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# Changes of temporospatial orientation in persons with intellectual disabilities who participate in modern dance workshops

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**A** Study Design  
**B** Data Collection  
**C** Statistical Analysis  
**D** Data Interpretation  
**E** Manuscript Preparation  
**F** Literature Search  
**G** Funds Collection

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## abstract

- Background:** The aim of the study was to identify whether participation in a short series of modern dance (hip-hop) workshops could improve the level of temporospatial orientation in persons with moderate intellectual disabilities.
- Material and methods:** The group consisted of 10 persons aged 14–23 ( $M = 19.5$ ,  $SD = 2.87$ ). A quasi-experiment was prepared in a one-group plan which consisted of a series of nine modern dance workshops lasting 60 minutes each and held twice a week. The following test layout / testing regime was used: pretest–posttest to check the temporospatial orientation level of dance workshop participants before and after the workshop. A “ball run” spatial orientation test was used in the study. The test was adapted to the cognitive abilities of the subjects.
- Results:** Student's t-test for dependent samples showed that the mean level of temporospatial orientation in persons with moderate intellectual disabilities before their participation in nine hip-hop dance workshops ( $M = 32.32$ ;  $SD = 3.98$ ) is significantly higher than the mean level of temporospatial orientation ( $M = 29.74$ ;  $SD = 5.45$ ) after completion of workshops,  $t(9) = 2.61$ ;  $p < 0.05$ .
- Conclusions:** Modern dance (hip-hop) classes improve temporospatial orientation in persons with moderate intellectual disabilities
- Key words:** temporospatial orientation, intellectual disability, modern dance, hip-hop.

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## INTRODUCTION

Intellectual disability is a complex condition with diverse clinical presentations determined by different etiological factors. It comprises varied symptoms of development disturbances associated with genetic disorders, neurodevelopmental disorders, metabolic disorders, neurotoxic infections, but also a result of environmental and cultural factors [1–3]. The DSM-V classification [4] is based on the fact that intellectual disability is a disorder beginning in the development period and includes deficits both in terms of intellectual and adaptive performance in areas relating to understanding concepts, social performance and practical fields. Educational possibilities of persons with moderate intellectual disabilities are very limited due to the large abnormalities in mental and physical development. Dysfunctions apply both to motor development and perception processes. There are also difficulties in moving from a lower level to a higher level of development. These changes are primarily determined by the abnormal performance shown by the anatomical structures of the brain. ID is classified as neurodevelopmental disorders. The studies carried out so far indicate abnormalities within the structure of the central nervous system [5, 6]. Motor coordination is closely linked to the functioning of the central nervous system. It depends on performance of receptors, secretion and transport of hormones by blood and the flow of information through the nervous system. Therefore, thorough coordination of movements requires establishment of action programs before the motion commences. During the movement, its course is systematically evaluated, and adjustments are made on the basis of the discrepancies between the achieved result and the planned objective of the action [7–16]. Due to the deficits in the correct functioning of the central nervous system in persons with intellectual disabilities, it can be noted that coordination abilities in this social group are significantly less developed than in an average person with a standard development status [17]. Taking up physical activities by persons with intellectual disabilities is a very important element in their revalidation/compensation. Therapists or teachers should consider what really is important and needed to improve the performance of persons with intellectual disabilities when developing programs/curricula for their students. There is no doubt that creation of programs aimed at developing coordination abilities is of utmost importance. Temporospatial orientation is determined by the capacity of the central nervous system to function. Efficient CNS enables fast and effective control and adjustment of motion in space [18–27]

Music and dance can provide persons with intellectual disabilities while learning with support and even guidance. Dance lessons are also part of rehabilitation [28] and cognitive, emotional and social therapy [29]. Sooful et al. [30] assume that dance and music encourage personal efforts, enable people to overcome the limitations imposed by their disabilities and help them to achieve a greater sense of accomplishment. A few studies to date showed that motor coordination could be shaped through different forms of dance [31–33]. Dance is a form of exercise that offers physiological and psychological benefits [34]. In addition, physical training with dancing can improve balance, strength, flexibility and functioning of the cardiovascular system, because it uses interval training but is considered an aerobic form [35]. Haghhigh et al. [36] investigated the effect of a combined program (aerobic and rebound therapy) with two different ratios on some physical and motor fitness indices in intellectually disabled girls. The results showed that both exercise programs in experimental groups improved endurance performance indices, lower extremities endurance, cardio-respiratory endurance, static and dynamic balance, agility and coordination in comparison to the control group.

There are many kinds of dance, such as ballroom dance, modern, jazz, ballet and traditional dance. We more often meet with dance in the rehabilitation of people with neurological disorders such as Parkinson disease or dementia. In research, we can find the use of such dances as Argentinian tango, Zumba and DMT [37–41]. Modern dance deserves special

attention, which, thanks to having been popularized by the media, can arouse public interest more easily than other dance variants. Modern dance teaches people to work in space and with space, namely, to move carefully and freely within it [42]. In modern dance you can see the components of jazz, modern dance, classical dance, stepping, etc. There are many styles of modern dance, e.g. new style, disco dance, dancehall, afro dance, breakdance, street dance, funky. In this collection of many dance techniques, improvised, dynamic and strong movement is what really counts. This area is constantly evolving.

Modern dance, which includes the hip-hop style, originates from the street dance, i.e. dancing in the streets created in 1970s. This dance requires dancers to coordinate their movements very closely. Hip-hop is a dance that is very characteristic, dynamic and lively, because of the uniqueness of many steps and transitions that require bouncing off the ground. The distinctive feature of this dance is a high degree of technical freedom. However, there are rules that any dancer specializing in this style should adhere to. The basis is the so-called "feeling", which means sensing the music, its rhythm, melody, the intensity of the song, which translates into dancers performing the same steps, but music will be interpreted differently. It is all about representation of music through motion as smoothly as possible. The tempo of hip-hop music is in the range of 70 to 130 beats per minute (BPM) [43]. So if we talk about a tempo of music being "at 90 BPM," we mean that there are 90 beats (pulses) every minute. Tempo in hip-hop can be freely selected according to the students' abilities; it is not imposed as in ballroom or folk dances. It is also important to move steadily and isolate the body by moving its individual parts precisely. Therefore, training requires learners to work on coordination abilities [44,45]. This dance is undoubtedly suitable for persons with intellectual disabilities due to its attractiveness and popularity, which may be an incentive to participate in such a form of physical activity. This activity combines motion, social interaction and play, and in addition, is easy to carry out because it does not require any specialized equipment. In addition, according to the studies by Bonny, Lindberg and Pacampara [46], dance such as hip-hop can contribute to improving cognitive processes and, as we know, it is used to create and modify the knowledge of the environment that shapes our behaviour (to explore the environment), which suggests that this may have a direct effect on temporospatial orientation. It is worth adding that it is difficult to find a similar topic in the literature where authors would undertake to check whether regular hip-hop dance training could improve temporospatial orientation, possibly due to the relatively short existence of the dance style.

## **AIM OF THE STUDY**

The aim of the study was to identify whether participation in a short series of modern dance (hip-hop) workshops could improve the level of temporospatial orientation in persons with moderate intellectual disabilities. Empirical verification of this aim required the following re-research question to be posed:

Does the level of temporospatial orientation in persons with moderate intellectual disabilities change after they have completed nine modern dance (hip-hop) workshops?

## **MATERIAL AND METHODS**

The criterion for inclusion into the study group was moderate intellectual disability, interest in dance (selection was made by specialists – physical education teachers with professional qualifications as teachers of persons with intellectual disabilities) and a written consent from parents followed by oral consent from students in order to participate in modern dance workshops and scientific research conducted on the school premises. 10 out of 14 people were qualified for the research (5 men and 5 women) aged

14–23 ( $M = 19.5$ ,  $SD = 2.87$ ), including a student with severe intellectual disabilities who performed at a similar level as the rest of the group. 4 persons were not qualified due to attendance of less than 50% at all the activities that took place.

In order to verify the research question raised, a quasi-experiment was prepared in a one-group plan which consisted of a series of nine modern dance workshops (hip-hop) lasting 60 minutes each and held twice a week for persons with moderate intellectual disabilities. The following test layout / testing regime was used: pretest-posttest to check the temporospatial orientation level of dance workshop participants before and after the workshop. The protocol of the dance workshops provided for a warm-up, proper classes (learning choreography based on basic steps of hip-hop such as: “Toy Man”<sup>1</sup>, “Bart Simpson”<sup>2</sup> or “Bounce”<sup>3</sup>) and finally: team-building and stretching physical exercises. Old school steps<sup>4</sup> were selected because they seem more appropriate for people with intellectual disabilities. The steps above are clearly structured and easy to follow the typical hip-hop pace. The tempo of the music was gradual. It started at 75 BPM and increased go to 95 BPM. A video recording was made to document the procedures used and to record the hip-hop choreography taught during the study<sup>5</sup>.

The following dependent variables included: the level of temporospatial orientation among the participants of the workshop recorded twice: before and after the modern dance (hip-hop) workshop. A “ball run” spatial orientation test [47] was used in the study. The test was adapted to the subjects’ cognitive abilities. Instead of digits, students were shown images of popular objects. 5 balls were placed along the circle of 3 m radius and the sixth ball was placed 1.5 m outwards – away from the centre of the half-circle. The subject was facing the balls with the heels touching the sixth ball. On the signal, the subject turned around and touched the sixth ball by any hand. At this point, the researcher showed a card in A4 format with a picture of: the heart, the bee, the flower, the sun and the cloud. The subject then ran towards the selected ball showing the same image as was just shown to him/her, approached it and touched it with their hand. Then he or she returned to the ball in the centre. When in contact with the ball, the subject was given next information about the direction of the run. In this manner, the subject ran toward all the balls placed along the half-circle, completing the test by touching the central ball. Only a better result out of the two tests was analysed. Since the temporospatial orientation indicator was the duration of the test performed, the lower result values indicate better temporospatial orientation. Measurements were made using an electronic handheld timer (accurate to 0.01 seconds).

## RESULTS

Student’s t-test was used for dependent samples. The normality of distribution was confirmed by the Shapiro-Wilk test:  $W = 0.852$ ;  $p = 0.061$ . The analysis using student’s t-test for dependent samples showed that the mean level of temporospatial orientation in persons with moderate intellectual disabilities before their participation in nine hip-hop dance workshops ( $M = 32.32$ ;  $SD = 3.98$ ) is significantly higher than the mean level of temporospatial orientation ( $M = 29.74$ ;  $SD = 5.45$ ) after completing the workshops,  $t(9) = 2.61$ ;  $p < 0.05$  (Fig. 1). The value of Cohen’s  $d = 0.57$  indicates an average relationship between the participation in modern dance (hip-hop) workshops and the estimated level of temporospatial orientation.

<sup>1</sup> “Toy Man” [https://www.youtube.com/watch?v=ZyPLvH\\_rre4](https://www.youtube.com/watch?v=ZyPLvH_rre4) [access: 9.05.2020]

<sup>2</sup> „Bart Simpson” <https://www.youtube.com/watch?v=KX-Nbtsk1E> [access: 9.05.2020]

<sup>3</sup> „Bounce” [https://www.youtube.com/watch?v=p\\_MY7LlS8c4](https://www.youtube.com/watch?v=p_MY7LlS8c4) [access: 9.05.2020]

<sup>4</sup> Old school steps gave the foundation for hip-hop style; the steps are schematic and have names. Over time, the old school evolved and led to the creation of the new school. As a rule of thumb, it is worth first mastering the old school steps before moving on to the new school.

<sup>5</sup> The author of the study may provide access to the recording.

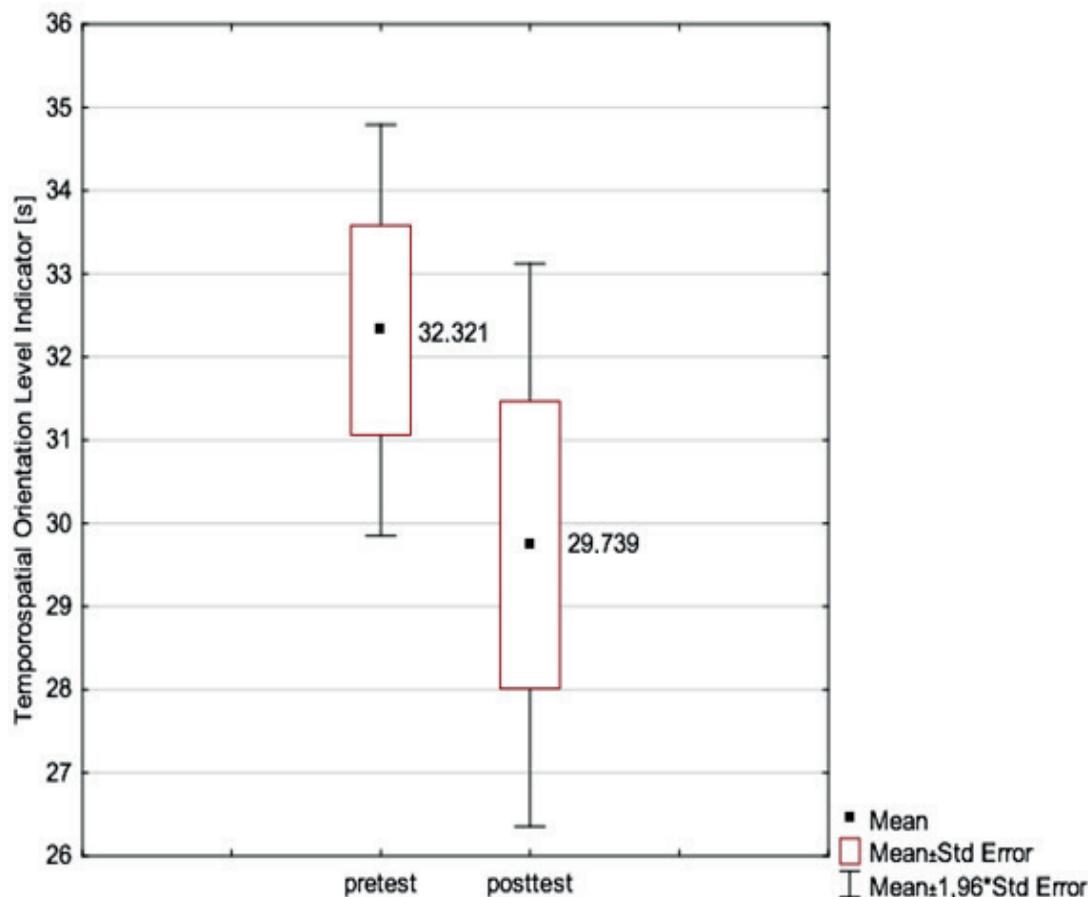


Fig. 1. Average level of temporospatial orientation in persons with moderate intellectual disabilities – participants of hip-hop dance workshops before (pre-test) and after (post-test) the workshops. The lower the average, the higher the level of temporospatial orientation

## DISCUSSION

Hip-hop is a dance style that requires a high level of motor coordination. It is based on many complex steps and at the same time gives a dancer a great deal of freedom in interpreting how he or she will perform a given step. Therefore, it is an activity suitable for persons with intellectual disabilities. It resembles the process of playing roles in the therapeutic theatre that increases the motivation to live. The roles and, in the case of hip-hop, dance forms are proposals that lead to the development of personalities, especially those that are restrained and restricted [48]. In modern dance, and especially in the hip-hop style, the improvisation mentioned above is an important element, for persons with intellectual disabilities can decide how to direct their movement, and instructors can control and dynamise this process, for example by identifying its components. The task of performing dance improvisation consisting of “drawing” circles using different parts of the body is a good example. Participants decide themselves which body parts to use in order to draw circle shapes and at the same time have the frameworks in which they try to perform the task. Such a framework is not based on limitations but on points of reference for the movement performed and on the sense of security.

The results obtained in this study show that following completed hip-hop dance workshops, persons with intellectual disabilities improved their temporospatial orientation. It may suggest the importance of dance in shaping this orientation. Jobling, Virji-Babul and Nichols [49] drew similar conclusions claiming that dance activities could improve the

sense of rhythm and awareness of the body in persons with Down syndrome. Thus, dance has beneficial effects on the nervous system efficiency and rapid and effective control and regulation of the movement in space [19]. It may be assumed that a high level of body awareness is a factor that determines temporospatial orientation. According to Levy et al. [50], developing awareness of the child's body through organization of impulses and internalization of control is significantly affected by dance. However, before children can cope with external dimensions of the environment, they must first understand their own body. Using accurate names of body parts and motion directions during dance activities not only expands the development of one's own body awareness, but also that of other people's [51]. For example, Barnet-López et al. [52] carried out studies with adults with intellectual disabilities during which the participants performed the human figure drawing test by Koppitz before and after the dance session. The results showed a significant improvement in their body awareness. Therefore, it is an activity suitable for persons with intellectual disabilities. Barnet-Lopez et al. [29] claim that the connection between the mind and the body is activated by dance therapy. This is what integrates the emotional, cognitive and physical dimension in a person.

There is no doubt that dance is an activity where coordination abilities play a major role. It appears that physical activity, which focuses on improving motor coordination, can have an impact on cognitive processes [53] responsible for processing information in the nervous system which ultimately "takes" them back into the environment in the form of reaction - namely behaviours. Kattenstroth et al. [39] think that dancing is increasingly used as an intervention because it combines many diverse features making it a promising neuroplasticity-inducing tool. They performed a broad assessment for people during aging. After 6 months, in the control group no changes or further degradation of performance was found. In the dance group, beneficial effects were found for dance-related parameters such as posture and reaction times, but also for cognitive, tactile, motor performance, and subjective well-being. Scientific research confirms that the level of temporospatial orientation can be increased and that it depends primarily on the methods used and the selection of motor exercises when creating training programs dedicated to this coordination capacity [54-56]. Gawlik and Zwierzchowska [57] even developed a set of exercises to shape coordination abilities and introduced them in the experimental group of blind persons and partially sighted boys aged 13 to 14 years during all physical education classes. Four dependent variables were controlled: temporospatial orientation capacity, dynamic balance ability, rapid simple reaction capability and the ability to move the whole body at high frequencies. The program was implemented over a period of six months and determined a significant improvement of the temporospatial orientation and the rate of response in the study group of subjects with visual impairment. In another study, Jennifer Monique Dabalsa [58] used jazz dance. She created a very diverse group of persons with disabilities. It consisted of 14 students, including persons with Down syndrome, ADHD, MPD and Asperger syndrome with autism spectrum. The classes took place for 12 days and lasted one hour per day during a summer workshop. Spatial orientation is also permanently linked to the perception of temporal parameters of movements and their changes. The level and development depend on the speed of assessment and control of the spatial conditions for the activity, which takes place on the basis of interaction of many analysers, mainly the visual and auditory ones [47]. An example of the fact that dance can shape temporospatial orientation is the study by Jansen [59]. She carried out an experiment involving 65 Bavarian students of the primary school aged 7-9 years. The subjects completed the test which resembled the popular computer-based Tetris logic game and assessed the mental rotation ability. The subjects were then divided into two groups. One group went through a five-week creative dance course and the other group attended standard sports classes at school. Interestingly, only children who learned to dance showed a significant improvement in their mental rotation of figures. The study

shows that dance improves spatial imagination, which in turn makes it easier to solve all problems in everyday life, e.g. to reach a specific location in a new city. It is worth adding that temporospatial orientation in dance is based, inter alia, on the assessment of the body position during movement, on the ability to use the entire space available to the dancer and to adapt, for example, the length of steps while performing the choreography. During such performance, the group settings are often changed in relation to the frontal wall or in relation to individual participants, which is often beneficial in terms of developing temporospatial orientation, limiting the size of the training area and frequent changing of the movement direction [60].

In conclusion, dance offers many advantages in shaping coordination abilities, including temporospatial orientation, which “describes” the location of a person or part of his or her body in relation to the reference point and allows him or her to implement the intended movements. This coordination ability is extremely important in daily lives of persons with moderate and severe intellectual disabilities. A high level of temporospatial orientation can provide a basis for increasing autonomy or personal efficacy in persons with intellectual disabilities, which in turn can facilitate their social functioning. Therefore, temporospatial orientation should be included in the revalidation plans for this group of persons and formed during modern dance classes.

## CONCLUSIONS

1. Modern dance (hip-hop) classes improve temporospatial orientation in persons with moderate intellectual disabilities.
2. The results obtained may provide evidence of the positive role played by modern dance in the therapy of nervous system disorders and be another inspiration in the process of developing next choreographies to improve the temporospatial orientation in persons with intellectual disabilities.

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