	45	46	47	47
2	62	58	60	57	60	46	43	44	45	45
3	61	57	58	55	58	45	42	43	43	44
4	60	56	57	54	58	43	40	41	42	42
5	59	55	57	54	58	42	39	40	40	42
6	60	55	57	54	58	41	38	39	40	41
7	60	56	58	55	59	40	38	39	39	41
8	61	57	59	56	60	40	37	38	39	41
9	63	59	60	57	62	29	27	28	28	30
10	65	60	62	59	64	29	27	27	28	30
11	66	62	64	61	66	29	27	27	28	30
12	68	64	66	63	68	28	27	27	28	30
13	70	65	67	64	70	28	27	27	27	31
14	71	66	68	65	71	28	26	27	27	31
15	71	67	69	66	72	28	26	27	27	31



Measuring results when rotating at a given angle



Comparing group results on rotation

Fig. 5 Measuring the Turns by the entered angle

Based on the overall results of a given measurement, we see relatively large differences between the results obtained at the start and end of the training. It is also possible to see a large scatter in the results obtained after the training period. After showing the results for each group (Figure 1, tracking the results of groups in a fine motorcycle), it can be concluded that different sports games, exercises and more physical activity affect the ability of the blind.

When comparing the results of individual groups, it is possible to assume that active athletes are quicker to acquire habits of orientation in space. This chart confirms the underlying hypothesis that an active sporting and physical activity can improve the overall spatial orientation.

3 Summary of Experiment Results

During the given and the last school year, several active measurements of the activities of the blind were carried out. In all measurements, the more active respondents who belonged to the monitored group achieved better results than their colleagues. The obtained results confirmed the validity of the hypothesis that increased exercise activity can improve the results of the spatial orientation of the blind, stimulating them for better performance.

It is necessary to carry out several surveys and scientific projects on the basis of mutual cooperation, so that they can better qualify the individual impacts and their correlation. We anticipate that this activity will be implemented in cooperation with scientific research facilities, care facilities for the visually impaired, schools and universities as well as business entities.

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