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Therapy of Sensory Integration Disorders in Pre-School and Early School-Age Children (Based on the Results of Pilot Experimental Studies)

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Abstract

The concept of sensory integration, developed by Jean Ayres, is currently receiving considerable attention among specialists working with children experiencing developmental problems resulting from sensory integration disorders. Developmental problems arising from sensory integration disorders are exemplified, among others, in the acquisition of skills and abilities necessary for proper functioning, including those related to cognitive development and education. Therefore, during the course of the pilot experimental studies, presented in this article, an attempt was made to establish the effectiveness of plastic footbridges and those made with natural materials on the sensory integration therapy in pre-school and early school-age children. The studies concentrated on selected aspects of children's functioning, including tactile performance of feet, motor coordination of the hands and legs with regard to gross motor skills, motor coordination of the hands with regard to fine motor skills, fitness and ability to maintain body balance. The research was carried out in four experimental groups: the first two groups included children of early school age with and without sensory integration disorders, and the other two included pre-school and early school-age children with deeper intellectual disabilities and sensory integration disorders. The two experimental groups carried out a series of five therapeutic classes using plastic footbridges, while two others used footbridges made of natural materials. The obtained data allowed a preliminary conclusion to be formulated about the superiority of footbridges made of natural materials

over plastic footbridges in the context of effective influence on the therapy of sensory integration disorders in the examined children. However, it is necessary to continue research in more numerous groups and with a larger number of therapeutic classes.

Keywords: sensory integration, sensory integration disorder therapy, sensory footbridges.

Sensory integration and sensory integration disorders – introduction

Jean Ayres (1920–1988), who worked for many years at the Brain Research Institute, University of California, USA, is considered the founder of the sensory integration concept. In 1950, she started to investigate the reasons underlying learning disorders. In her research, she primarily focused on the neurological basis of human behaviour, publishing the results in two books (Ayres, 1970; 1973)[1].

The most highlighted issue in Ayres's theory is the assumption that the different sensory experiences that reach a human being in large numbers through different perceptual modalities must be integrated with each other. According to the author, perceptual and motor functions are formed along with human development at subsequent ontogenetic stages and consequently, they condition a child's ability to learn. The integration functions of sensory perception are developed in a natural order, and each child must complete the same developmental stage. The basic thesis of Ayres's concept is that each new structure is in some way dependent on the previous ones in terms of its function. Disorders at a more basic level may exert a negative impact on the diversity and efficiency of the higher functions formed on their basis (1979, p. 4). According to Ayres, the neural processes occurring in the human brain are linear and autonomous (1979).

Sensory integration (SI), as Ayers states, "consists in processing information transmitted by the senses so that it can be used in a purposeful, successful way" (Ayres, 2013, p. 7). In another place, she indicates that "sensory integration is the process of organizing and processing sensory impressions (sensory stimuli), which aims at creating a useful body response and meaningful perception, emotional response and thinking by the brain. Sensory integration is the process of segregating, organizing and combining all sensory experiences

[1] Updated and extended edition of the book by J. Ayers, *Sensory Integration and the Child,* was published in the USA in 2005.

reaching a person into a complete and extensive brain function" (Ayres, 1998, p. 47). Therefore, as she adds, "for the muscular work to be coordinated and efficient, brain activity must be properly organised and structured" (Ayres, 2013, p. 39). L. Seiler, the continuator of Ayers's work, indicates that "sensory integration concerns sensible organisation and division of sensory stimuli in the brain so that they can be used. The use of information from stimuli takes place at the level of perception or experience of the body and the environment; it is expressed through relevant behaviours and movements. Areas of the central nervous system necessary for the sensible, satisfactory confrontation of the individual with his or her environment cooperate with each other based on the principle of integration" (1998, p. 118).

"Sensory integration is the process of transforming sensory impressions" (Brüggebors, 1992, p. 34). It allows for the integration of these impressions and affects proper human behaviour. "The process of transforming sensory impressions enables the learning process. Stimuli, sounds, objects, people can only be perceived if the transmitted sensations are organised, if they are relevant to the person receiving them. Any other information is easily ignored by the senses of sight and hearing; it is not recorded or it is quickly forgotten. The particular information received by the senses is compared, rearranged, arranged in the proper order, allocated to the right place, just like puzzle pieces" (Brüggebors, 1992, p. 34).

Following the above statements, the main principle of the therapy created by Ayres is based on the assumption that normal, i.e. age-appropriate adaptive behaviours can be developed by referring to previous patterns of behaviour and movement (1979, p. 29). The learning process in a newborn child – in the author's opinion – is limited to the "growing up" of existing neurons by providing sensual impulses and motor activity. Therefore, it is necessary to create connections or contacts through synapses. Based on this assumption, Ayers (1979) proves that learning disorders are a manifestation of abnormalities in the functioning of neurons in the brain and describes them as dysfunctions of sensory integration.

The basic assumptions of the sensory integration (IS) method treat the issues of sensory integration in terms of an important and highly complex process with neurophysiological background, on the basis of which sensory impressions are delivered to the central nervous system, where they are qualitatively and quantitatively organised. The processes of sensory integration take place in important areas of the nervous system: the spinal cord, the brain stem, the cerebellum and the brain hemispheres. They determine the functioning of more

complex processes, such as intellectual activity, numeracy and reading skills. Sensations provided by the sensory receptors: touch, sense of balance (related to the activity of the vestibular system, responsible for feeling and recording body movements), proprioception (the so-called deep feeling), smell, taste, sight, hearing are used in various situations through the function of the nervous system. This refers both to the experiences related to the formation and acquisition of new skills and those related to other forms of everyday activity of an individual (e.g. climbing stairs, cycling, fastening and unfastening buttons). In situations where perception disorders and integration of sensory experiences are present, specific problems may occur, including cognitive development, especially cognitive activity, motor development or behavioural problems.

Theoretical and practical assumptions of the IS method indicate that a diagnosis of problems suffered by a person with sensory integration disorders is a basis for therapeutic activities. It should be of a complex nature (Majewska et al., 2016). Every treatment can not only remove or alleviate problems but also, if it is misused or misapplied, it can increase them, direct them to the wrong track. And most importantly, it does not serve the real development of the person being treated. Hence, the primary objective of the IS is to improve the synaptic connections of the central nervous system, the quality of transmission and organisation of information received by the various senses. The task is to provide, in the course of physical activity, such an amount and such stimuli as will result in the actual integration of sensations coming from the environment and the human body (Majewska et al., 2016).

IS therapy is mainly aimed at children with sensory integration disorders: tactile, visual, auditory, vestibular hypersensitivity or hyposensitivity, gravitational insecurity, movement intolerance, dyspraxia, speech retardation and speech disorders, with specific school difficulties (dyslexia, dysgraphia, dysorthography, dyscalculia), psychomotor retardation, children from high-risk pregnancies, prematurely born or significantly late, after stays in neonatal ICU, complicated births, born by Caesarean section, with intellectual disabilities, blind and partially sighted, deaf and hard of hearing, with ADHD, ADD, autism, Down, Asperger, Rett, Williams, Turner, Klinefelter syndromes and CP (cerebral palsy) (Majewska et al., 2016).

Additional symptoms which may indicate the advisability of IS therapy in a child, although a single symptom is not sufficient, and at least a few of them are required, include: difficulties in reading, writing, counting, quick fatigue while writing, concentration difficulties, difficulties in working with an adult or interacting with other children (Majewska et al., 2016).

The sphere of motor skills and orientation in the scheme of one's own body is characterised by problems observed when cutting with scissors, tracing, calculating, grasping a crayon, pen, keeping the head upright while sitting for a long time, sitting on a chair or changing the position on the chair, pointing to body parts, right and left, orientation in the surroundings, motor activity, throwing and catching the ball, orientation during team games, keeping up with the peers while performing movement exercises. The following are present: fear of falling, of altitude, of learning new motor activities, of assessing the distance (when moving, the child walks unsteadily, walks on fingers, trips), excessive mobility, muscle tension disorders (Majewska et al., 2016).

In the area of so-called everyday activities, especially self-care skills: the child performs many activities with difficulty, more slowly, deviating from the required standard of performance, or is unable to master them. Problems with hygiene activities, toilet, dressing up, drinking, chewing and swallowing food may be present (Majewska et al., 2016).

In the sphere of cognitive and psycho-emotional functioning, the following are observed: quick fatigue, weakness, reactions disproportionate to the stimulus, taking offence quickly and frequently, complaining about minor injuries, aggressive behaviour, withdrawal, shyness, avoiding contacts, low self-esteem and lack of self-confidence (Majewska et al., 2016).

In the sphere of sensual functioning: 1) hypersensitivity to stimuli (sudden, violent reactions, squinting the eyes, plugging the ears, focusing on certain scents, avoiding playing with modelling clay, painting with fingers, touching certain textures and substances, intolerance to combing their hair, washing the head, a vomiting reaction when brushing teeth; 2) hyposensitivity to stimuli (long, intense spinning on a carousel), deliberately hitting or bumping into a wall, rubbing hands or other parts of the body with objects of a rough texture, sniffing selected objects, seeking for experiences, trying non-standard, inedible things, ignoring pain (Majewska et al., 2016).

In conclusion, it should be emphasised that sensory integration disorders in children have diverse, ambiguous, broad and serious consequences. This is the reason why diagnostic and, consequently, therapeutic activities should be oriented towards the specialist activities which ensure the maximum efficiency.

Methodology of the experimental research conducted

The therapy of sensory integration disorders involves a wide range of natural materials and teaching aids (Figure 1). Sometimes these are devices specifically

produced for a given activity and very expensive. Such aids include sensory footbridge, made of plastic or natural materials.

Figure 1. Sensory discs made of natural materials.

Sources: Author's archives.

Footbridges made of natural materials are made of flexible, laminated beech plywood, bent into an arch. They reach a height of 20 cm at their highest point, which does not pose any risk in case the child losses the balance. Their load capacity is 120 kg. Footbridges are connected by means of islands made of ecological materials and properly protected. A specially designed jigsaw-like assembly system enables the islands to be connected with footbridges. The islands are made of wood, they have replaceable discs that can be exchanged or disassembled, which makes it possible to create individual sets. The removable discs contain sensory materials such as corrugated steel sheet, carpet, wooden pegs, solid stone, cork, non-slip plywood, Plexiglas with mirror, hemp rope coiled in a spiral, marmoleum flooring, stones embedded in resin, artificial grass and bean bags.

To examine the impact of sensory integration activities, which will use footbridges made of natural materials and plastic, on the therapy of sensory

integration disorders in pre-school and early school-age children, pilot experimental studies were conducted in the form of a pedagogical experiment. The object of the research was the question of developing in pre-school and early-school children selected sensory integration skills (based on the evaluation sheet developed for the purpose of the research to assess selected skills and abilities in the area of sensory integration). The subjects of the study were pre-school and early school-age children experiencing sensory integration disorders and pre-school and early school-age children experiencing, apart from sensory integration disorders, the effects of other developmental disorders (essentially intellectual disabilities).

The primary aim of the study was to initially assess the effect of sensory footbridges on the development of specific functions and abilities in pre-school and early-school children with sensory integration disorders (with disabilities and non-disabled).

The research used the individual case study method and a pedagogical experiment, a technique based on the evaluation scale measuring the development of selected functionalities in the field of sensory integration of the child (the scale was developed for the study, the research tool was a questionnaire for evaluation of the development of selected functionalities in the field of sensory integration).

The main problem of the research was defined as follows: What are the effects of applying sensory footbridges made of various materials (plastic, natural material) in the therapy of evaluated sensory integration disorders in the examined children? The specific problems included two questions: 1. Did the examined children make progress in developing the functions evaluated during the pilot experimental studies? 2. Does the type of footbridge affect progress in the development of functions and performance evaluated during the pilot experimental studies in the examined children?

In the research conducted, one main hypothesis and two detailed hypotheses were put forward. The main hypothesis: The use of sensory footbridges made of various materials (plastic, natural material) has an impact on the therapy of sensory integration disorders assessed in the examined children (tactile performance of feet, motor coordination of hands and legs as regards gross motor skills, motor coordination of hands as regards fine motor skills, performance and the ability to keep the body in balance), although this impact differs, i.e. it depends on the type of material from which the footbridges are made. Specific hypotheses: 1. During the course of the pilot experimental studies, the examined children will make progress in the development of the evaluated

functions, especially the following: tactile performance of feet, motor coordination of hands and legs as regards gross motor skills, motor coordination of the hands as regards fine motor skills, performance and ability to keep the body in balance. 2. The type of sensory footbridge affects the progress in the development of functions and skills in the examined children, evaluated during the pilot experimental studies. Significantly higher effects are obtained when using footbridges made of natural materials as compared to footbridges made of plastic.

The research was conducted at the John Paul II Rehabilitation and Education Centre, Szczytno Branch, and in Maria Skłodowska-Curie Primary School No. 3 in Szczytno in Poland. The research was organised in six stages:

1. Developing methodological assumptions of the study in terms of its object, subject, purpose, problems and research hypotheses, method(s), techniques and research tool.
2. Selection of the research site and research sample: two groups of children, the first was the experimental group and the second was the control group. Groups consist of six children in each, including three children with sensory integration disorders and three children each with sensory integration disorders combined with other developmental disorders (generally with intellectual disability). The low number of examined children was due to the pilot nature of the research, the specificity of IS activities, the possibilities of using the footbridges and their availability in the institutions participating in the study and the availability of specialists conducting the given activities.
3. Pilot study–aim: verification of the research tool prepared for the study.
4. Diagnosis of the assessed functions and skills in the field of sensory integration in the examined children.
5. Implementation of a pedagogical experiment – five classes on sensory integration in experimental and control groups – classes were conducted between 9 and 30 September 2019. The duration of each class – 15–20 minutes. During the classes, each child had to walk over the footbridges three times (1 x forward, 1 x sideways, 1 x backward), stopping on each island for up to five seconds. Children walked over the footbridge barefoot. During the activities in the experimental group, LED tapes and bells were used as additional equipment for the footbridges.

The plan of using individual discs during the classes: class 1: a) experimental group: sheet metal, rope, cork, b) control group: green hedgehog, yellow balls, pink stripes; class 2: a) experimental group: sheet metal, rope, non-slip ply-

wood, b) control group: green hedgehog, yellow balls, smooth blue disc; class 3: a) experimental group: sheet metal, plywood, non-slip plywood, b) control group: turquoise balls, orange circles, smooth blue disc; class 5: a) experimental group: stones, pegs, non-slip plywood, solid stone, b) control group: turquoise balls, orange circles, smooth blue disc, yellow balls.

6. Analysis and summary of the obtained data in the context of evaluating skills and abilities developed in the examined children from the experimental and control group; verification of the diagnosis made before the implementation of the pilot experimental studies. Formulating preliminary research conclusions.

The ethics of the study involved explaining to parents and children the nature and the purpose of the study, obtaining parents' consent for their children to participate in the study and in therapeutic activities. It also took into account the provisions of the Personal Data Protection Act (GDPR) by changing the initials of the children participating in the survey[2].

The experimental research involved two groups of children in the public education system (three children in each group) and two groups of children from special education system (three children in each group). The initial assessment of the functioning of all children participating in the study was made on 07.10.2019, and the next assessment after the cycle of therapeutic activities, i.e. 11.10.2019. From a public school, six children participated in the study, from the first grade, including five at the age of 7 years and one child at the age of 8 years (was a member of the experimental group) – the average age in the control group was 7.0 years, in the experimental group 7.3 years. From a special education facility, six children also participated in the research. In the experimental group, similarly to the control group, there was one child each aged 4, 7 and 8 years (the average age of children was 6.3 years). There was one child in each of these groups with autism, moderate intellectual disabilities and Down Syndrome.

Research results

The research allowed the functions and skills in the area of sensory integration causing the greatest difficulties for the examined children to be identified, which allows the specialist to direct developmental activities at stimulating given

[2] Ustawa z dnia 10 maja 2018 roku o ochronie danych osobowych, Dz. U. 2018 poz.1000 ze zm. [The Personal Data Protection Act of 10 May 2018, O.J. 2018 item 1000 with changes].

functions and skills. Furthermore, the study allowed the identified difficulties in the groups of children participating in the pedagogical experiment to be compared, based on the variable of presence/absence of disability and the occurrence of sensory integration disorders combined with other developmental disorders and the absence of additional developmental disorders combined with sensory integration disorders.

The analysis of the data obtained before the experimental classes in experimental and control groups and after the realisation of a cycle of classes in the field of sensory integration with the use of footbridges made of natural materials and plastic created an opportunity to evaluate the progress in development or to identify the lack of progress in development concerning the assessed functions and skills (Table 1).

In the group of children with sensory disorders not combined with other developmental disorders and with sensory disorders combined with other developmental disorders, the presence of tactile sensitivity of the feet was diagnosed as regards recognising materials on discs. The hypersensitivity to specific materials in the experimental group – after the end of all classes – changed by increasing the hypersensitivity to hemp rope (in one child). On the other hand, the groups of children with disabilities (in the experimental and the control groups), demonstrated the absence of the analysed sensitivity and hypersensitivity (also after the end of the experiment), which can be explained by the condition of the motor and sensory skills of children from these groups.

In children from an experimental group from a public school, the performance of gross motor skills as regards single-leg jumping, on the right and left leg, improved (in one child). No progress was observed in this area among children with disabilities, which can be attributed to the disability condition, as well as to the low number of therapeutic classes conducted. However, progress was observed (in experimental groups) as regards the performance of the evaluated gross motor skills (one child with disabilities who had not previously performed the assessed skills started to perform them with difficulties). In the experimental group of children with disabilities, one child acquired the skill of touching the right thumb with the left thumb and left thumb with the right one, alternately, from a distance of about 50 cm, moving hands in a horizontal plane; the skill of touching the right little finger with the left little finger, and the left little finger with the right one, alternately, from a distance of about 50 cm, moving hands in a horizontal plane, and the skill of performing the "chimney sweep" finger play.

The performance of the assessed fine motor skills in the experimental groups changed: three children from the public school moved from the level

of performing with very great difficulty to the level of performing these activities with slight difficulties. In the group of children with disabilities, one child moved from the level of not performing the assessed activities to the level of performing them with very great difficulty, and another child progressed from the level of performing the assessed activities with very great difficulty to the level of smooth performance.

No significant progress was observed (in each of the examined groups) in terms of the way children walked across the footbridges, except for one child from the experimental group from a public school, who progressed from the level of walking with assistance to unassisted walking. The same applies to the speed of walking across the footbridges. In this case, one child from the experimental group from the public school progressed from a slow walk to a normal walk level.

Table 1. Results of completed pilot experimental studies in the experimental and control group.*

Item	Evaluated competence, skill, function	Children from a public primary school				Children with disabilities			
		Experimental group		Control group		Experimental group		Control group	
		Evaluation before the experiment	Evaluation after the experiment	Evaluation before the experiment	Evaluation after the experiment	Evaluation before the experiment	Evaluation after the experiment	Evaluation before the experiment	Evaluation after the experiment
1	**Foot sensitivity to sensory discs**								
a)	**Ability to recognize materials of which the sensory discs are made (touching them with foot, with eyes covered) without looking at the material:**								
	Stones embedded in resin	2	2	3	3	2	3	2	3
	Hemp rope coiled in a spiral	2	2	3	3	3	2	2	2
	Wooden pegs	2	3	3	3	2	2	3	3
	Non-slip plywood	2	2	3	3	3	3	3	3
	Metal sheet	2	2	3	3	3	2	3	3
b)	**Presence of tactile hypersensitivity to selected materials in the sensory discs (with eyes covered) without looking at the material:**								
	Stones embedded in resin	2	3	1	1				
	Hemp rope coiled in a spiral	2	3	1	1				
	Wooden pegs	1	2	1	1				
	Non-slip plywood	1	1	1	1				
	Metal sheet	3	3	1	1				
2	**Motor coordination**								
a)	Gross motor skills								
2a1	Movement, fitness tasks:								
	Jumping up with landing on both feet	2	2	3	3	2	2	3	3
	Single leg jumping, on the right and left leg, alternately	2	2	1	3	2	1	1	1
	Touching the left knee with the right hand	2	2	3	3	1	1		
	Touching the right foot with the left hand	1	3	3	3	1	1		
2a2	Performance of motor tasks:								
	Smooth performance	1	2		2				
	Performance with minor difficulties			3	1			1	1
	Performance with very significant difficulties	2	1			2	3		
	No performance					1		2	2

Table 1. Results of completed pilot experimental studies in the experimental and control group (cont.).

b)	Fine motor skills:								
2b1	Movement, fitness tasks:								
	Joins fingers spread about 50 cm apart in the horizontal plane	3	3	2	2	2	2	1	1
	From a distance of about 50 cm, alternately touches the right thumb with the left one and the left thumbs with the right one, making a horizontal movement.		1	2	3	2	3		1
	From a distance of about 50 cm, alternately joins the small fingers, the right with the left one and the left with the right one, making a horizontal movement.		2	3	3	2	3	1	1
	Performs a finger play task with his/her hands.	3	3	1	3				
2b2	Performance of motor tasks:								
	Smooth performance			1	3		1		
	Performance with minor difficulties		3	2					
	Performance with very significant difficulties	3				2	2	1	1
	No performance					1		2	2
3	**Walking along footbridges in the context of body balance skills**								
31a	Movement along the footbridge:								
	Fully unassisted walk	1	2	3	3	2	2	2	2
	Walks with assistance, support	1				1		1	1
	Refuses to move along the footbridge								
31b	Speed of walking along the footbridge:								
	Moves very quickly, runs	1	1	3	2			1	1
	Walks with a normal speed		1				1	1	1
	Walks very slowly	2	1			3	2	1	1
	Does not move at all (refuses to perform a task)								

Sources: Author's research.

The table presents only the number of children showing the presence or absence of the assessed ability or skill (0 was not entered).

Verification of the research hypotheses

Based on the obtained research results, it can be concluded that the assumed theoretical objective, which was to investigate the effect of sensory integration activities on the development of tactile performance of feet, motor coordination of arms and legs as regards gross motor skills, motor coordination of hands as regards fine motor skills, fitness and ability to keep the body balance in the examined children, was achieved. The examined functions and skills were assessed in children from experimental and control groups based on an evaluation sheet assessing selected abilities and skills in the field of sensory integration of the child (prepared for the research), before and after the cycle of classes. On this basis, it was possible to identify functions and skills in which the progress was made (motor coordination of hands as regards gross motor skills, fitness and ability to maintain body balance). A practical goal was also achieved, by demonstrating the higher effect of using footbridges made of natural materials in comparison to plastic footbridges in the sensory integration therapy.

The main hypothesis and the detailed hypotheses were verified and partially confirmed. It was proven that the use of sensory footbridges made of different materials (plastic, natural material) had a varied effect on the therapy of the assessed sensory integration disorders in the examined children, although this impact is not identical, as it depends on the type of material from which the footbridges are made (the main hypothesis). Based on the obtained data, it was confirmed that certain differences existed between plastic footbridges and footbridges made of natural materials in terms of their effective impact on the therapy in the examined children assessed for sensory integration disorders. Children from experimental groups (working with footbridges made of natural materials) more smoothly and more independently realised the developed skills in the field of gross and fine motor skills. On the other hand, significantly lower effects in terms of the assessed fine motor skills performance were recorded in children from the control groups.

During the pilot experimental studies, the first detailed hypothesis was verified: that sensory integration classes will result in progress as regards the development of the functions and skills in the examined children. The impact of the conducted classes on the development of tactile performance of feet and the ability to maintain body balance in the examined children was not confirmed. However, their effect on the development of gross motor skills was confirmed, especially as regards single-leg jumping alternately on the right and left leg, as well as the skills related to the smooth performance of the assessed motor ac-

tivities in the area of high motor skills (a disabled child who had not performed the assessed skills earlier started to perform them with difficulty), as well as fine motor skills, especially the ability to touch the right thumb with the left one and the left thumb with the right one, alternately, from a distance of about 50 cm, performing at the same time a horizontal movement, or the skill of performing the "chimney sweep" finger play task. The performance of the assessed skills (especially in experimental groups) also changed, progressing to a more independent level.

The data initially obtained confirmed the second specific hypothesis. It was proven that sensory footbridges made of natural materials more effectively contribute to the development of selected functions and skills in the area of sensory integration in the examined children. Progress was confirmed in the development of such skills as coordination of hand movement in terms of gross motor skills, coordination of hand movement in terms of fine motor skills and the fluency of movements in the area of gross and fine motor skills. The effect on other examined functions and skills, including the development of the ability to keep the body balance, was not confirmed (probably due to the short duration of the experiment and the low number of completed therapeutic classes).

Research conclusions and recommendations for sensory footbridges made of natural materials (based on the conducted experimental research)

The results of the pilot experimental studies confirmed the assumption of higher efficiency of sensory footbridges made of natural materials in the therapy of sensory integration disorders. In children from the experimental groups, a much higher level of development of the assessed functions and skills in the area of gross and fine motor skills was recorded, as well as the smooth performance and the degree of independence concerning these skills. Much less progress was observed in children from the control groups.

The conducted research also allowed to formulate recommendations for the improvement of sensory footbridges made of natural materials used during the pedagogical experiment. It was found that their texture should be improved by introducing a more rough surface to allow for more grip and stability of the feet, as well as better body balance, by enriching the texture of the sensory disc with a surface allowing for deeper sensory experiences (especially for the population of children with disabilities) and improving disinfection of their surface. All children, both from the special centre and from the public school,

"slipped" already during their first classes, while climbing up and down the footbridges, although the exercises were performed barefoot. The children from public school developed in the following classes a reflex to help them avoid the slope on the footbridges to prevent slipping, but the children from the rehabilitation centre slipped off the footbridges when using this aid. It is also necessary to change the location of the bell, to hide this element of the footbridge, as it distracted especially children with disabilities (as they tried to take it out of the footbridge). For the children from the public school, all sensory discs were interesting and provided a kind of "novelty", with a variety of activities and experiences. For children with disabilities, on the other hand, some of the discs with a smoother surface were hardly noticeable, as well as poorly perceived by their senses, so it would be worth creating additional discs with a more pronounced and deeper surface.

Conclusion

The conducted research is of a pilot nature, and it requires further scientific exploration, the inclusion of more groups of children participating in sensory integration classes and longer duration of experimental interactions. The research requires a greater focus on the development of children with sensory integration disorders such as hypersensitivity, hyposensitivity, lack of tactile sensitivity, keeping the body balance and unassisted performance of tasks involving gross and fine motor skills. This is important because sensory integration disorders in children have a direct or indirect impact on their learning efforts and school performance.

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